KING EDWARD VI
HANDSWORTH GRAMMAR
SCHOOL FOR BOYS

KING EDWARD VI
ACADEMY TRUST
BIRMINGHAM

Year 9

2025 Mathematics 2026

Unit 13 Tasks – Part 1

DO NOT WRITE INSIDE

KING EDWARD VI
HANDSWORTH GRAMMAR
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ACADEMY TRUST
BIRMINGHAM

Year 9

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Unit 13 Tasks – Part 2

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2025 Mathematics 2026

Unit 13 Tasks – Part 3

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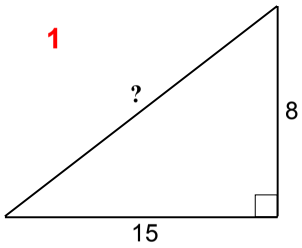
Contents Page

1 2D Pythagoras' Theorem

Use Pythagoras' theorem to find the length of the **hypotenuse** marked **?** in each of these **right-angled** triangles.

Drawings are NOT to scale.

1



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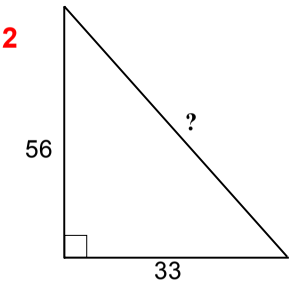

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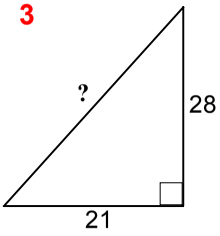

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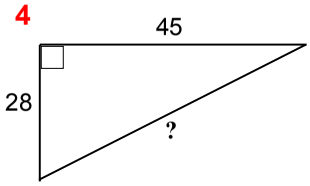

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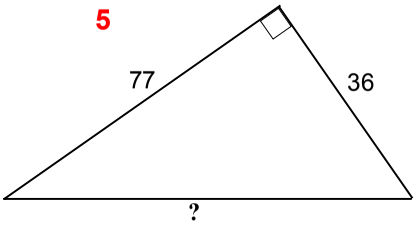

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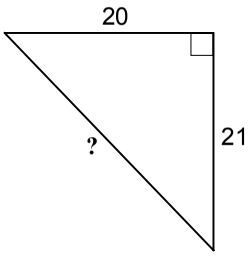

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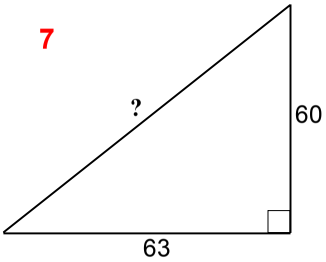

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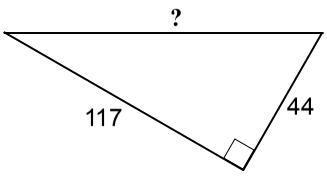

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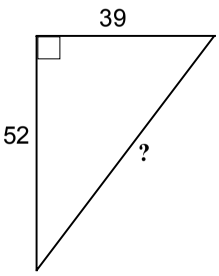

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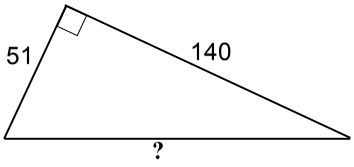

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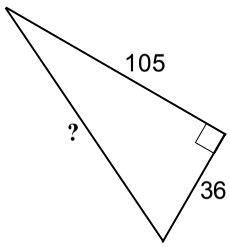

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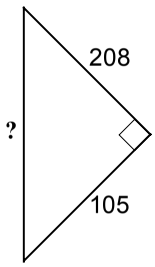

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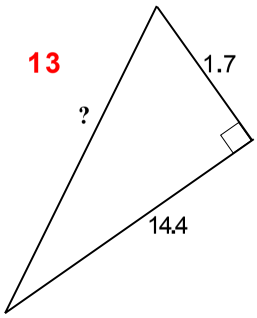

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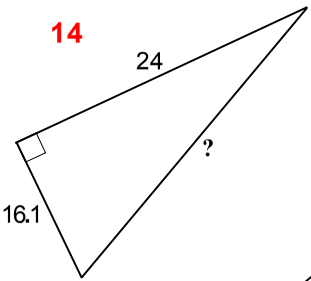

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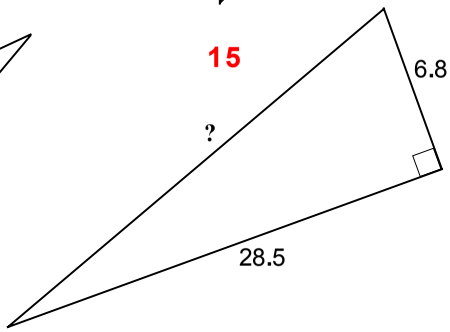
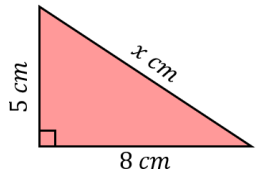


Fluency Practice

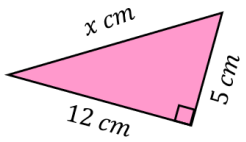
Finding the Length of the Hypotenuse using Pythagoras' Theorem

(a) Find x to 1 decimal place



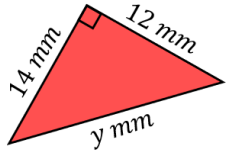
$$x^2 = 5^2 + 8^2$$
$$x^2 = 89$$
$$x = \sqrt{89}$$
$$x = 9.4\ cm\ (1\ dp)$$

(b) Find x



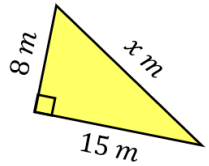
$$x^2 = 5^2 + 12^2$$

(c) Find y to 1 decimal place

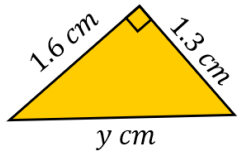


$$y^2 = 12^2 + 14^2$$

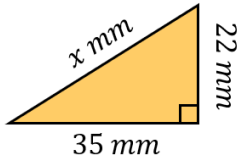
(d) Find x



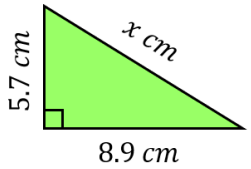
(e) Find y to 1 decimal place



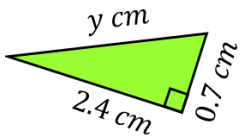
(f) Find x to 1 decimal place



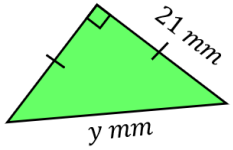
(g) Find x to 1 decimal place



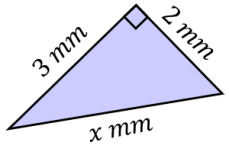
(h) Find y



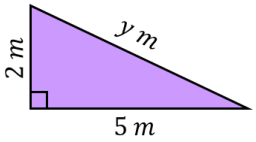
(i) Find y to 1 decimal place



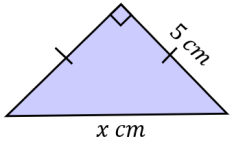
(j) Find x, leaving your answer as a surd



(k) Find y, leaving your answer as a surd



(l) Find x, leaving your answer as a surd



Purposeful Practice

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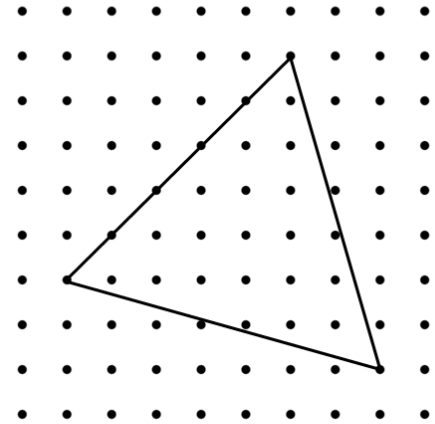

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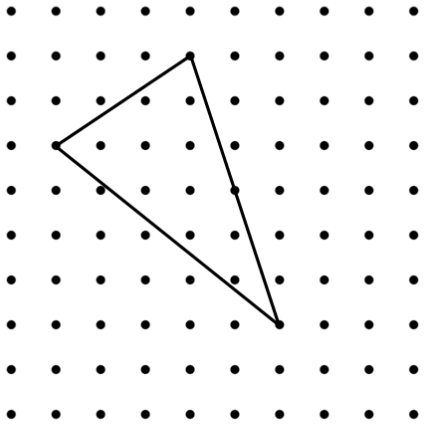

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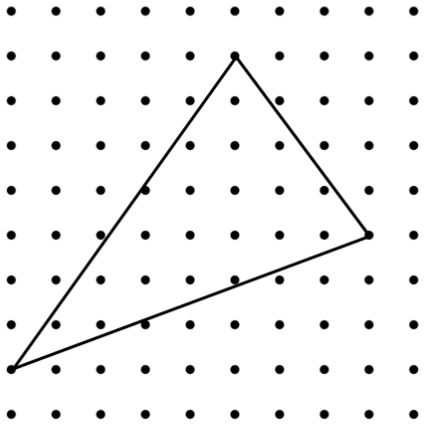

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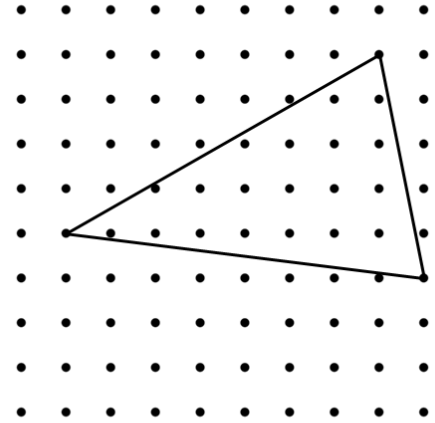

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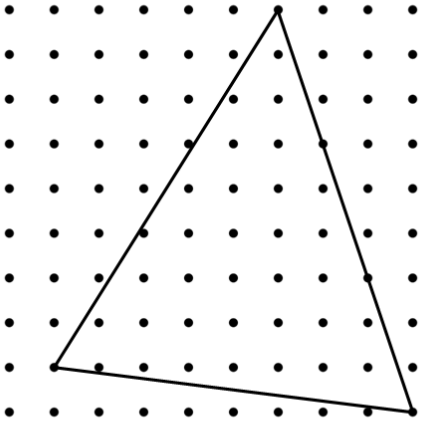

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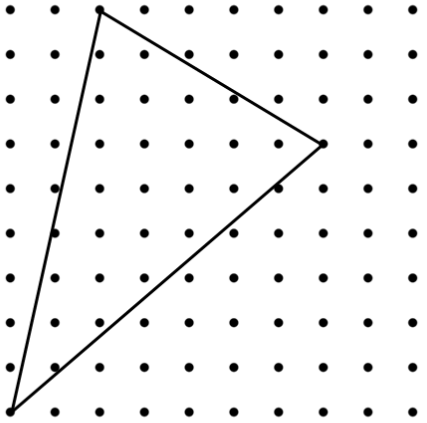

which of these are isosceles triangles?

Intelligent Practice

Justify whether or not the triangles below are right-angled.

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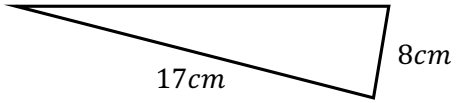

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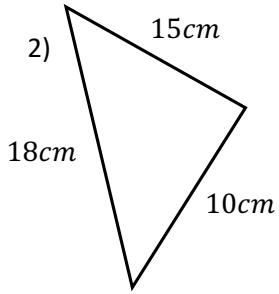

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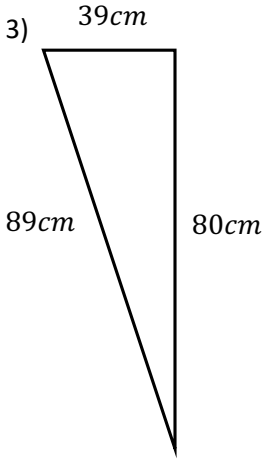

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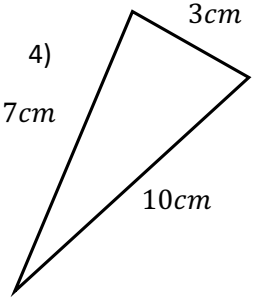

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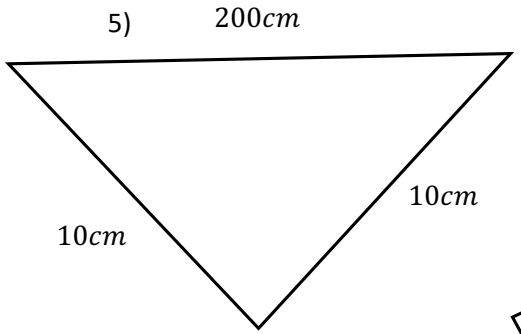

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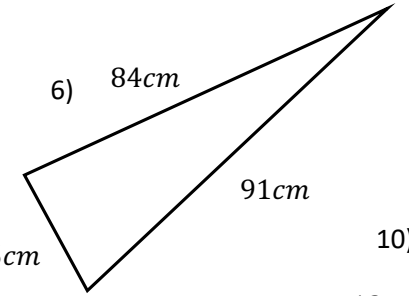

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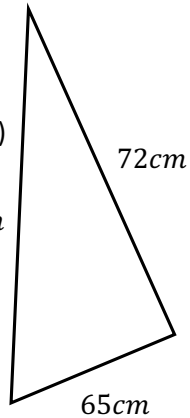

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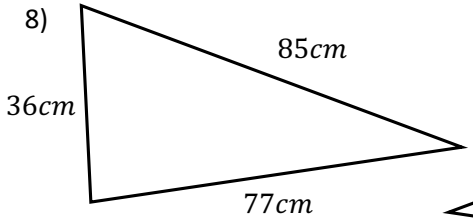

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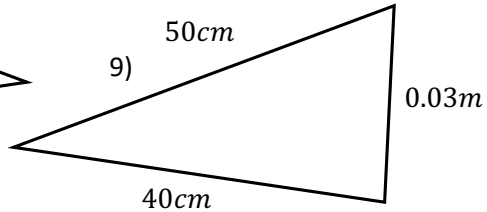

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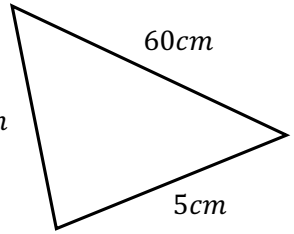

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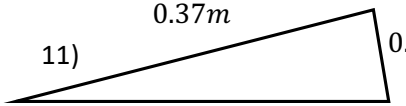

Use Pythagoras' theorem to decide whether each of these triangles is right-angled or not.

Drawings are NOT to scale..

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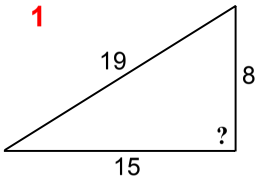

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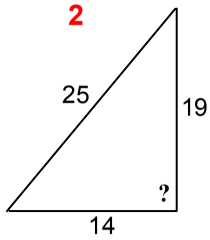

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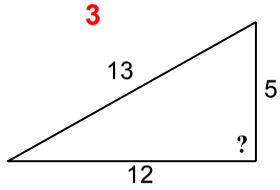

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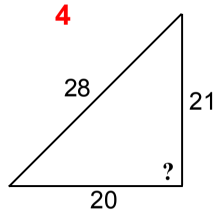

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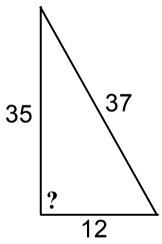

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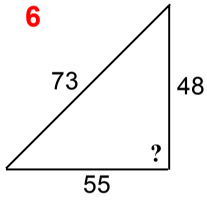

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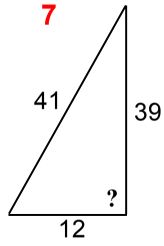

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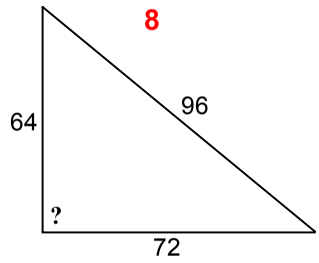

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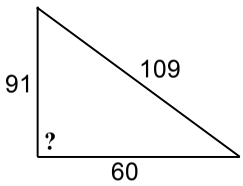

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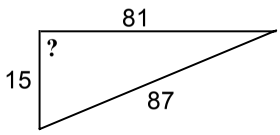

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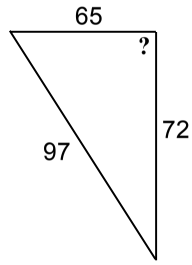

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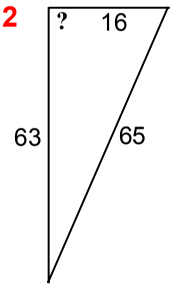

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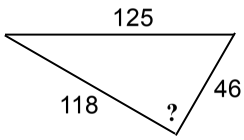

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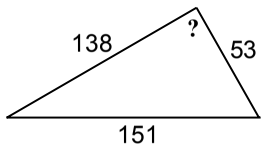

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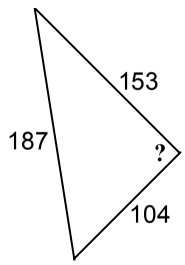

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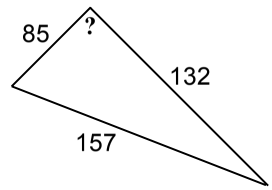

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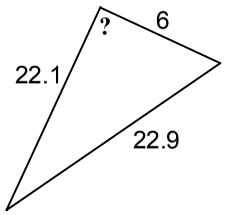

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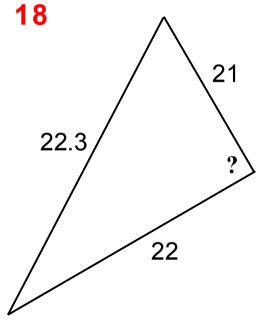

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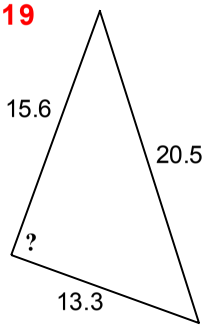

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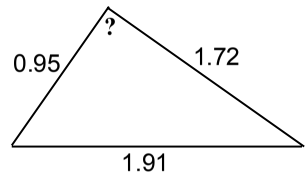
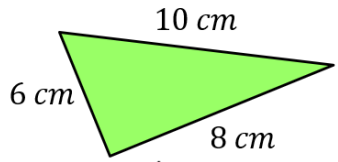
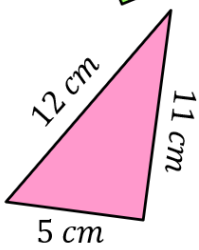


Use Pythagoras' Theorem to decide whether each of these triangles is right-angled. Explain your reasoning.

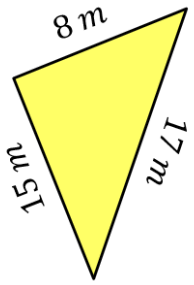
(a)



(b)

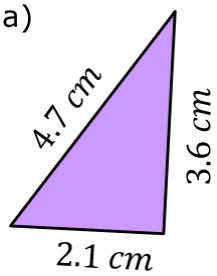


(c)

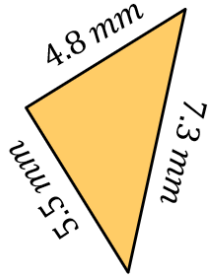


Decide whether each of these triangles is right-angled.

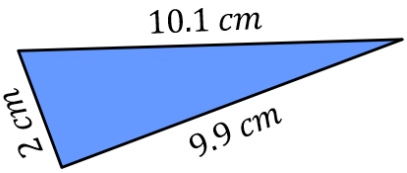
(a)



(b)

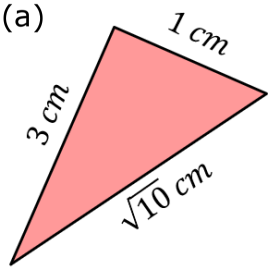


(c)

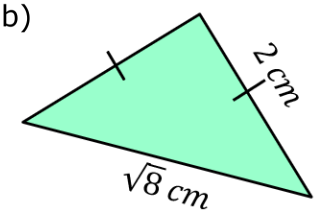


Which of these triangles is right-angled?

(a)



(b)



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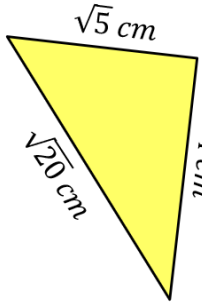
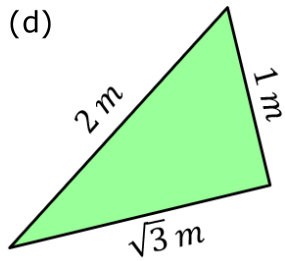


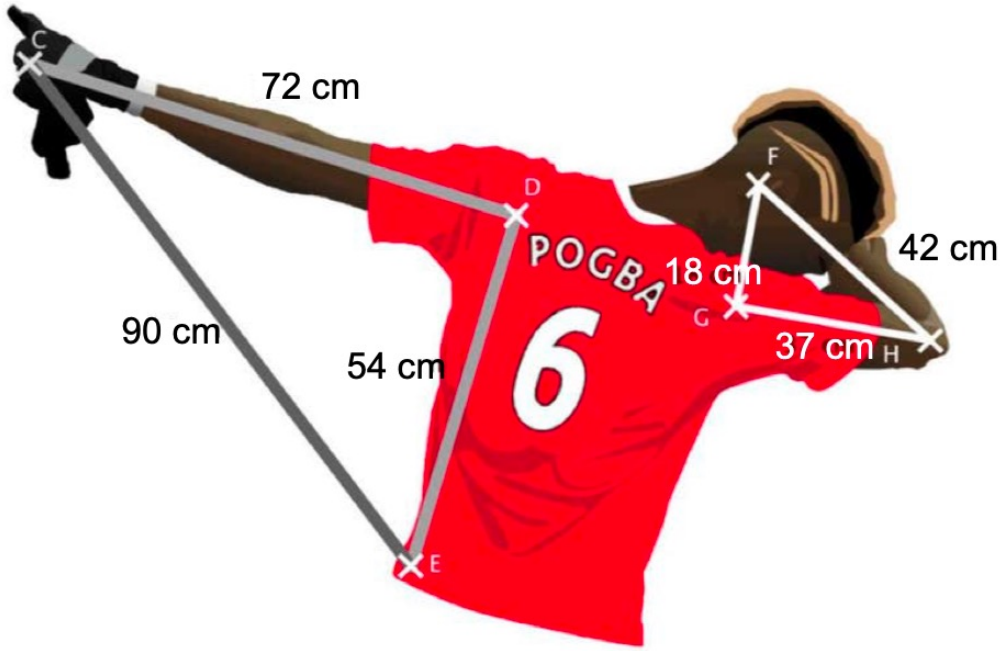
(d)



Purposeful Practice

Cristiano Ronaldo is jealous of Paul Pogba's dab, so Pogba tries to demonstrate that his dab is perfect. According to the book 'the Universal Declaration of the Rights of the Dab', a dab is only perfect if both triangles represented in the figure below are right angled.

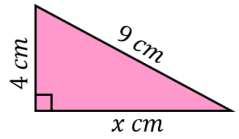
Is Paul Pogba's dab perfect?



Fluency Practice

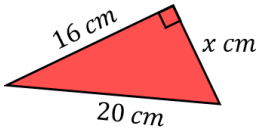
Finding the Length of a Short Side using Pythagoras' Theorem

(a) Find x to 1 decimal place



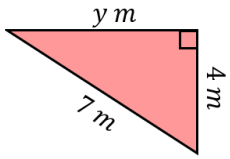
$$9^2 = x^2 + 4^2$$
$$x^2 = 9^2 - 4^2$$
$$x^2 = 65$$
$$x = \sqrt{65}$$
$$x = 8.1\ cm\ (1\ dp)$$

(b) Find x



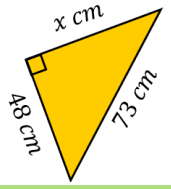
$$20^2 = x^2 + 16^2$$
$$x^2 = 20^2 - 16^2$$

(c) Find y to 1 decimal place

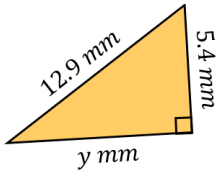


$$7^2 = y^2 + 4^2$$
$$y^2 = 7^2 - 4^2$$

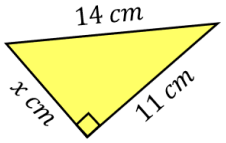
(d) Find x



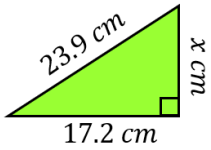
(e) Find y to 1 decimal place



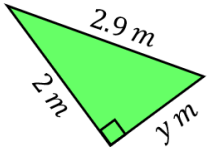
(f) Find x to 1 decimal place



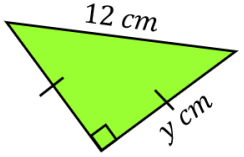
(g) Find x to 1 decimal place



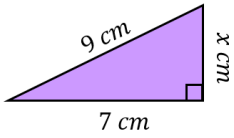
(h) Find y



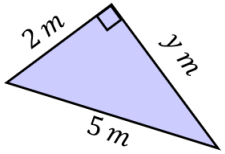
(i) Find y to 1 decimal place



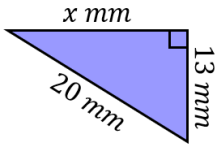
(j) Find x, leaving your answer as a surd



(k) Find y, leaving your answer as a surd



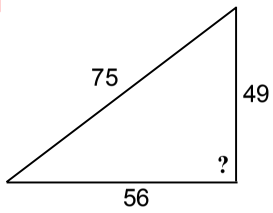
(l) Find x, leaving your answer as a surd



Use Pythagoras' theorem to find the length of the edge marked **?, OR** decide whether the triangle is right-angled or not

Drawings are NOT to scale.

1



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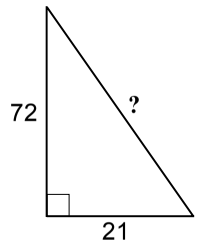

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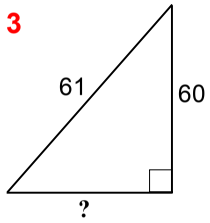

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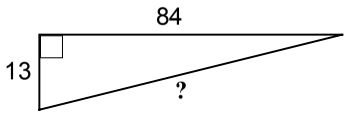

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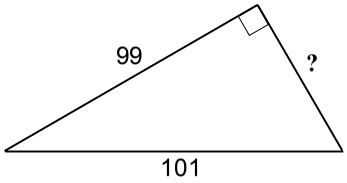

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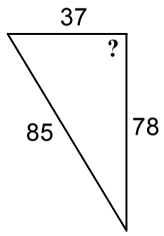

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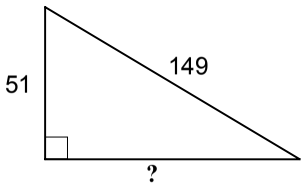

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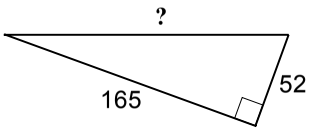

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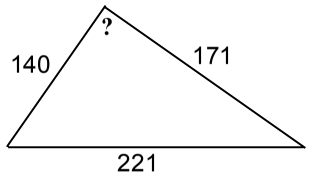

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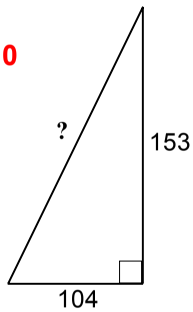

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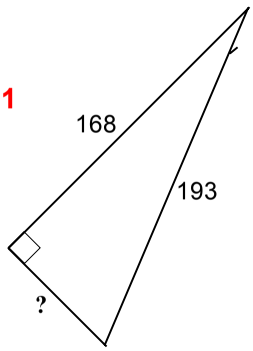

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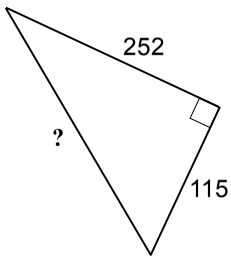

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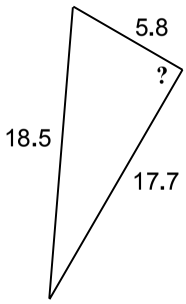

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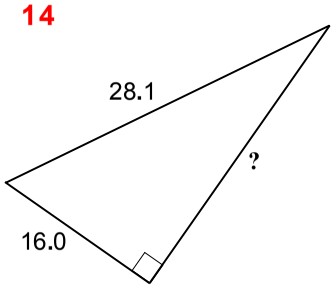

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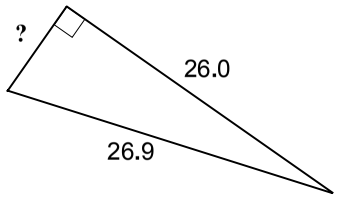
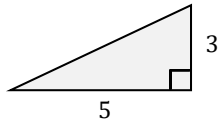


Fluency Practice

Find the missing lengths & simplify your answers. **Pythagoras' Theorem with Surds** Diagrams not drawn accurately.

A



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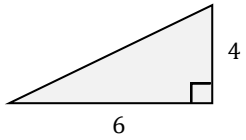

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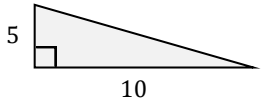

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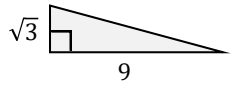

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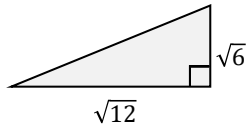

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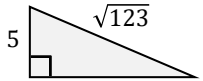

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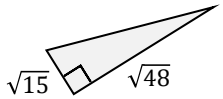

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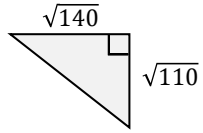

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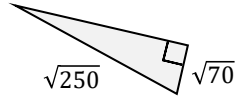

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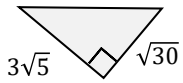

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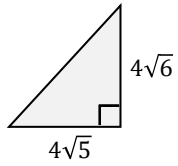

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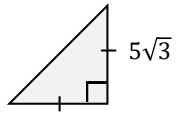
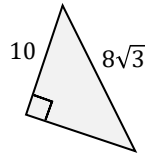
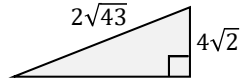


N



O



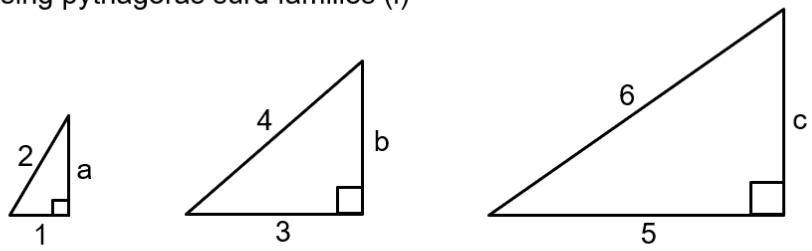
Calculate the area.

14 Answers	$3\sqrt{7}$	$3\sqrt{2}$	$5\sqrt{6}$	$\sqrt{34}$	$2\sqrt{23}$	$5\sqrt{5}$	$5\sqrt{3}$
	$2\sqrt{13}$	$4\sqrt{11}$	$2\sqrt{21}$	$5\sqrt{10}$	$7\sqrt{2}$	$6\sqrt{5}$	$3\sqrt{6}$

Purposeful Practice

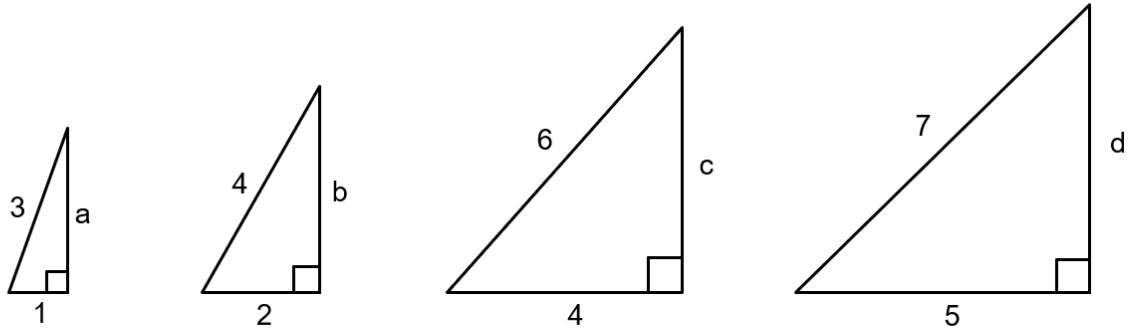
generalising pythagoras surd families (i)

(1)



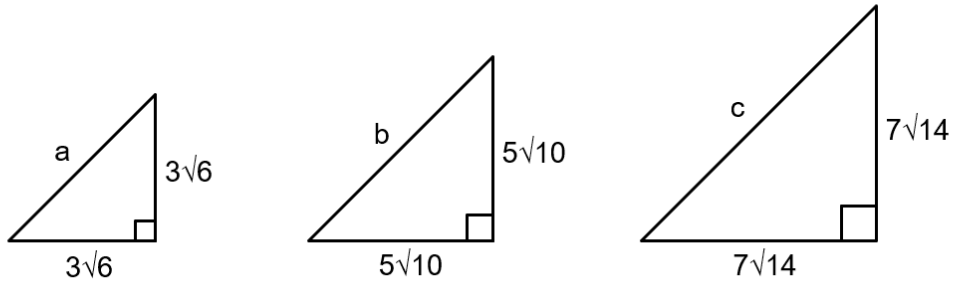
. . .

(2)



. . .

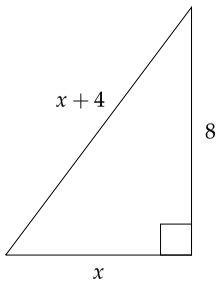
(3)



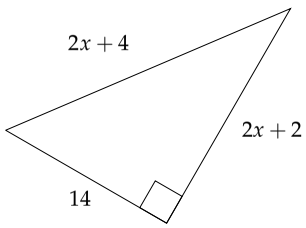
. . .

Find the value of x for each question.

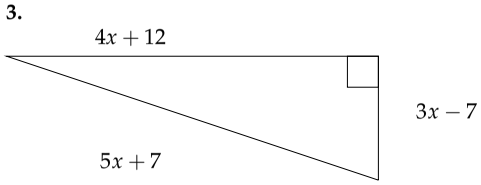
1.



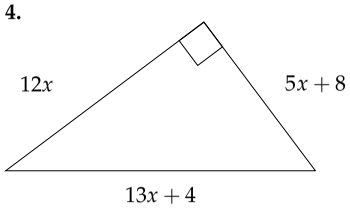
2.



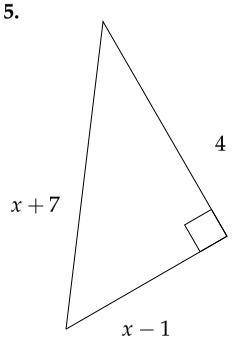
3.



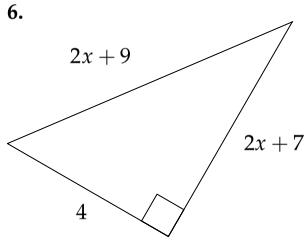
4.



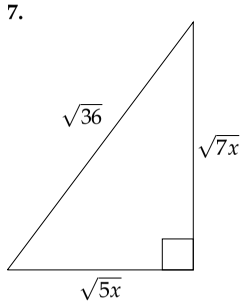
5.



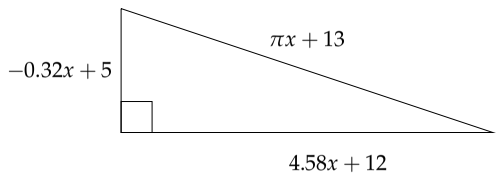
6.



7.



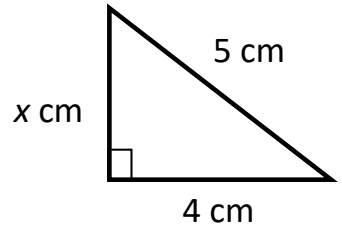
8. (no calculators!)



Purposeful Practice

Instructions: Calculate the value of x. Then complete the remaining boxes trying to make the minimal change possible.
On each triangle, state the size of all three lengths. Where decimals are needed, round to 2 decimal places.

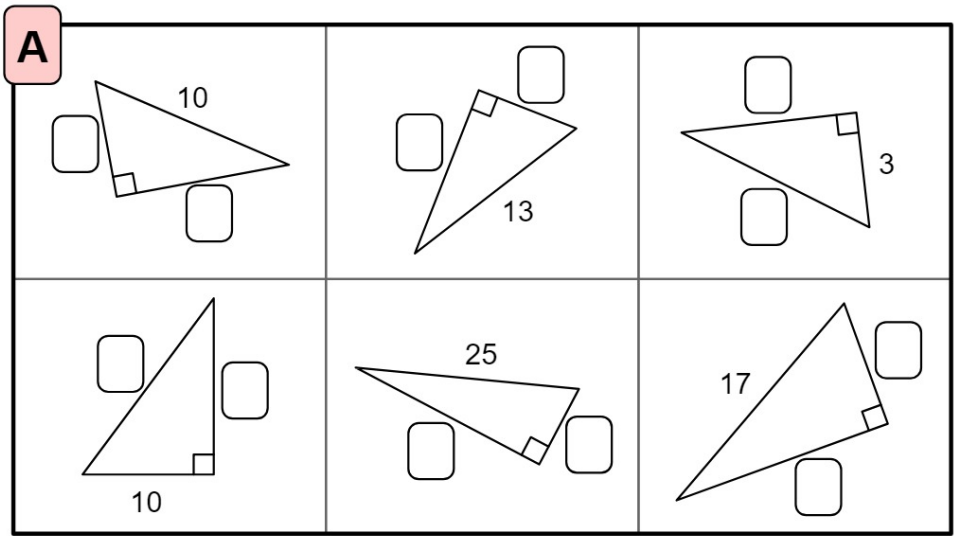
Value of hypotenuse

Value of the height	Less	Same	More
More			
Same			
Less			

pythagoras puzzles

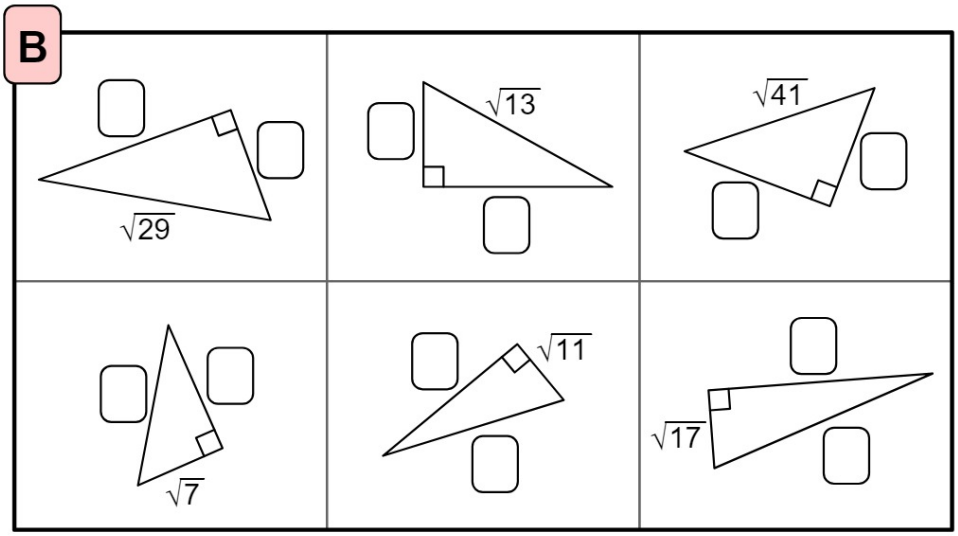
Match the cards to the side lengths of the right-angled triangles.
Use each card once only. Diagrams are not drawn to scale.

A



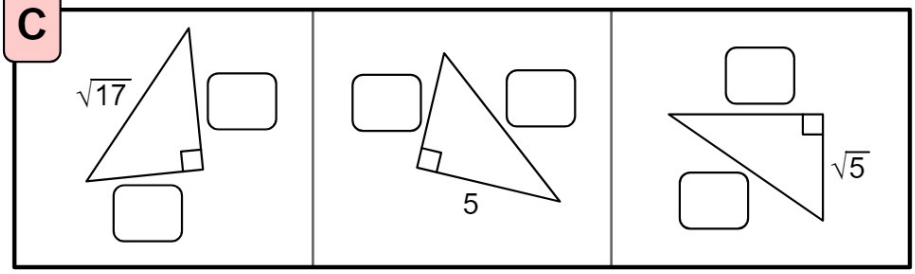
4 5 5 6 7 8 8 12 15 24 24 26

B



2 2 3 3 4 4 5 5 5 6 8 9

C



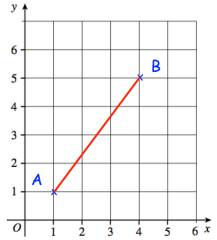
2√2 3 √11 2√3 4 √37

Fluency Practice

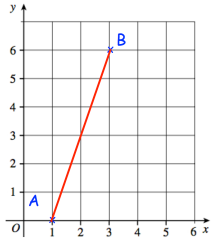
Round answers to 2dp

Question 1: Calculate the length of the line joining the points A and B.

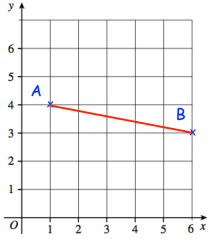
(a)



(b)

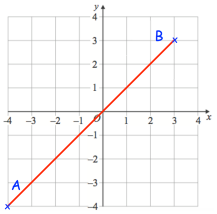


(c)

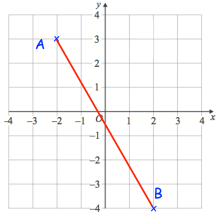


Question 2: Calculate the length of the line joining the points A and B.

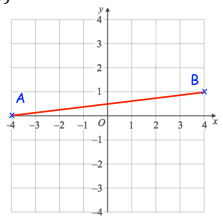
(a)



(b)

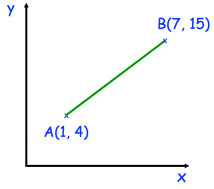


(c)

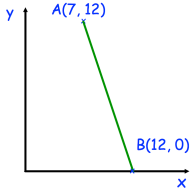


Question 3: Calculate the length of the line joining the point A and B.

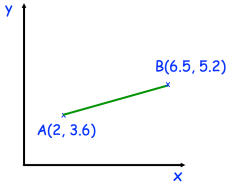
(a)



(b)

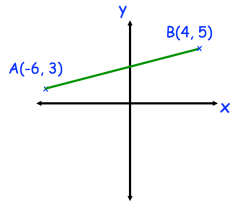


(c)

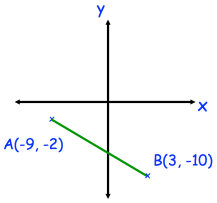


Question 4: Calculate the length of the line joining the points A and B

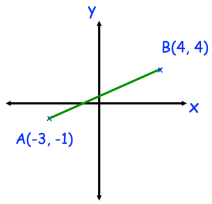
(a)



(b)



(c)

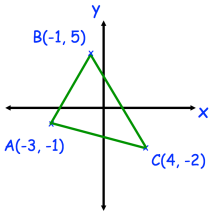


Question 5: Calculate the distance between the following pairs of coordinates

(a) (5, 1) and (9, 6)
(b) (1, 4) and (10, 10)
(c) (0, 0) and (6, 8)
(d) (2.5, 3) and (8, 0)
(e) (−6, 2) and (8, 3)
(f) (−5, −9) and (−3, 8)
(g) (−5, 7) and (−3, −2)
(h) (−9, −9) and (3, −20)
(i) (−4, 0) and (0, −4)

Apply

Question 1: Calculate the perimeter of triangle ABC.



Question 2: The distance between the points (1, 2) and (16, p) is 17.
Find the possible values of p.

Question 3: The distance between the points (−3, −4) and (q, 5) is 15.
Find the possible values of q.

Intelligent Practice

Find the length of the line segments between the given points. Give your answers as simplified surds, where appropriate:

1) $(0, 0)$ and $(6, 8)$

2) $(0, 0)$ and $(-6, 8)$

3) $(0, 0)$ and $(6, -8)$

4) $(0, 0)$ and $(-6, -8)$

5) $(1, 1)$ and $(7, 9)$

6) $(1, 1)$ and $(8, 10)$

7) $(1, 1)$ and $(-8, 10)$

8) $(1, 1)$ and $(8, -10)$

9) $(1, 1)$ and $(8, 12)$

10) $(15, 1)$ and $(8, 12)$

11) $(15, 23)$ and $(8,12)$

12) $(1, 1)$ and $(-16, 20)$

13) $(1, 1)$ and $(-17, 19)$

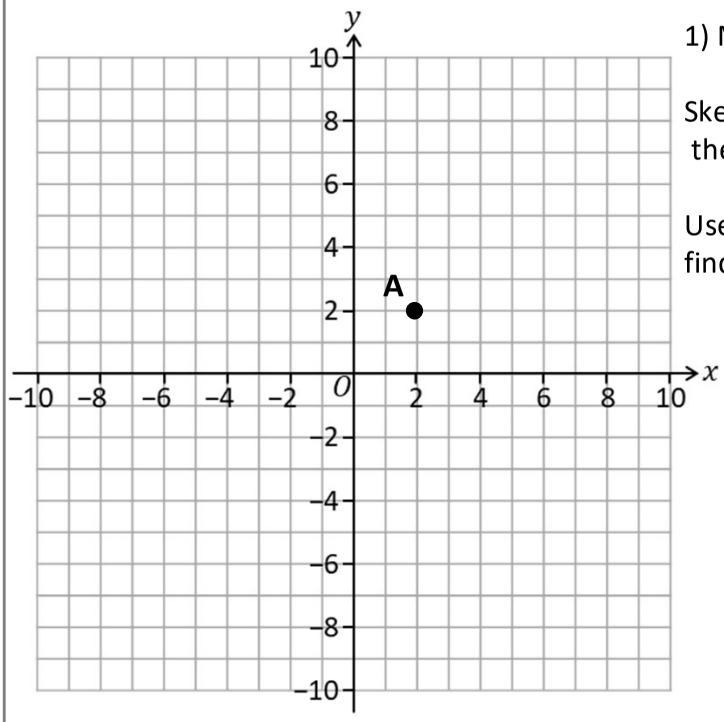
14) $(-8, 10)$ and $(-17, 19)$

EXTENSION

Point A is at (1, 2). The distance between Point A and Point B is 10 units.

Find all the possible co-ordinates of Point B.

Pythagoras' Theorem with Coordinates



1) Mark point **B** at (8, 6).

Sketch a triangle with line **AB** as the hypotenuse (longest side).

Use Pythagoras' Theorem to find the length of **AB**.

Does it matter if the horizontal or vertical distances are positive or negative?

2) **CD** **C**(2, 8) **D**(8, 10)

3) **EF** **E**(−8, 2) **F**(−6, 9)

4) **GH** **G**(−2, 1) **H**(−6, −4)

5) **IJ** **I**(8, −7) **J**(3, −2)

6) **KL** **K**(6, −9) **L**(−9, −5)

Find the length of these lines without using a grid.

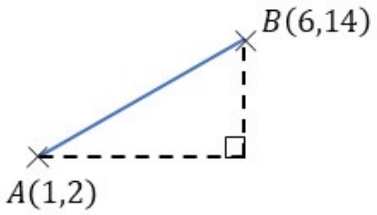
	Start	End	Horizontal Distance	Vertical Distance	Length
7	(2, 2)	(8, 12)			
8	(8, 3)	(15, 2)			
9	(−5, −6)	(7, −2)			
10	(8, 7)	(−2, −1)			
11	(−11, −2)	(−3, −18)			

12) The length of line **MN** is 13 grid units.
M(−6, 3) **N**(−1, y)
Find a possible y co-ordinate of point **N**.

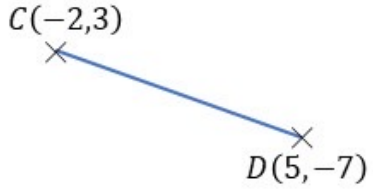
13) The length of line **OP** is 9 grid units.
O(x, −4) **P**(1, −10)
Find a possible x co-ordinate of point **O**.

Purposeful Practice

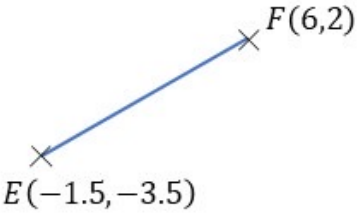
1 Calculate the length of AB.



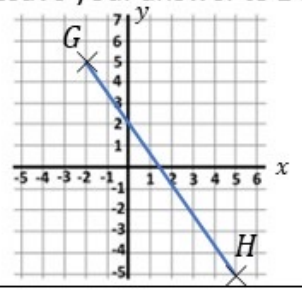
2 Calculate the length of CD. Leave your answer to 2 d.p.



3 Calculate the length of EF. Leave your answer to 3 s.f.



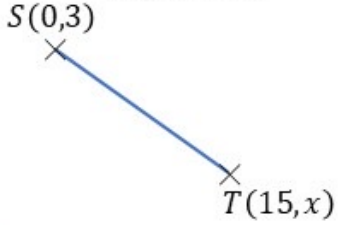
4 Calculate the length of GH. Leave your answer to 1 d.p.



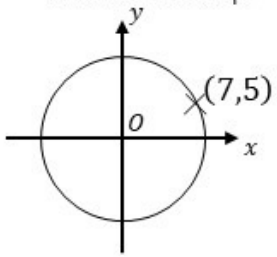
5 Find the length of the line segment between the coordinates $(-7,-9)$ and $(-2,-11)$.

6 A line has equation $y = 3x - 4$, calculate the length of the line segment between $x = -2$ and $x = \frac{1}{3}$

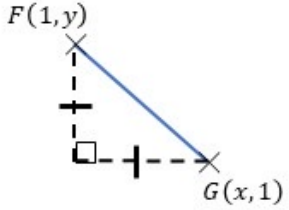
7 The length of ST is 17, calculate the possible values of x.



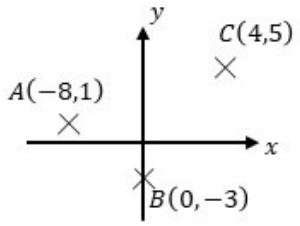
8 The circle is centred at the origin. Calculate the circumference of the circle to 2 d.p.



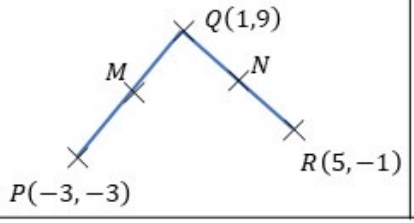
9 The length of FG is 10. $x > 0, y > 0$. Calculate the values of x and y, leave your answers in exact form.



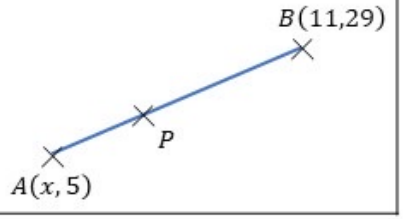
10 $Angle\ ABC = 90°$ Calculate the area of triangle ABC to 1 d.p.



11 M is the midpoint of PQ. N is the midpoint of QR. Calculate the length of the line segment MN to 1 d.p.

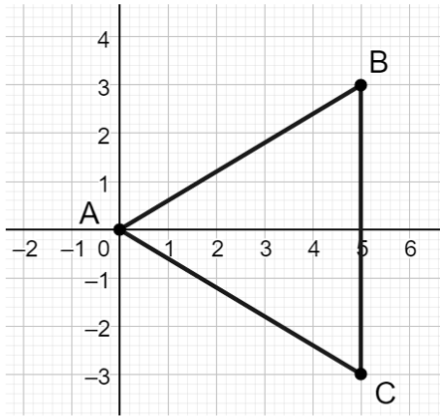


12 APB is a straight line. AP:PB = 2:3 The length of AP = 10. Calculate the coordinates of P.

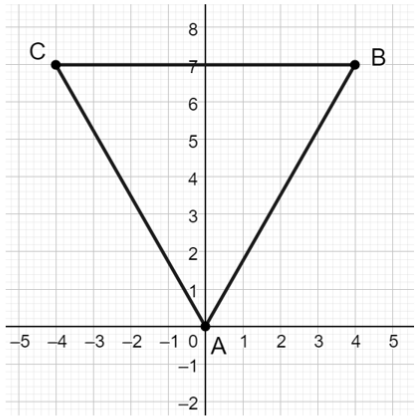


equilateral triangle or not?

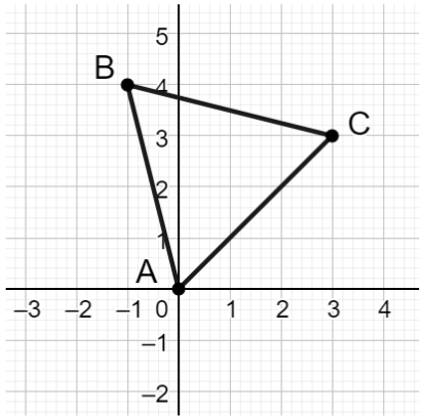
(1)



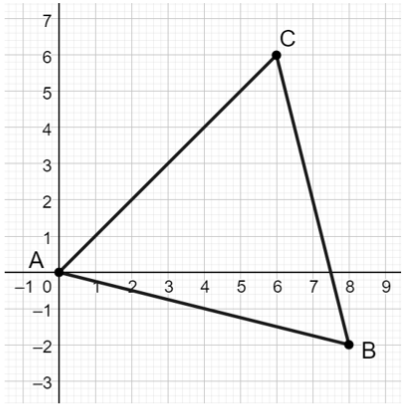
(2)



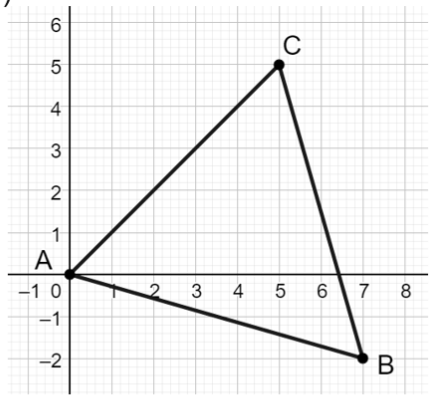
(3)



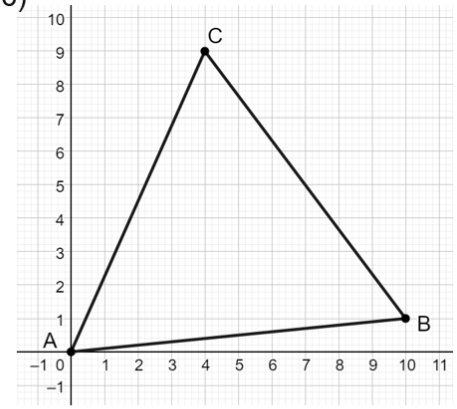
(4)



(5)

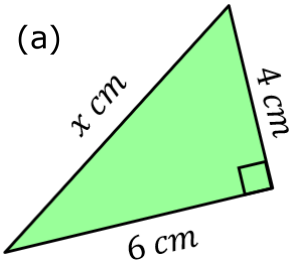


(6)

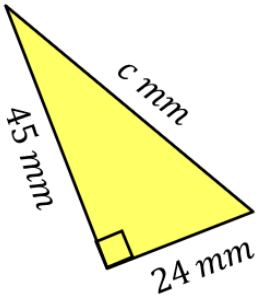


Find each of these lengths, rounding to 1 decimal place when necessary.

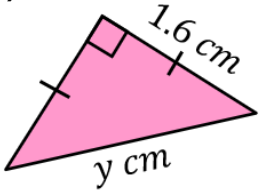
(a)



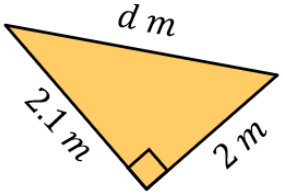
(b)



(c)

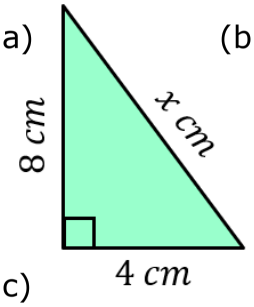


(d)

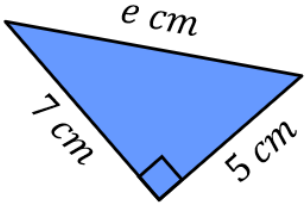


Find each of these lengths, leaving your answers in surd form.

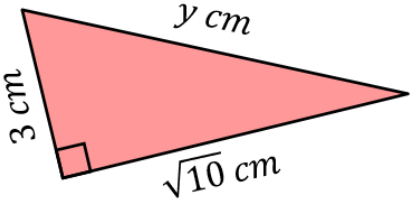
(a)



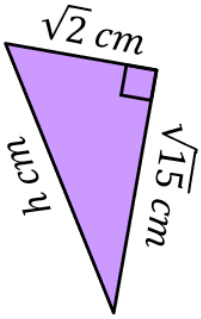
(b)



(c)

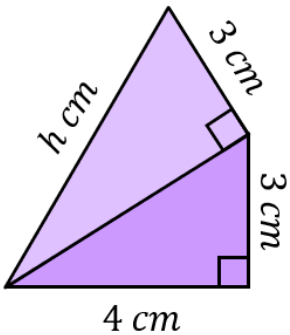


(d)

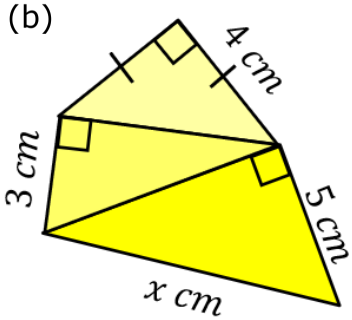


Find the missing lengths, rounding your answers to 3 significant figures.

(a)



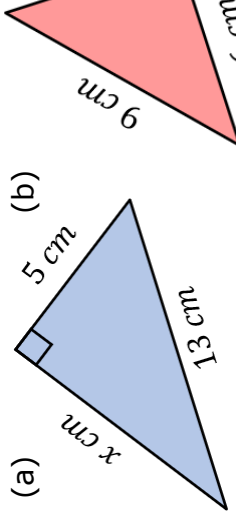
(b)



Fluency Practice

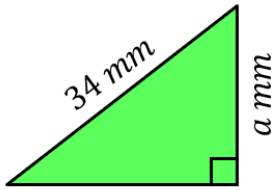
Find each of these lengths, rounding to 1 decimal place when necessary.

(a)

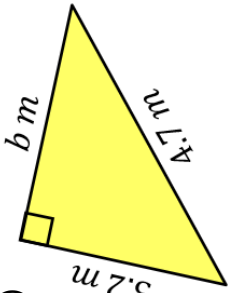


(b)

(c)

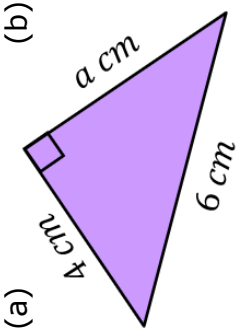


(d)



Find each of these lengths, leaving your answer in surd form.

(a)



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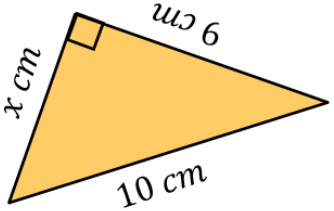

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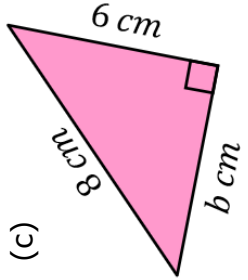

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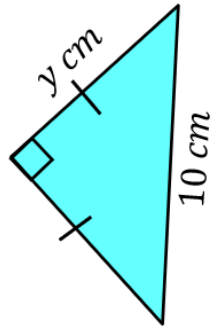
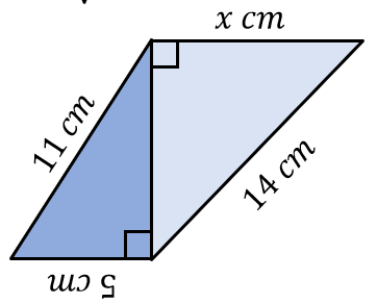
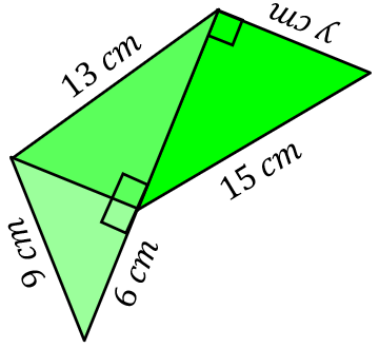


Find the missing lengths, rounding your answers to 3 significant figures.

(a)

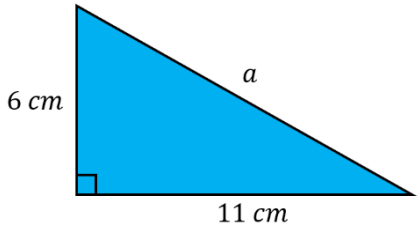


(b)

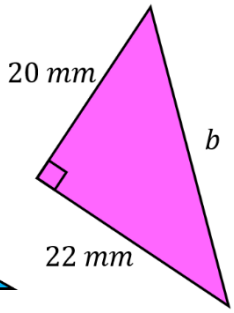


Find the missing lengths.

(a)

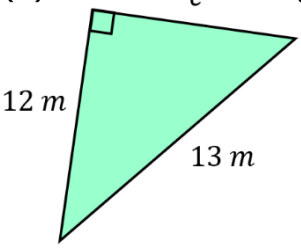


(b)

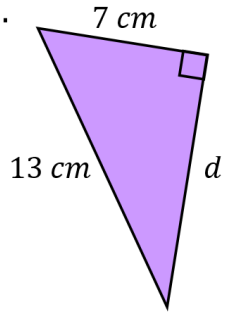


Find the missing lengths.

(a)

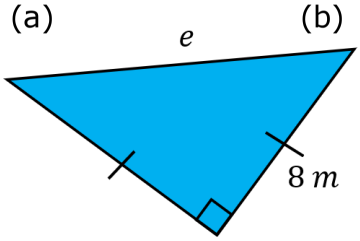


(b)



Find the missing lengths.

(a)



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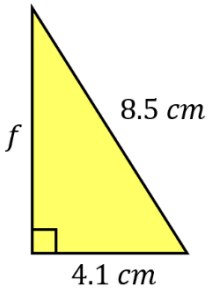
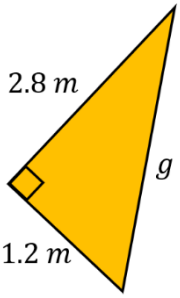


(c)



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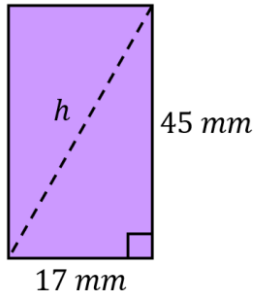
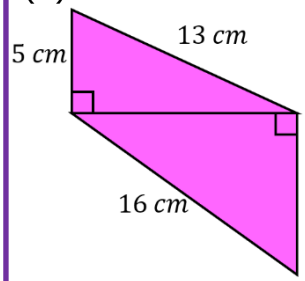


Find the missing lengths.

(a)



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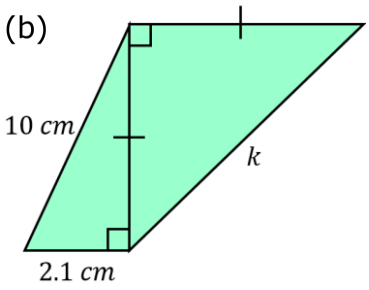
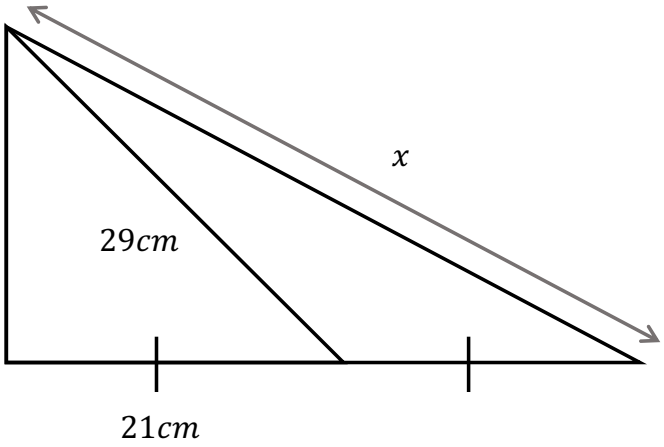
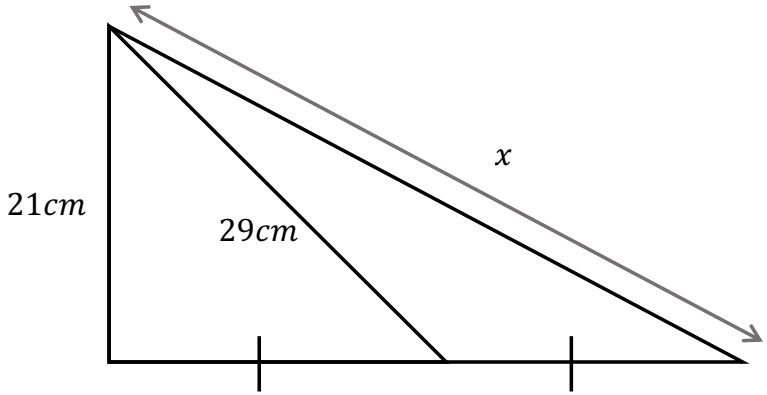
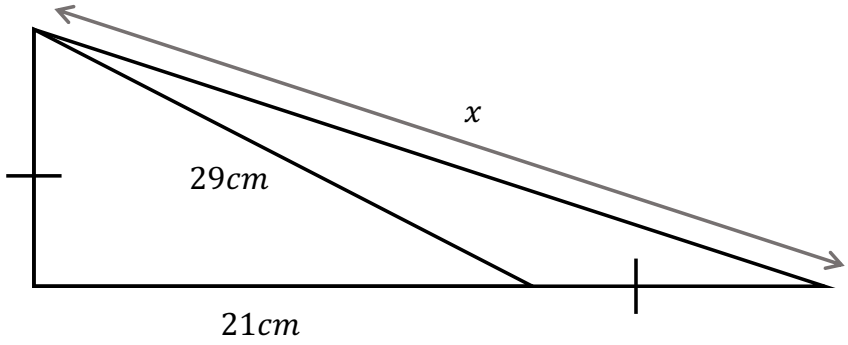


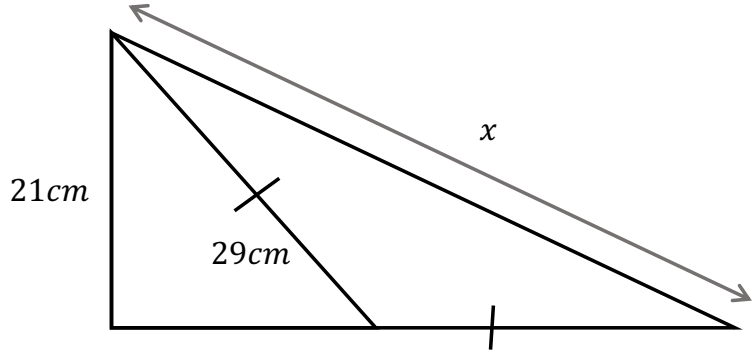
Intelligent Practice

Find the value of x in each instance to 2dp. Predict whether you think each answer will be higher or lower than the one before it.



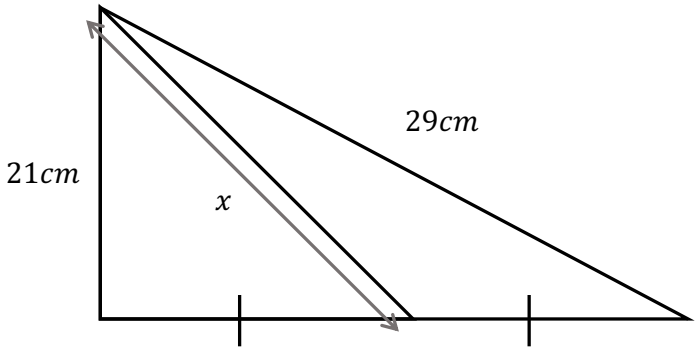


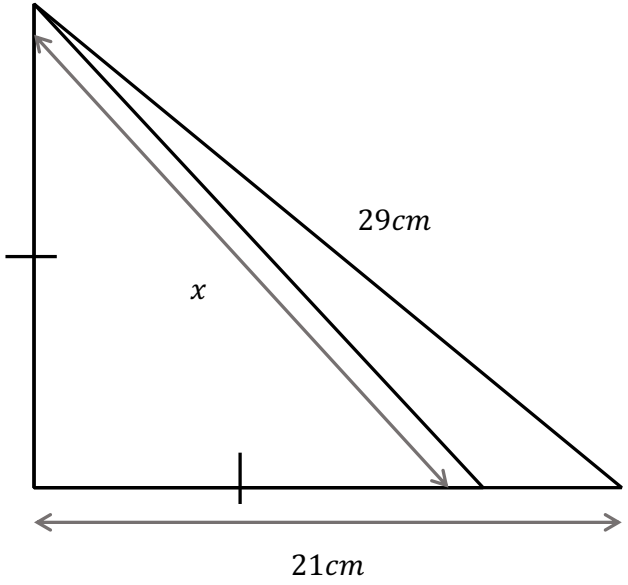


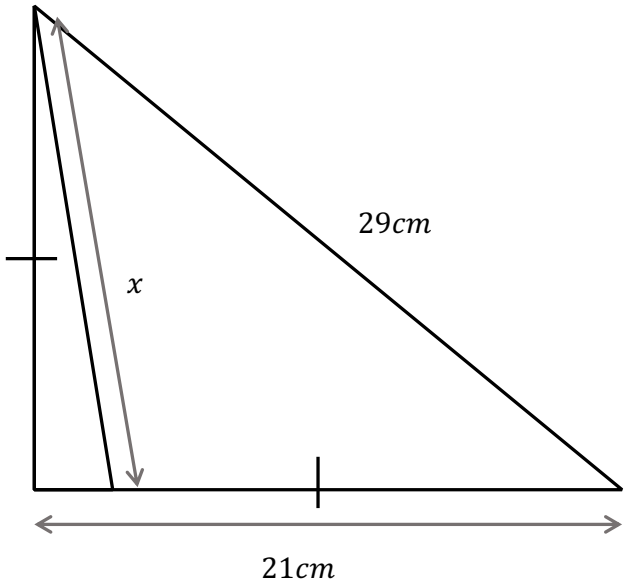


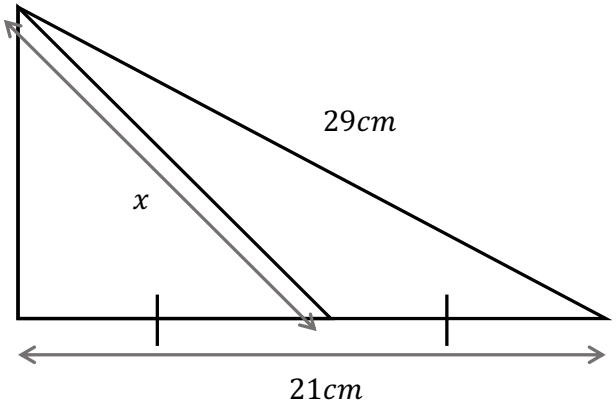
Intelligent Practice

Find the value of x in each instance to 2dp. Predict whether you think each answer will be higher or lower than the one before it.





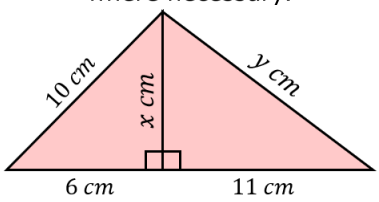




Multi-Step Pythagoras' Theorem

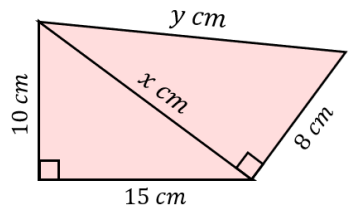
(a)

Find x and y, rounding to 1 decimal place where necessary.



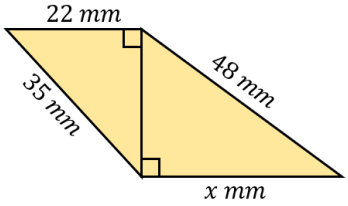
(b)

Find x and y, rounding to 1 decimal place where necessary.



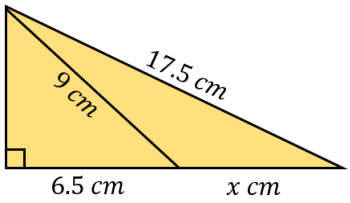
(c)

Find x, to 1 decimal place.



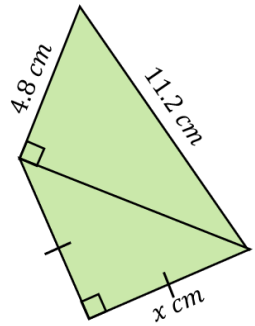
(d)

Find x, to 1 decimal place.



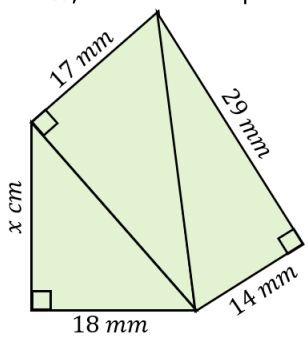
(e)

Find x, to 1 decimal place.



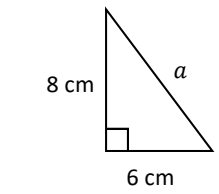
(f)

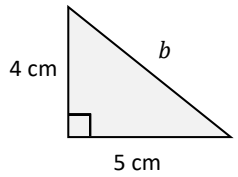
Find x, to 1 decimal place.

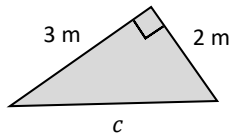


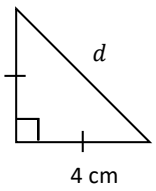
Fluency Practice

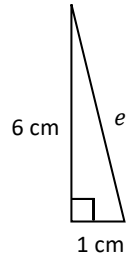
Using Pythagoras' Theorem Find each missing length.

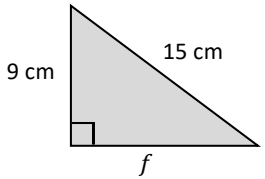


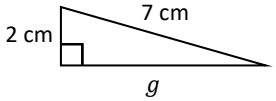


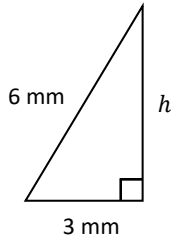


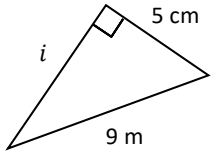


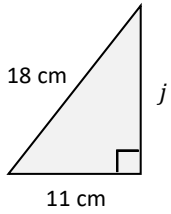


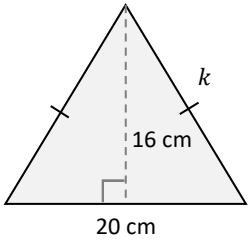


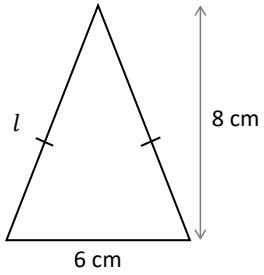


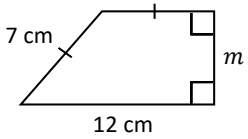


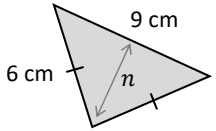


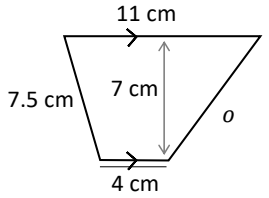












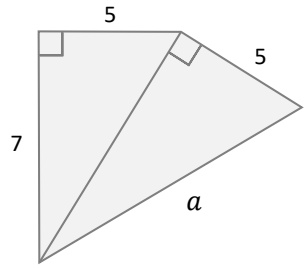
14 Answers	5.7	12	5.2	18.9	6.1	4.0	3.6
	14.2	6.4	4.9	10	8.5	7.5	6.7

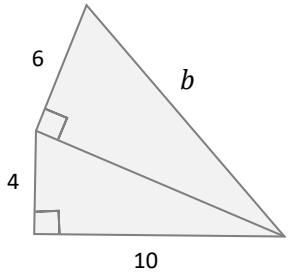
Fluency Practice

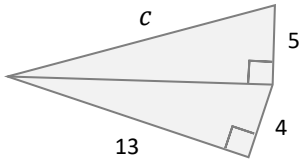
Keep it in the Calculator!

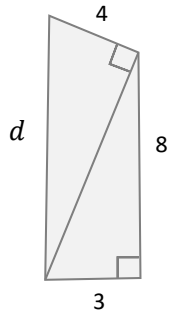
What **method** can you use to find the value of each letter? Lengths are cm.

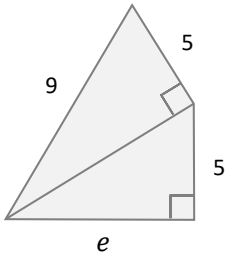
NOT DRAWN ACCURATELY

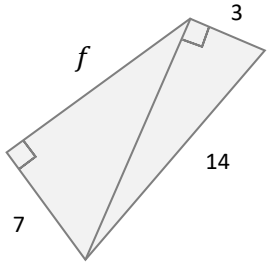


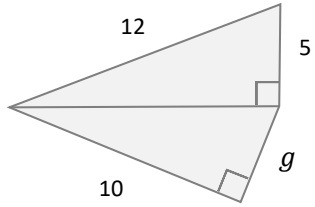


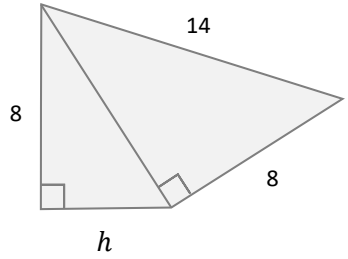


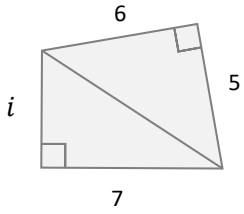


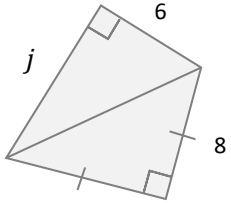


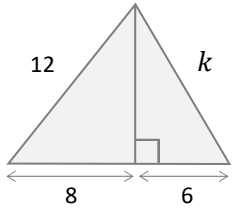


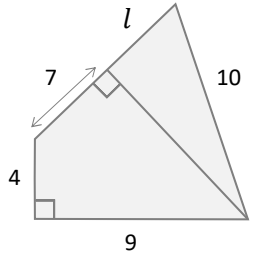












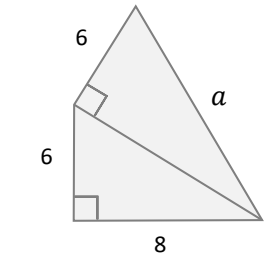
10 Answers	5.6	4.4	9.9	8.2	14.5
	12.3	9.4	9.6	11.7	3.5

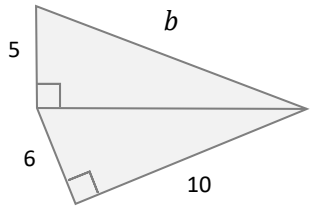
Fluency Practice

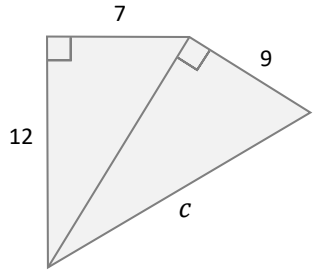
Keep it in the Calculator!

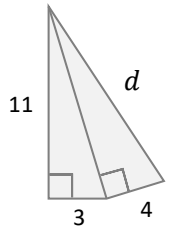
What **method** can you use to find the value of each letter? Lengths are cm.

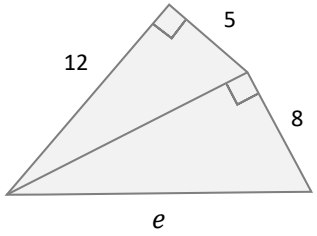
NOT DRAWN ACCURATELY

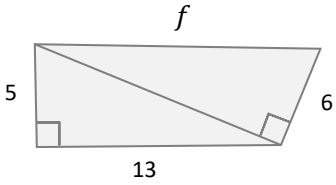


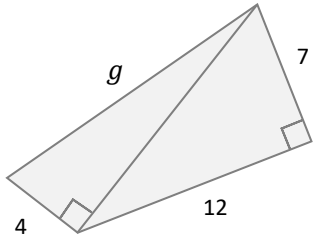


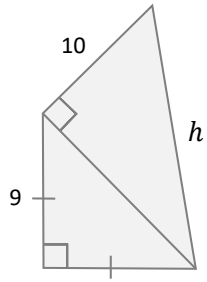


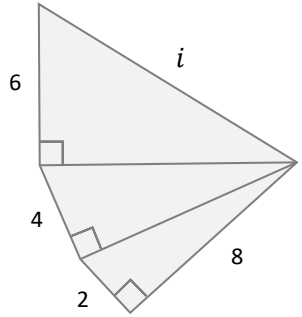


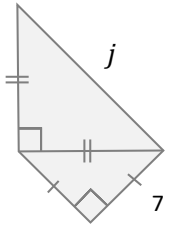


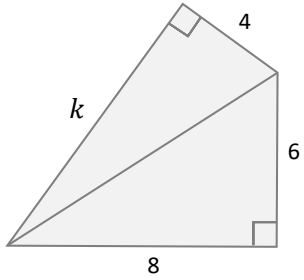


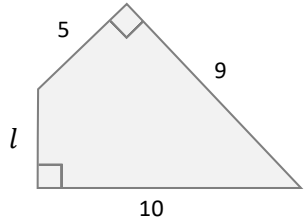






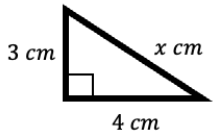
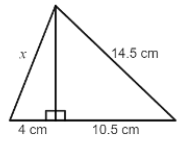
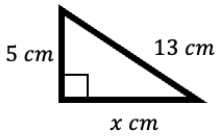
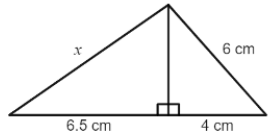
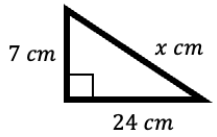
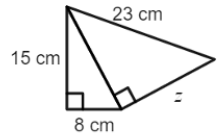
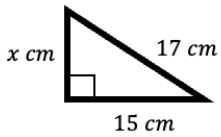
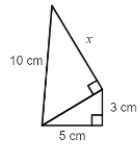
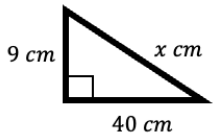
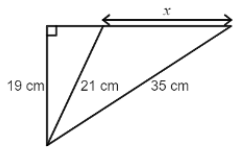
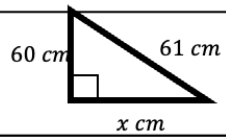
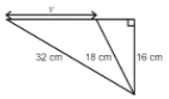






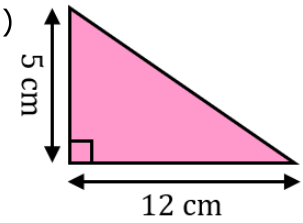
10 Answers	12.7	16.2	15.2	15.3	16.6
	11.0	12.1	14	11.7	14.5

Fluency Practice

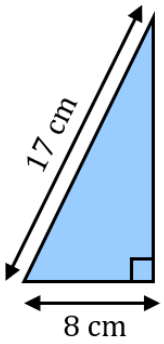
Q	Find the missing length	Answers	Q	Find the missing length	Answers
1			7		
2			8		
3			9		
4			10		
5			11		
6			12		

Find the area and perimeter of each of these right-angled triangles:

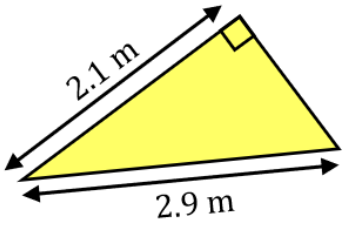
(a)



(b)

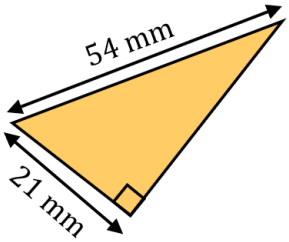


(c)

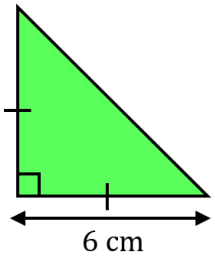


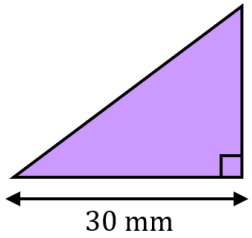
Find the area and perimeter of each of these right-angled triangles, giving your answers to 1 decimal place.

(a)



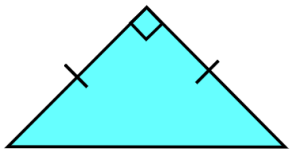
(b)



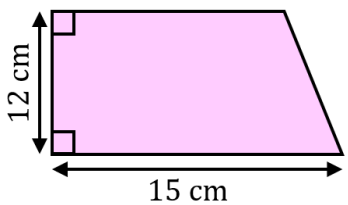


(a) The area of this triangle is $600\ \text{mm}^2$. Find the perimeter of the triangle.

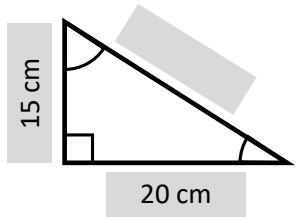
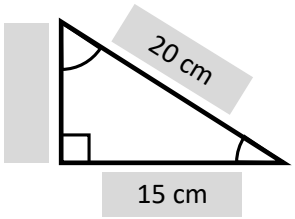
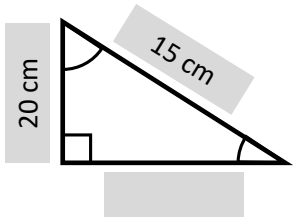
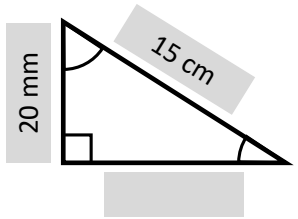
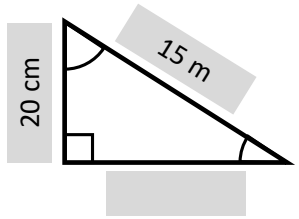
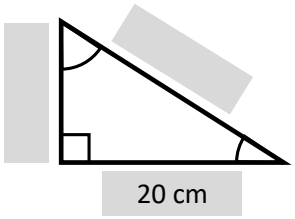
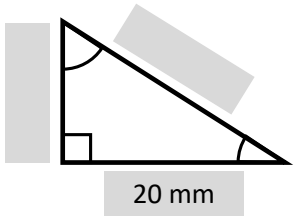
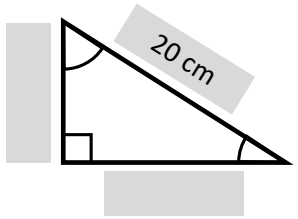
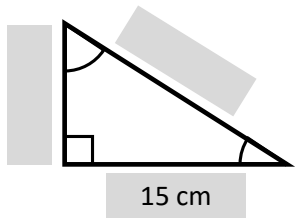
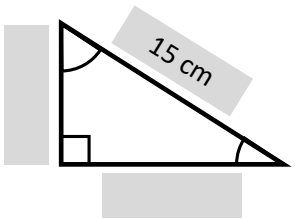
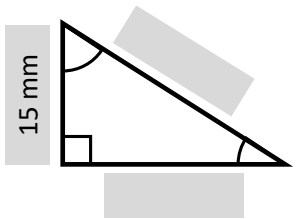
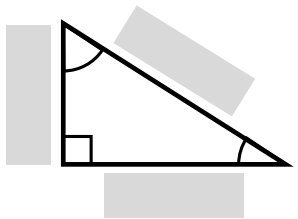
(b) The area of this triangle is $24.5\ \text{cm}^2$. Find the perimeter of the triangle.



The area of the trapezium is $120\ \text{cm}^2$. Find the perimeter of the trapezium.

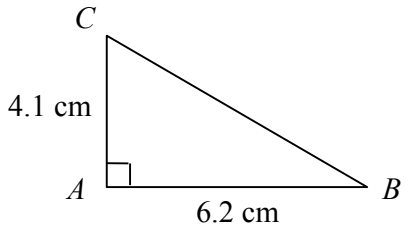


Intelligent Practice

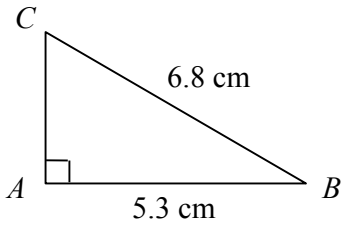
1.  Perimeter = Area =	2.  Perimeter = Area =	3.  Perimeter = Area =	4.  Perimeter = Area =
5.  Perimeter = Area =	6.  Perimeter = Area = 15 cm^2	7.  Perimeter = 15 cm Area =	8.  Perimeter = Area = 15 cm^2
9.  Perimeter = Area = 20 cm^2	10.  Perimeter = Area = 20 cm^2	11.  Perimeter = 20 cm Area =	12.  Perimeter = 20 cm Area = 15 cm^2

Fluency Practice

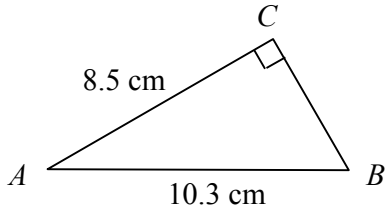
A1 Find length *BC*



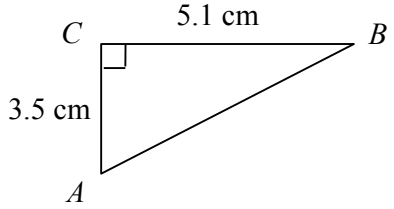
A2 Find length *AC*



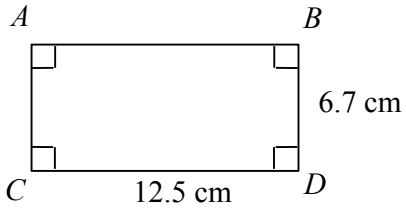
A3 Find length *BC*



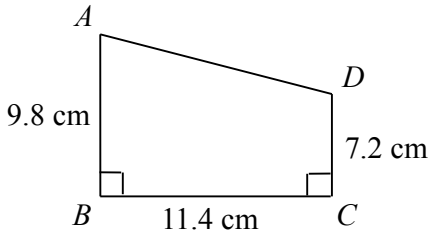
A4 Find length *AB*



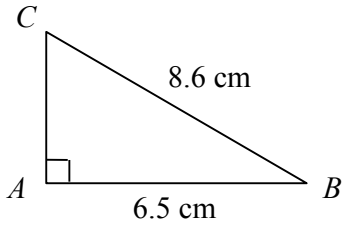
B1 Find length *BC*



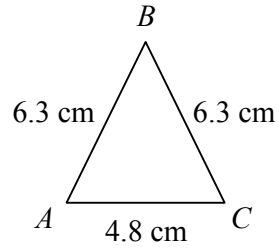
B2 Find length *AD*



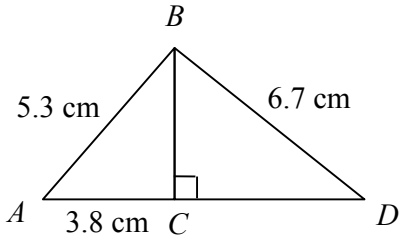
B3 Find the **area**



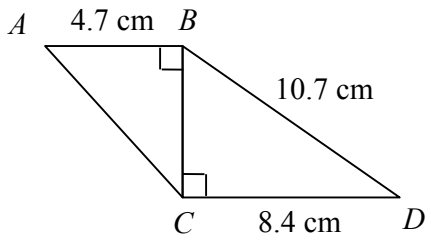
B4 Find the **area**



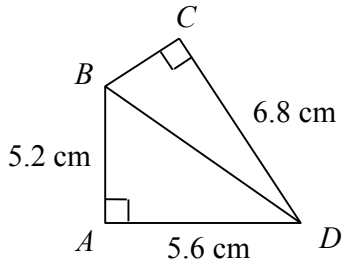
C1 Find length *CD*



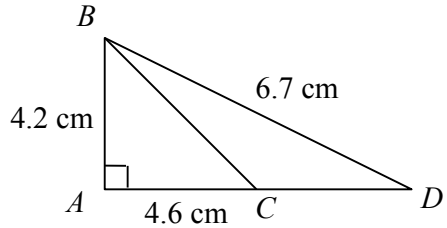
C2 Find length *AC*



C3 Find length *BC*



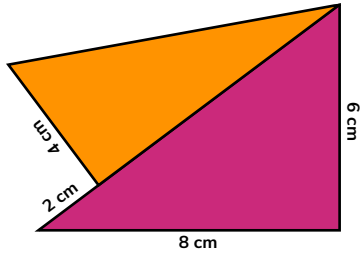
C4 Find length *CD*



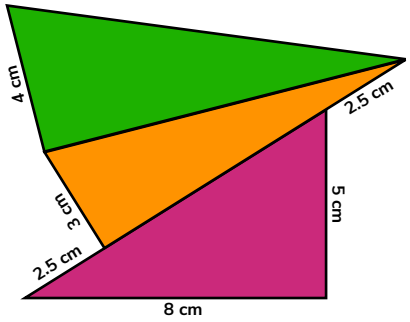
PYTHAGORAS PILE UP

In each case, find the hypotenuse of the top triangle, correct to 1 decimal place.
All the triangles are right-angled. Not to scale. No rounding until the end!

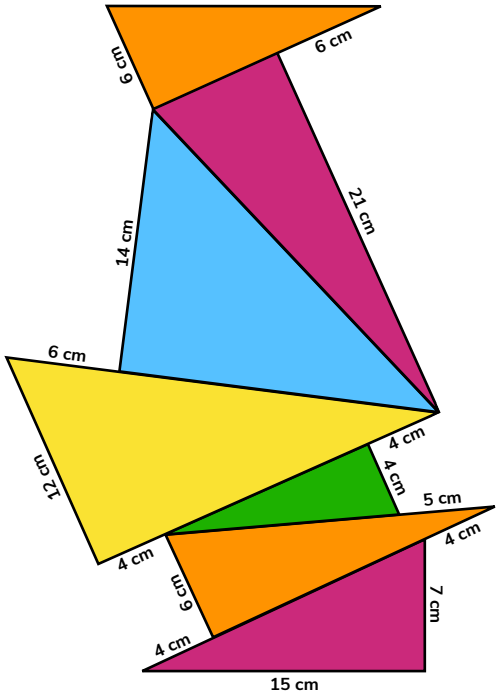
A.



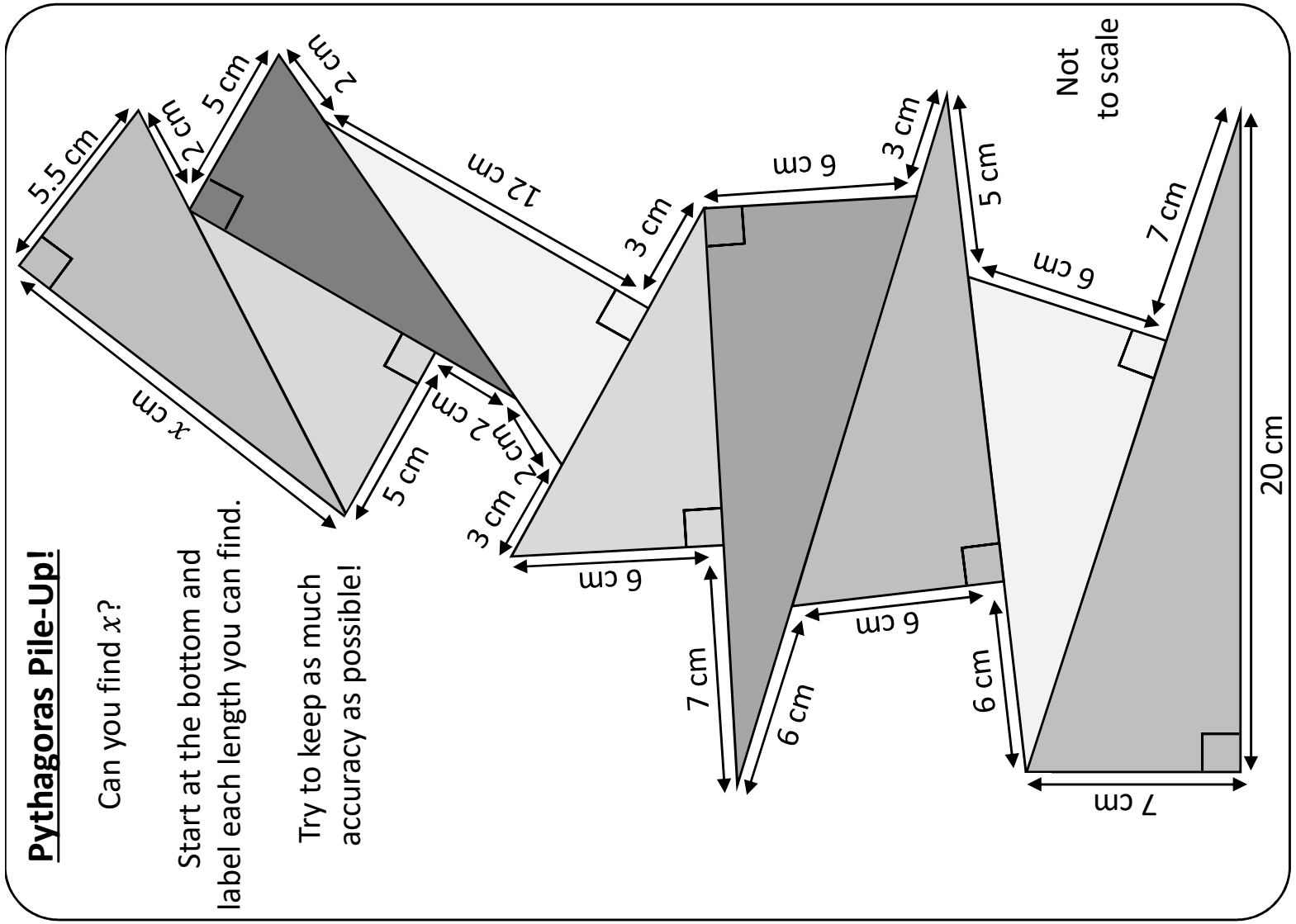
B.



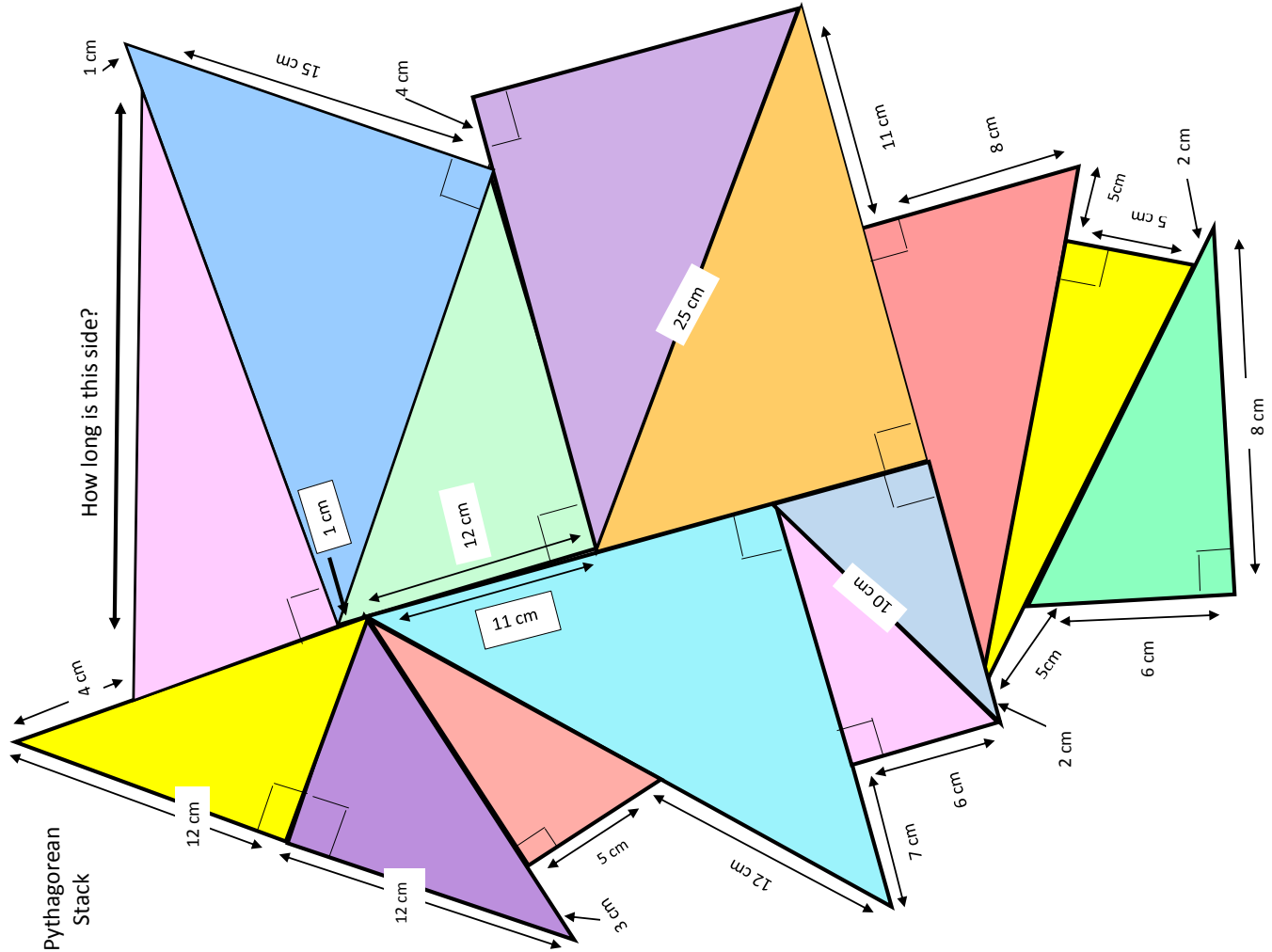
C.



Purposeful Practice



Purposeful Practice

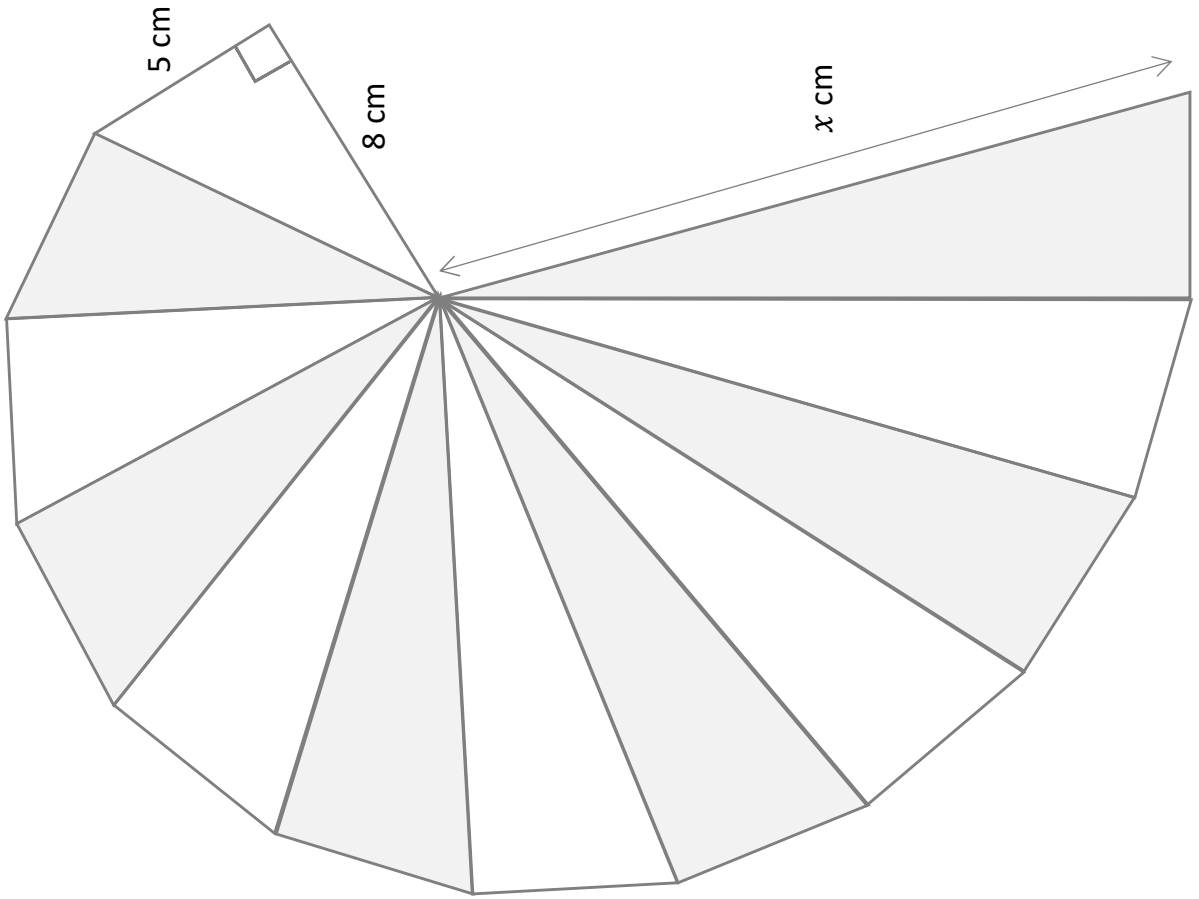


Fluency Practice

Pythag. Shell

All the triangles making up the shell are right-angled and they all have the same height.

Find the value of x.

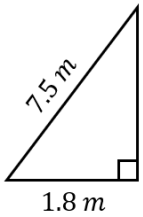


Purposeful Practice

Pythagoras' Theorem Worded Problems

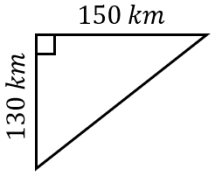
(a)

A ladder which is 7.5 m long, leans against a wall. The foot of the ladder is 1.8 m from the foot of the wall. How far up the wall does the ladder reach to 1 decimal place?



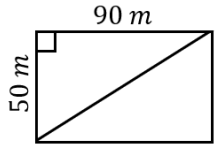
(b)

A ship sails 150 km west, then turns and sails 130 km south. How far from its original position is the ship now, to the nearest km?



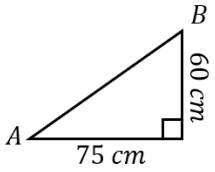
(c)

A football pitch is 90 m by 50 m. Find the length of the diagonal of the pitch to 1 decimal place.



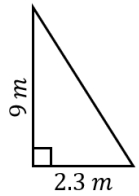
(d)

A snail starts at point A and travels 75 cm east and then 60 cm north to point B. Find the direct distance from A to B.



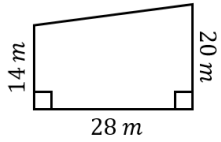
(e)

A ladder leans against a wall. The foot of the ladder is 2.3 m from the foot of the wall, and the ladder reaches 9 m up the wall. How long is the ladder, to 1 decimal place?



(f)

A farmer has a field in the shape of a trapezium, as shown. He wants to put a fence all the way around the field. How long will the fence need to be, to 1 decimal place?



(g)

A netball pitch is 15 metres wide and 30 metres long. Find the length of the diagonal to 1 decimal place.

(h)

A bird flies from its nest 2 km due north, then 3.5 km due east. Find the distance of the bird from its nest after its flight.

(i)

A ladder of length 8.2 m leans against a wall. The ladder reaches 6.9 m up the wall. How far is the foot of the ladder from the foot of the wall?

(a) A model football pitch is 2m long and 0.5m wide. How long is the diagonal?

(b) A 12m long ladder leans against a wall. The foot of the ladder is 2.5m from the foot of the wall. How far up the wall does the ladder reach?

(c) A triangle has sides 7cm, 24 cm and 26 cm. Is the triangle right-angled?

(d) Find the length of the line that joins the coordinate points (13, 6) and (1, 1).

(e) A boat sails 40km east then turns and sails 50km south. How far is the boat from its original position?

(f) A ladder, 15m long, leans against a wall. If it needs to reach 12 m up the wall, how far from the foot of the wall must the ladder be placed?

(g) A piece of land is in the shape of an isosceles triangle with sides 6.5m, 6.5m and 7.4m. Find the area of the piece of land.

(h) A 10m mast on a boat is supported by a wire called a stay. The stay is 11m long. How far from the base of the mast does the stay reach?

(i) A rectangle is 4cm long. The length of the diagonal is 5cm. What is the area of the rectangle?

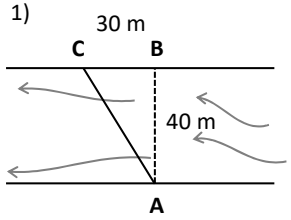
(j) Calculate the area of an equilateral triangle with side length 10mm.

(k) Calculate the area of a regular hexagon with side length 8 cm.

Purposeful Practice

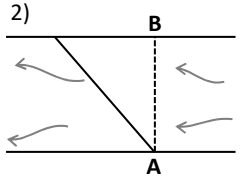
Practical Pythagoras Problems

1)



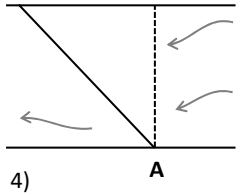
Mak tries to swim across this river from **A** to **B**.
The river is 40 m wide.
The current pushes him 30 m downstream to **C**.
How far did Mak actually travel in total?

2)



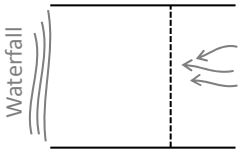
Emily tries to swim across this river from **A** to **B**.
The river is 37 m wide & she actually travels 72 m.
How far downstream from **B** did Emily arrive?

3)



Max tries to swim directly across a river from **A**.
In total he swims 108 m.
The current pushes him 84 m away from his target.
How wide is the river?

4)

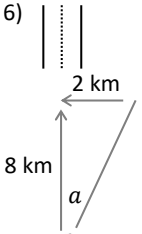


Pai tries to swim directly across a
32 m wide river, 238 m before a waterfall.
In total she travels 245 m.
Does Pai make it across before the waterfall?

5)

Tran swims at 1.2 m/s perpendicular to a river's current.
The river's current has a speed of 0.8 metres per second.
What is Tran's total speed?

6)



A runway is 8 km directly North from a plane coming to land.
The wind is coming directly from the East.
If the pilot does not fly into the wind, the wind will push the plane 2 km West & off course.
How far must the plane actually fly to reach the runway?

7)

On approach, a crosswind will push a plane
7 km left of the runway. The plane must fly 45 km to
reach the runway. How far is the runway from the plane?

8)

A plane's engine propels it forward at 300 m/s.
A perpendicular crosswind pushes the plane directly sideways at 50 m/s.
How far does the plane actually travel in one second?

9)

A plane's engine propels it forward at 280 m/s.
In one second the plane actually travels 300 metres (its *groundspeed*).
What is the speed of the perpendicular crosswind?

10)

A pilot wants to land with a groundspeed of 352 m/s.
The crosswind is 22 m/s.
At what speed must the pilot fly into the crosswind?

WORDED: PYTHAG.

1) Denise uses a ladder to install a light on a wall. The ladder needs to reach a height of 5 metres. For safety, the base of the ladder must be 2 metres from the base of the wall. What minimum length must the ladder be?

2) Kelly is jumping from a 12 metre tall sea-cliff. Rocks extend for 4 metres perpendicular to the base of the cliff.
To land safely in the water, how far must Kelly travel in total?

3) James travels down a straight water-slide. He loses 17 metres in height over 86 metres. How far horizontally did James travel?

4) A zip-line is 250 metres long. It travels a horizontal distance of 140 metres. How far does the zip-line drop from start to finish?

5) Sandy climbs a mountain in the Alps. She walks 24 km but only travels 23.5 km South. Approximately how many metres in height did Sandy gain by climbing the mountain?

6) The Metrix building is 225 metres tall. 50 metres away is the Kerber building which stands at 150 metres tall.
How far is it between the tops of these buildings?

7) The apex of a roof is made by leaning 6-metre pieces of wood together. The base of the roof is 4 metres wide. How tall is the roof?

8) An equilateral triangle has a side length of 8 centimetres.
What is the area of the triangle?

9) Danny travels North & Michele travels East, both at the same speed. After 3 hours they are 12 kilometres apart. How far did Danny travel?

Purposeful Practice

diagrams are not drawn accurately
give your answers to 2 decimal places

KS3 SAT questions (i)

missing sides

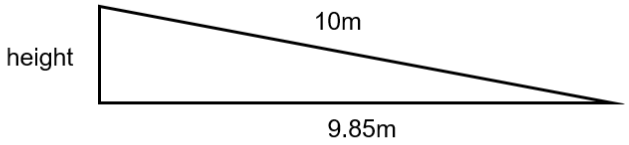
(a) calculate the length of the longest side (*AB*) of a right-angled triangle *ABC* with shorter sides *BC* = 2cm and *AC* = 5cm

(b) calculate the length of the side of a right-angled triangle *DEF* with a hypotenuse *EF* = 15cm and another side *DE* = 14cm

ramp

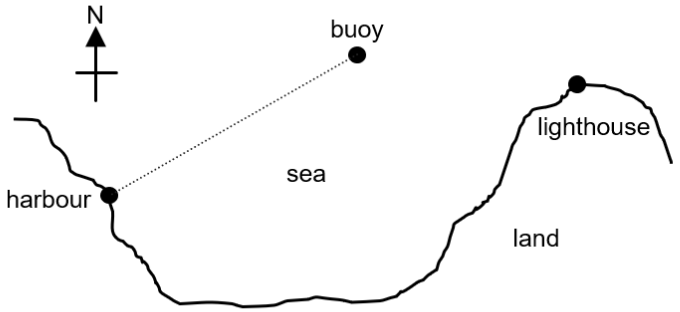
a ramp that is 10m long must not have
a height greater than 0.83m
here is the side view for a ramp

is this ramp too high?
please show calculations to explain your answer



boat

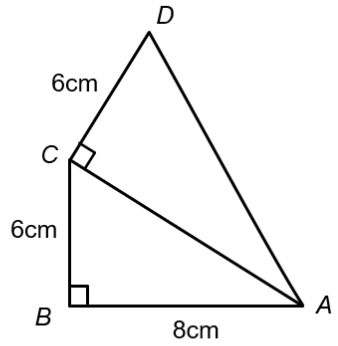
a boat sails from the harbour to a buoy
which is 6km to the east and 4km to the north of the harbour
calculate the shortest distance between the buoy and the harbour



KS3 SAT questions (ii)

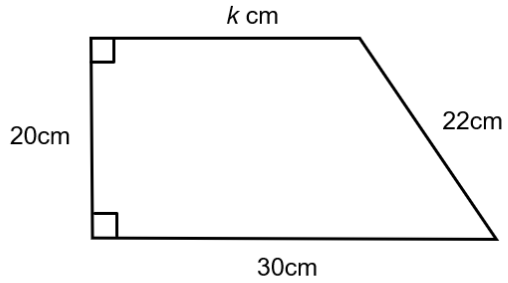
two triangles

ABC and *ACD* are both right-angled triangles
calculate the length of *AD*



trapezium

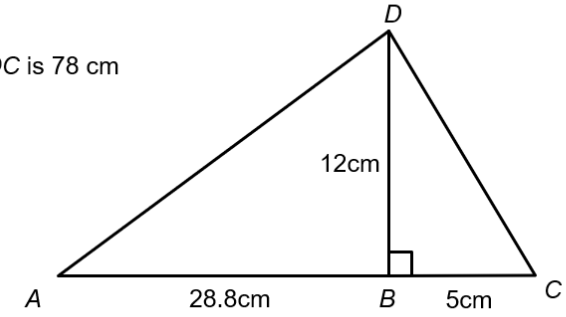
work out the size of length *k*



perimeter

two right-angled triangles are joined together to
make a larger triangle *ADC*

(a) show that the perimeter of triangle *ADC* is 78 cm
(b) show that triangle *ADC* is right-angled

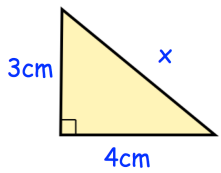


diagrams are not
drawn accurately

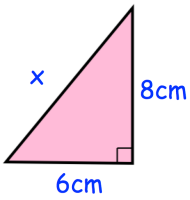
give your answers to
2 decimal places

Question 1: For each right angle triangle below, work out x

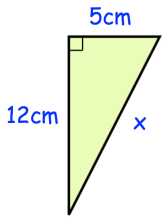
(a)



(b)

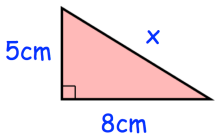


(c)

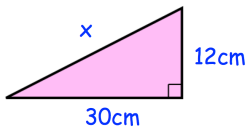


Question 2: Calculate x
Give each answer to 2 decimal places.

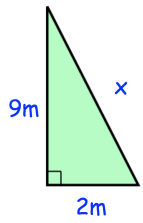
(a)



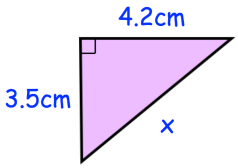
(b)



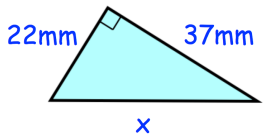
(c)



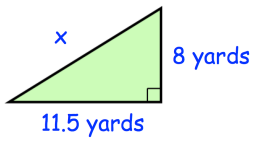
(d)



(e)

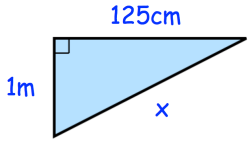


(f)

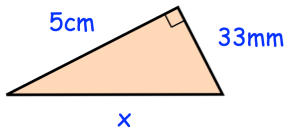


Question 3: Calculate x
Include suitable units and give each answer to 1 decimal place.

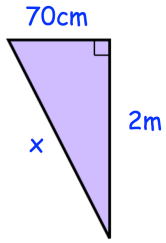
(a)



(b)

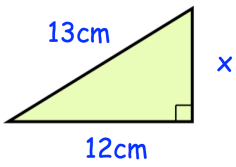


(c)

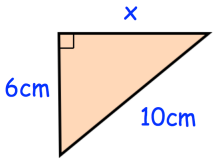


Question 4: For each right angle triangle below, work out x

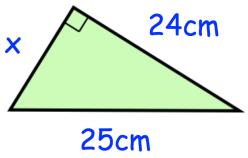
(a)



(b)

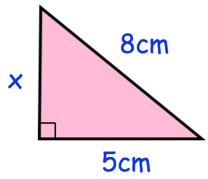


(c)



Question 5: Calculate x
Give each answer to 2 decimal places.

(a)



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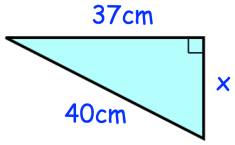

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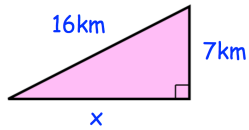
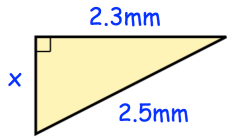
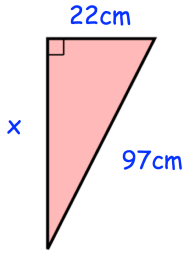


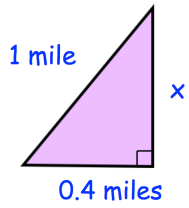
(d)



(e)

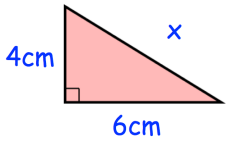


(f)



Question 6: Calculate x for each right angle triangle.
Give each answer to 2 decimal places.

(a)



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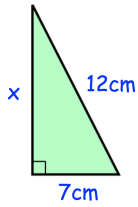
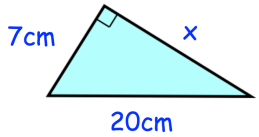
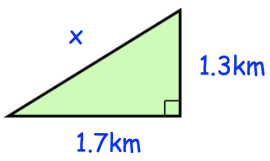


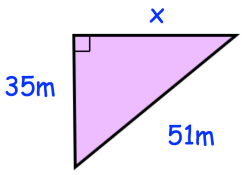
(c)



(d)



(e)



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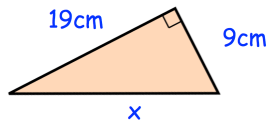
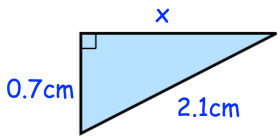
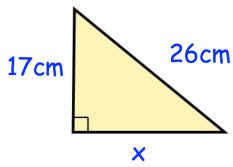


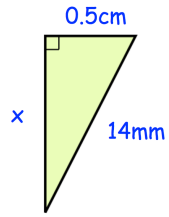
(g)



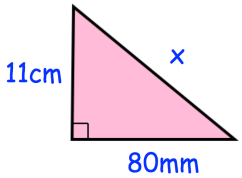
(h)



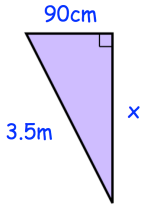
(i)



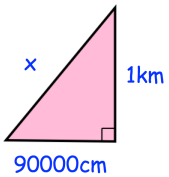
(j)



(k)

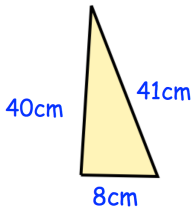


(l)

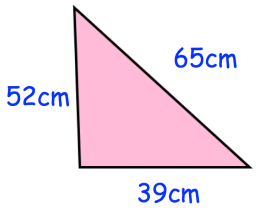


Question 7: Work out if each triangle below is right angled or not.
The triangles are not drawn accurately.

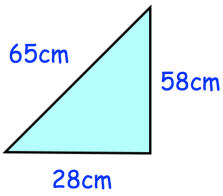
(a)



(b)

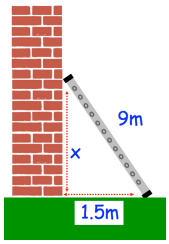


(c)

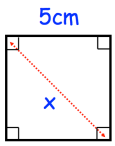


Apply

Question 1: A 9m ladder is placed against a wall.
The foot of the ladder is 1.5m from the foot of the wall.
How far up the wall does the ladder reach?

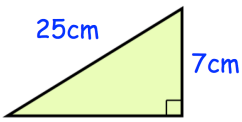


Question 2: Shown is a square with side length 5cm.
Find the length of the diagonal, x.



Question 3: Shown is a right angle triangle.
Calculate:

(a) the perimeter of the triangle.
(b) the area of the triangle.

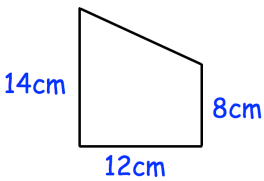


Question 4: A rectangle is 20cm long and 8cm wide.
Find the length of the diagonal of the rectangle.

Question 5: An airplane is flying from Redville to Leek.
The airplane flies 50 miles East and then 180 miles South.
How far is Leek from Redville directly?

Question 6: A frame is made from wire.
The frame is a trapezium
Calculate the total amount of wire needed to make the frame.

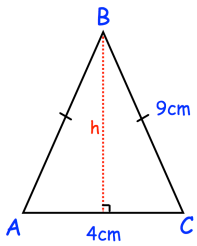
Give your answer to 1 decimal place.



Question 7: ABC is an isosceles triangle.

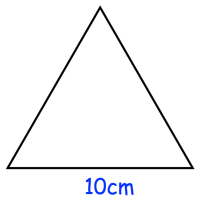
(a) Find h.

(b) Find the area of the triangle.



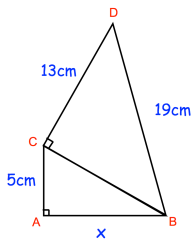
Question 8: Shown is an equilateral triangle.

Find the area of the equilateral triangle.



Question 9: Stanley has drawn a right angle triangle.
One side is 14cm and another is 18cm.
There are two possible lengths for the third side.
What are they?

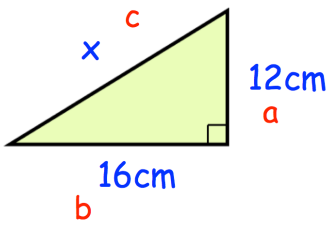
Question 10: ABC and BCD are right angle triangles.
Find the length of AB



Question 11: A wooden flagpole is 25 foot tall.
In a storm, the flagpole is broken and its top touches the ground 5 foot from the base.

Find the lengths of the segments of the flagpole.

Question 12: Benjamin has completed this question.
Can you spot any mistakes?



$a^2 + b^2 = c^2$

$12^2 + 16^2 = x^2$

$144 + 256 = x^2$

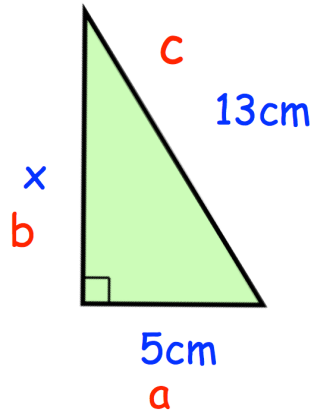
$400 = x^2$

$x^2 = 400$

$x = 200\text{cm}$

Purposeful Practice

Question 13: Chantelle has completed this question.
Can you spot any mistakes?



$a^2 + b^2 = c^2$

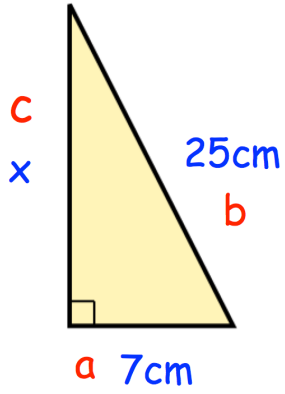
$5^2 + x^2 = 13^2$

$10 + x^2 = 26$

$x^2 = 16$

$x = 4\text{cm}$

Question 14: Victor has completed this question.
Can you spot any mistakes?



$a^2 + b^2 = c^2$

$7^2 + 25^2 = x^2$

$49 + 625 = x^2$

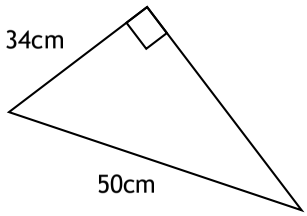
$674 = x^2$

$x^2 = 674$

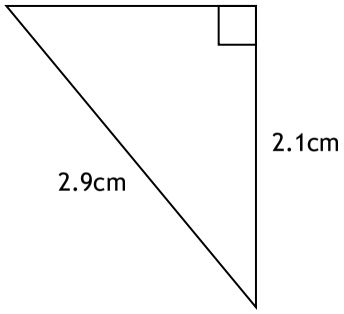
$x = 25.96\text{cm}$

Find the area and perimeter of each triangle

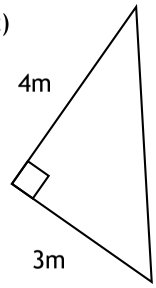
a)



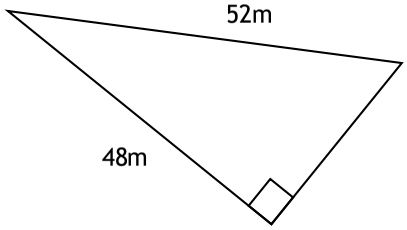
b)



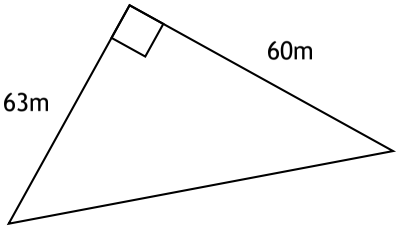
c)



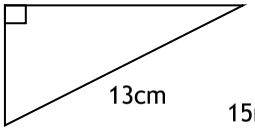
d)



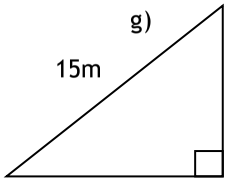
e)



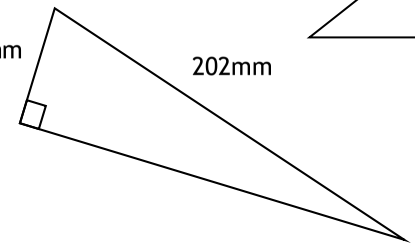
f)



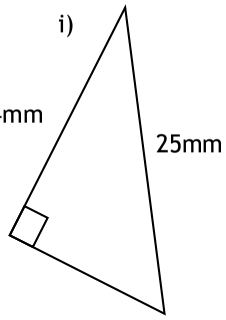
g)



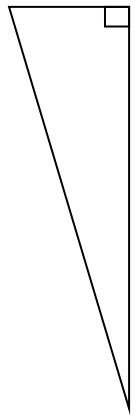
h)



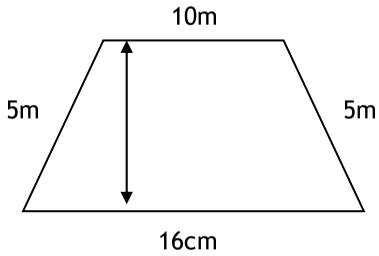
i)



j)



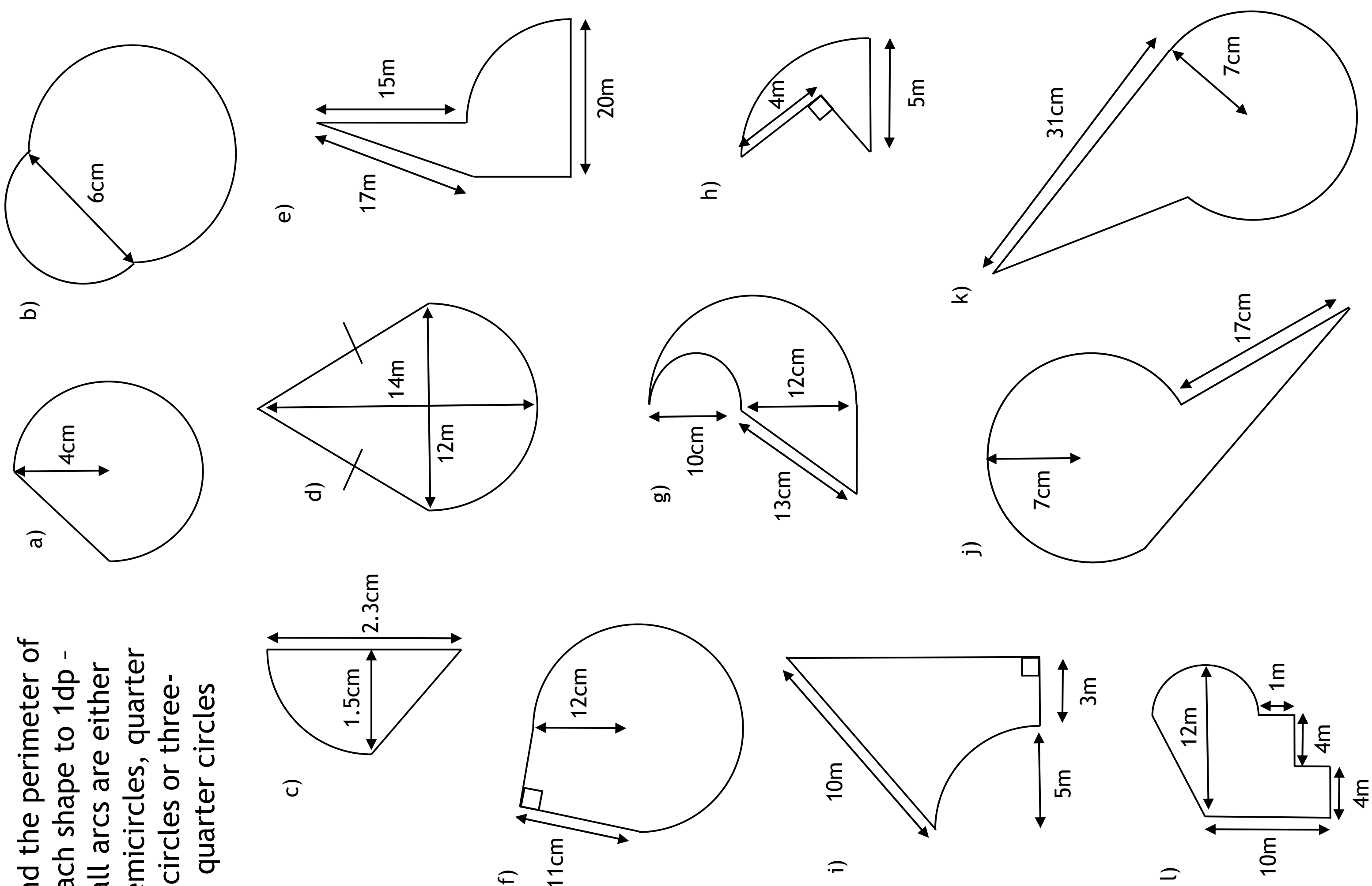
Which triangles above are similar? Write the pairs.



Find the height of the trapezium

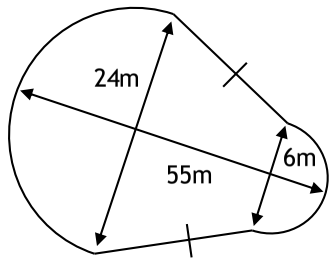
Fluency Practice

Find the perimeter of each shape to 1dp - all arcs are either semicircles, quarter circles or three-quarter circles

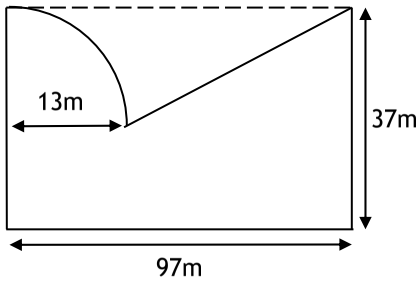


Find the perimeter of each shape to 1dp – all arcs are either semicircles, quarter circles or three-quarter circles

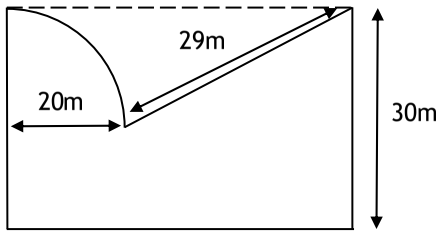
m)



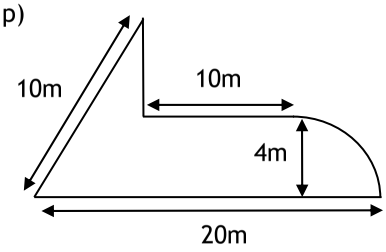
n)



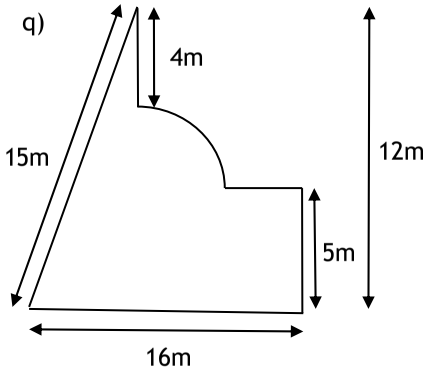
o)



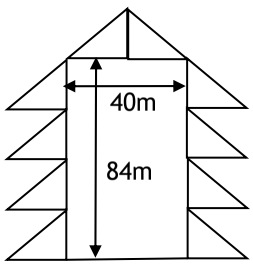
p)



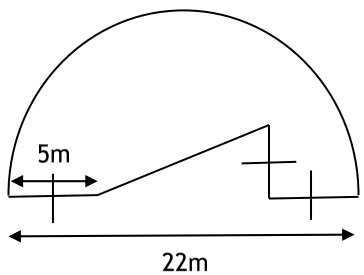
q)



r) *The shape below is made of 10 congruent triangles surrounding a rectangle*



s)



2 Properties of 3D Shapes

Question 1: Draw the following 3D shapes

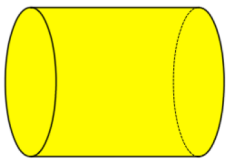
(a) A cube (b) A cuboid (c) A sphere

(d) A cylinder (e) A triangular prism (f) A cone

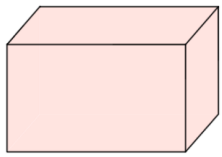
(g) A square-based pyramid (h) A tetrahedron/triangular-based pyramid

Question 2: Name each of the 3D shapes below

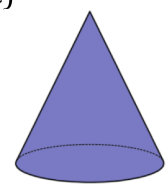
(a)



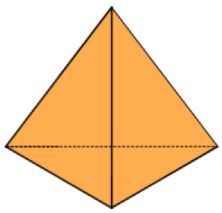
(b)



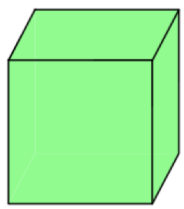
(c)



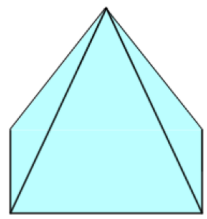
(d)



(e)



(f)



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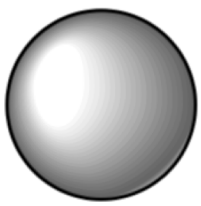
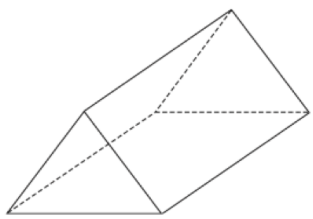


(h)



Question 1: Below is a picture of some objects.
Write down any 3D shapes you see and what they are in the picture.

Question 2: Can you spot any mistakes below?

The names of five solid shapes are given.

triangular prism sphere cube cuboid cylinder

Three of them are drawn below.

A B C

Complete these statements.

Shape A is called a ..... Cube .....

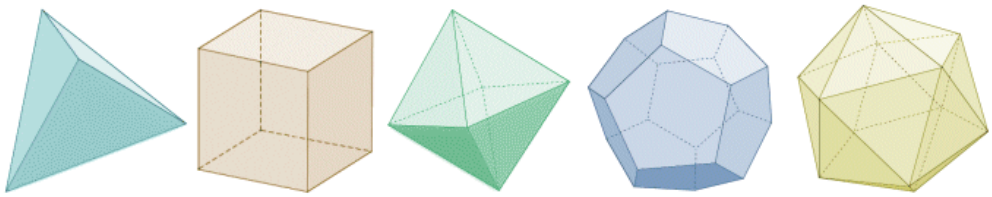
Shape B is called a ..... Cylinder .....

Shape C is called a ..... Sphere .....

Extension Task

Go on a 3D shape hunt around the classroom, the playground or at home.
Take photographs of any 3D shapes you can find.

There are five Plato's solids – the tetrahedron, cube, octahedron, dodecahedron and icosahedron. They all have faces which are regular shapes.



Tetrahedron Hexahedron Octahedron Dodecahedron Icosahedron

A 3-D shape has faces (surfaces), vertices (corners) and edges. Complete the table for the five 3-D shapes given.

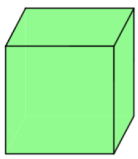
3-D Shape	Shape of Face	No. of Faces	No. of Vertices	No. of Edges	Faces + Vertices
Tetrahedron					
Cube					
Octahedron					
Dodecahedron					
Icosahedron					

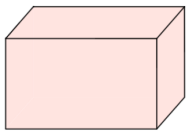
What can patterns can you see in the table?

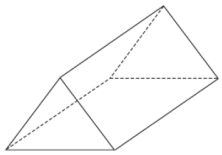
EULER'S FORMULA

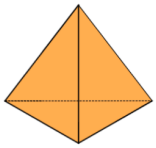
Investigate whether Euler's formula is true for other 3D shapes too.

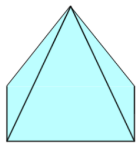
Question 1: For each 3D shape below, write down how many edges, faces and vertices it has.

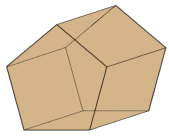
(a) 

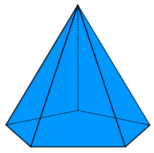
(b) 

(c) 

(d) 

(e) 

(f) 

(g) 

Apply

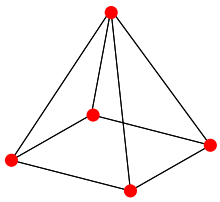
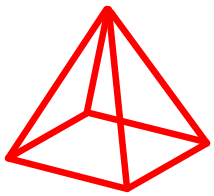
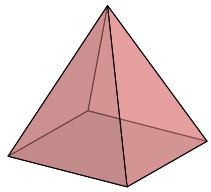
Question 1: Can you spot any mistakes in the question below?

	Faces	Edges	Vertices
Cube	12	6	8
Square-based Pyramid	5	5	5
Triangular Prism	9	9	6

example

A square-based pyramid has:

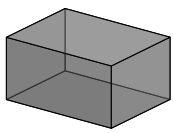
5 vertices **8 edges** **5 faces**

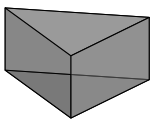
exercise

1. State the number of faces, edges and vertices of each shape:

a) Cuboid

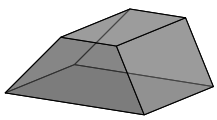


b) Triangular prism

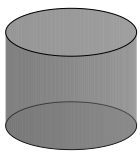


c) Cone

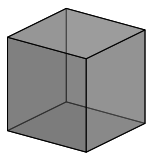
d) Trapezoidal prism



e) Cylinder

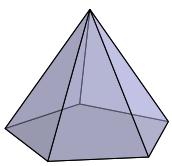


f) Cube

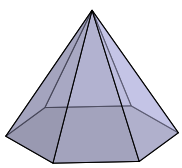


2. a) State the number of faces, edges and vertices of each type of pyramid:

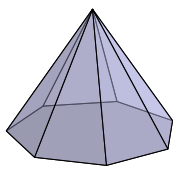
i) Pentagonal pyramid



ii) Hexagonal pyramid



iii) Heptagonal pyramid



b) A pyramid has a base with n sides. Select the correct expressions for the pyramid's:

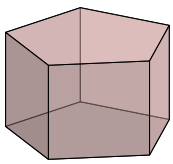
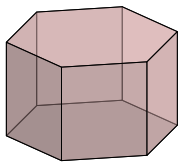
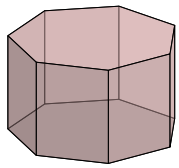
i) number of faces

ii) number of edges

$2n$	$n + 5$	$n + 2$	$n + 1$

3. a) State the number of faces, edges and vertices of each type of prism:

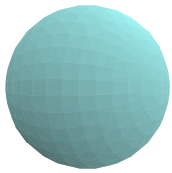
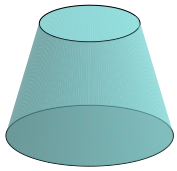
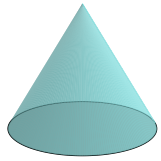
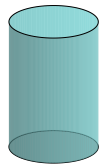
i) Pentagonal prism ii) Hexagonal prism iii) Heptagonal prism

b) The cross-section of a prism is a polygon with n sides.
Write expressions for the prism's:

i) number of faces ii) number of edges iii) number of vertices

4. Here are four shapes with curved faces:

Sphere Frustum Cone Cylinder

a) Which of the shapes have no edges?

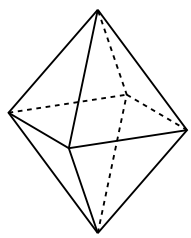
b) Which of the shapes have no vertices?

c) Which two of the shapes have the same number of faces, edges and vertices?

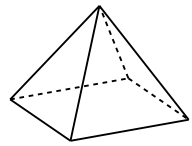
5. a) Work out how many faces, edges and vertices the octahedron in the diagram has.

b) Kim says: "The square-based pyramid is half of the octahedron, so it has half as many faces, edges and vertices."
Is Kim correct?

Octahedron



Square-based pyramid



6. For any 3d shape, the number of faces F, edges E and vertices V are always connected by the formula $V - E + F = 2$.

a) Rearrange the formula to make V the subject.

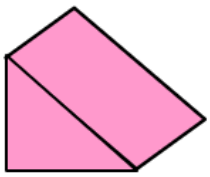
b) Rearrange the formula to make E the subject.

c) A shape has 9 faces and 16 edges. Work out how many vertices the shape has.

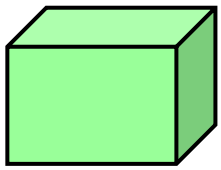
d) A shape has 4 faces and 4 vertices. Work out how many edges the shape has.

For each of the 3D shapes shown, write down the number of faces, vertices and edges.

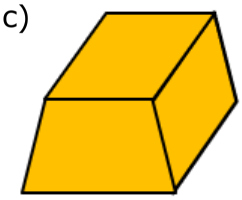
(a)



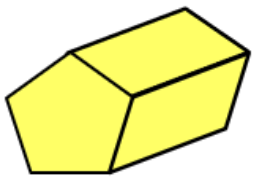
(b)



(c)



(d)

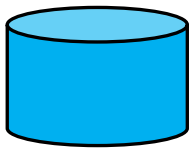


Complete the table for the 3D shapes.

3D Shape	Faces	Vertices	Edges
Cube			
Hexagonal Prism			
Square-based Pyramid			
Tetrahedron			
Octahedron			

For each shape shown, write down the number of flat faces, curved surfaces, edges and vertices.

(a)



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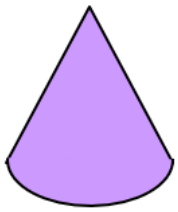

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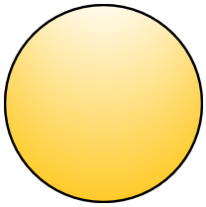

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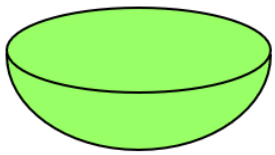


Fluency Practice

Some sketches of 3D shapes have been started for you.

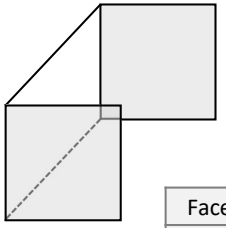
Complete each shape (no need to be accurate!) then count the **Faces**, **Edges** & **Vertices**

plural of *vertex*

Describing Polyhedra

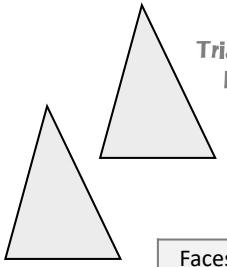
(plural of 'polyhedron' – '*many*' '*bases*')

A 3D shape with flat sides.



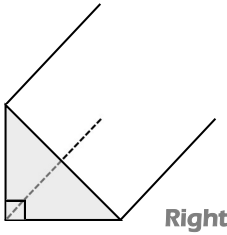
Cuboid

Faces	
Edges	
Vertices	



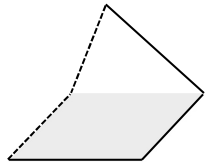
Triangular Prism

Faces	
Edges	
Vertices	



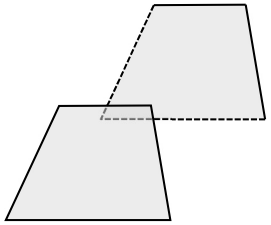
Right-Angled Triangular Prism

Faces	
Edges	
Vertices	



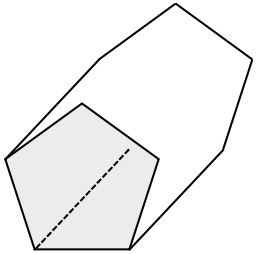
Square-Based Pyramid

Faces	
Edges	
Vertices	



Trapezium-Based Prism

Faces	
Edges	
Vertices	

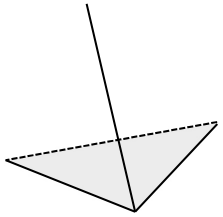


Pentagonal Prism

Faces	
Edges	
Vertices	

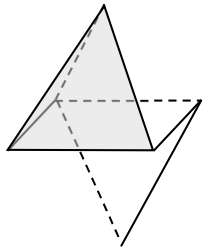
Triangle-Based Pyramid

(Tetrahedron)



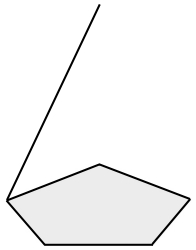
Faces	
Edges	
Vertices	

Faces	
Edges	
Vertices	



Octahedron

Faces	
Edges	
Vertices	

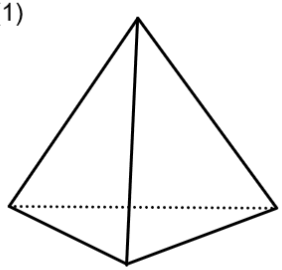


Pentagonal Pyramid

Is there a **formula** that connects the faces, edges & vertices of a polyhedron?

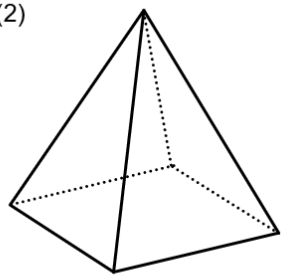
Fluency Practice

(1)



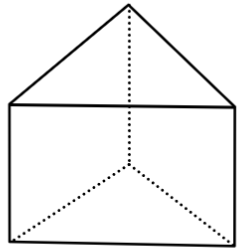
F =
V =
E =

(2)



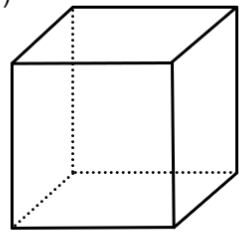
F =
V =
E =

(3)



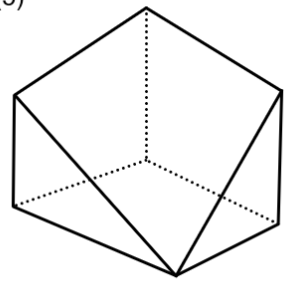
F =
V =
E =

(4)



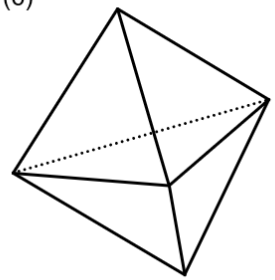
F =
V =
E =

(5)



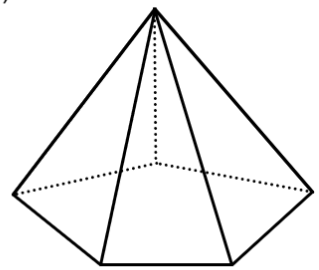
F =
V =
E =

(6)



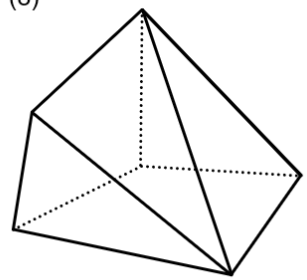
F =
V =
E =

(7)



F =
V =
E =

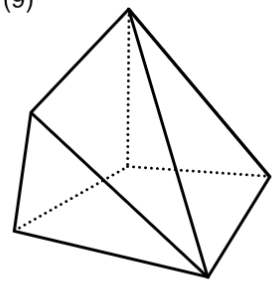
(8)



F =
V =
E =

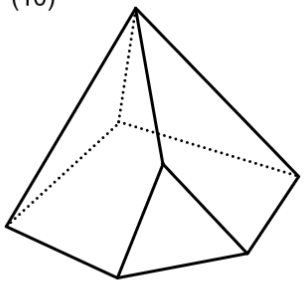
Fluency Practice

(9)



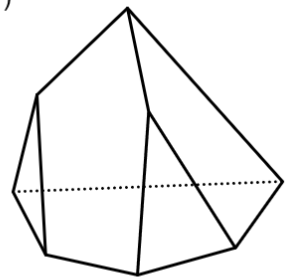
F =
V =
E =

(10)



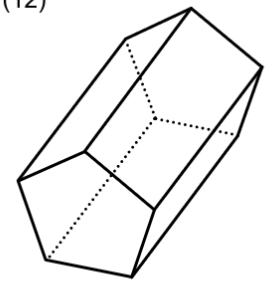
F =
V =
E =

(11)



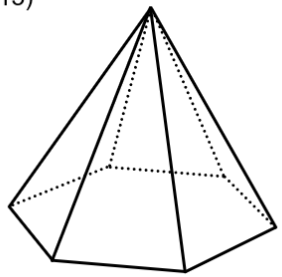
F =
V =
E =

(12)



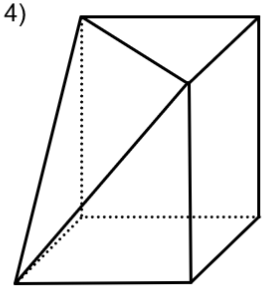
F =
V =
E =

(13)



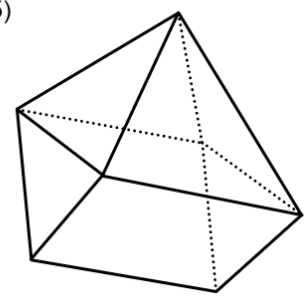
F =
V =
E =

(14)



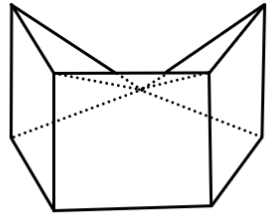
F =
V =
E =

(15)



F =
V =
E =

(16)

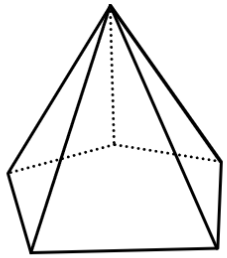


F =
V =
E =

Fluency Practice

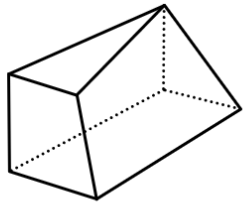
pair off the polyhedra with the same *F*, *V*, *E* values (i)

(1)



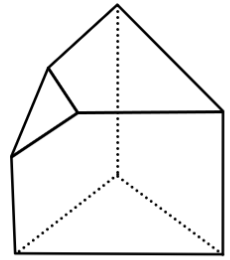
F =
V =
E =

(2)



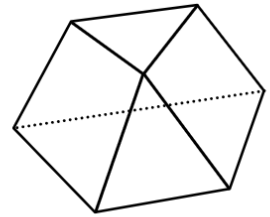
F =
V =
E =

(3)



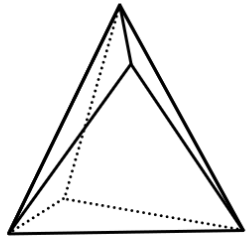
F =
V =
E =

(4)



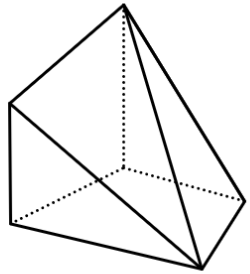
F =
V =
E =

(5)



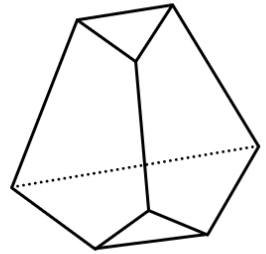
F =
V =
E =

(6)



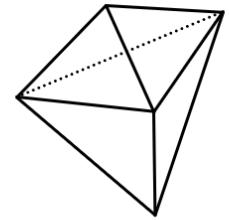
F =
V =
E =

(7)



F =
V =
E =

(8)

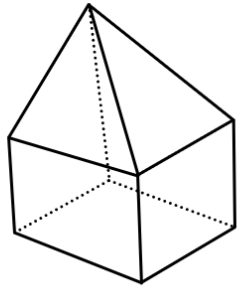


F =
V =
E =

Fluency Practice

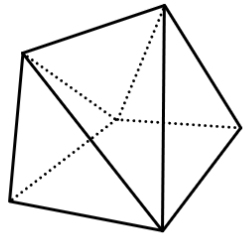
pair off the polyhedra with the same *F*, *V*, *E* values (ii)

(1)



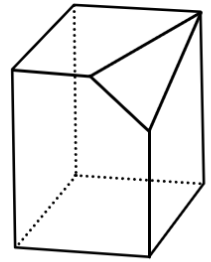
F =
V =
E =

(2)



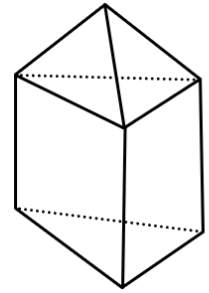
F =
V =
E =

(3)



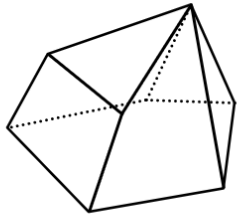
F =
V =
E =

(4)



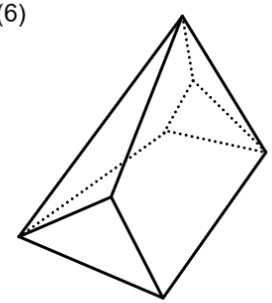
F =
V =
E =

(5)



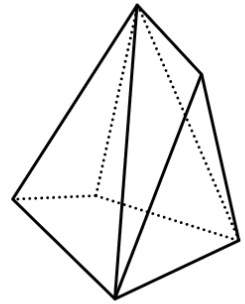
F =
V =
E =

(6)



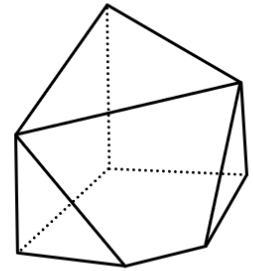
F =
V =
E =

(7)



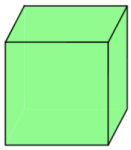
F =
V =
E =

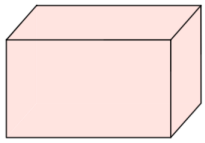
(8)

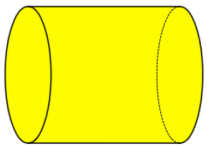


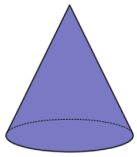
F =
V =
E =

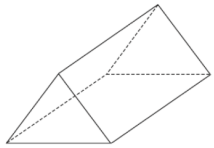
Question 1: Draw the nets for these 3D shapes

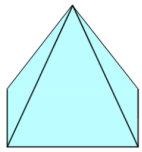
(a) 

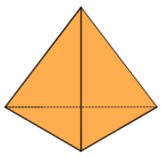
(b) 

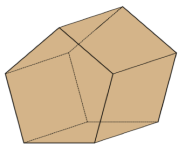
(c) 

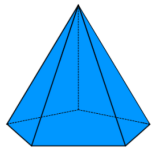
(d) 

(e) 

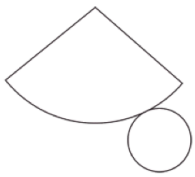
(f) 

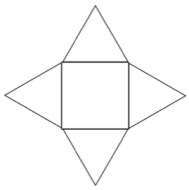
(g) 

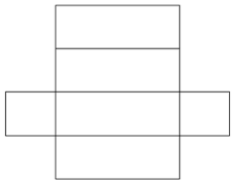
(h) 

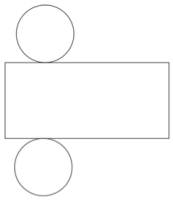
(i) 

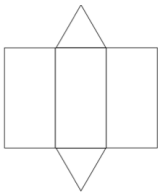
Question 2: Below are nets for various 3D shapes. Name the 3D shapes.

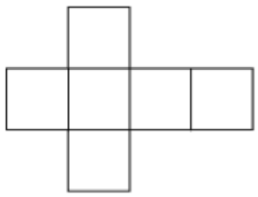
(a) 

(b) 

(c) 

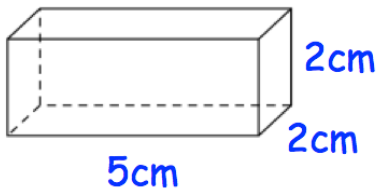
(d) 

(e) 

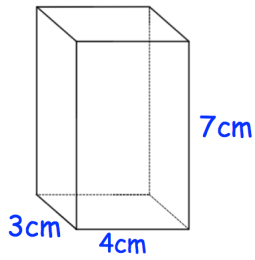
(f) 

Question 3: Draw accurate nets for these 3D shapes on squared paper.

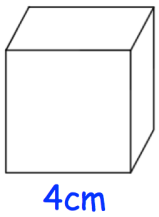
(a)



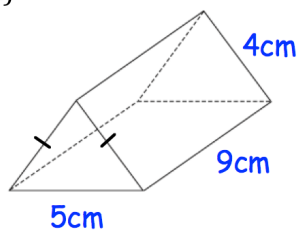
(b)



(c)

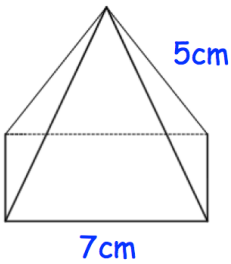


(d)

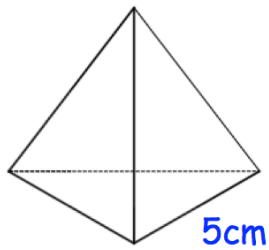


Question 4: Shown below is a square-based pyramid and a tetrahedron.
Draw accurate nets for these 3D shapes on squared paper.

(a)

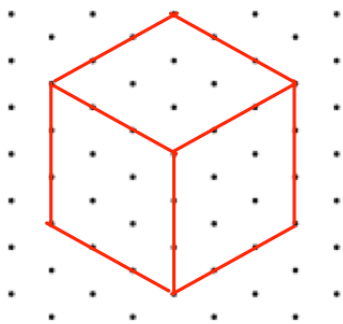


(b)

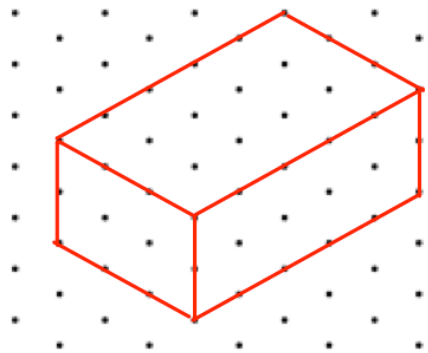


Question 5: The solids on 1cm isometric grids. Draw their nets on squared paper.

(a)

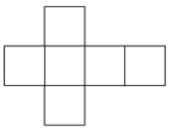


(b)

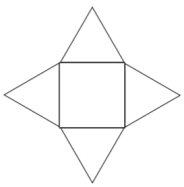


Apply

Question 1: Shown below is a net for a cube. Draw all the other possible nets for a cube.

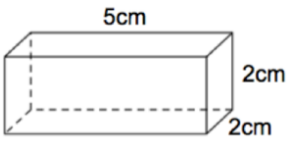


Question 2: Shown below is a net for a square-based pyramid. Draw all other possible nets for a square-based pyramid.



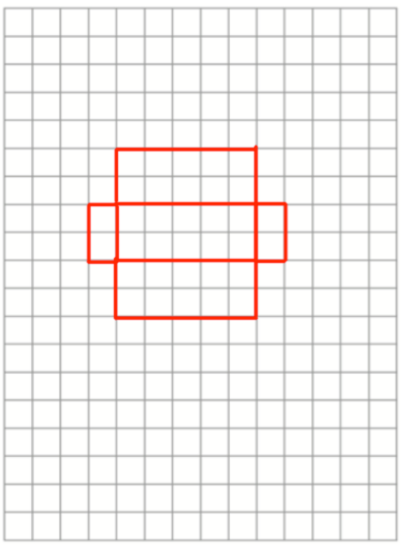
Question 3: Can you spot any mistakes below?

Shown below is a cuboid.



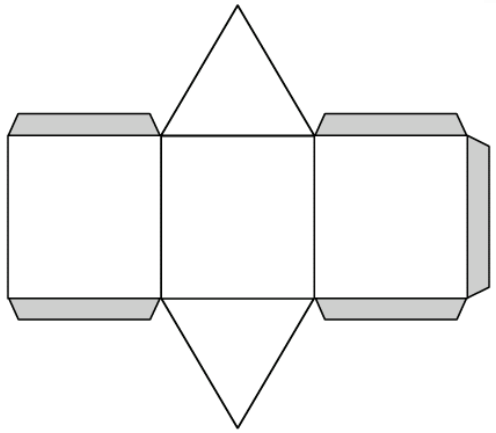
Draw a net for the cuboid.

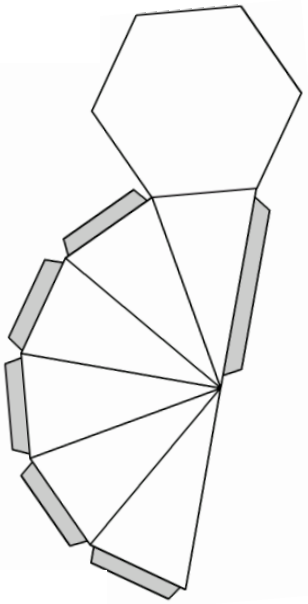
Each square represents 1cm²

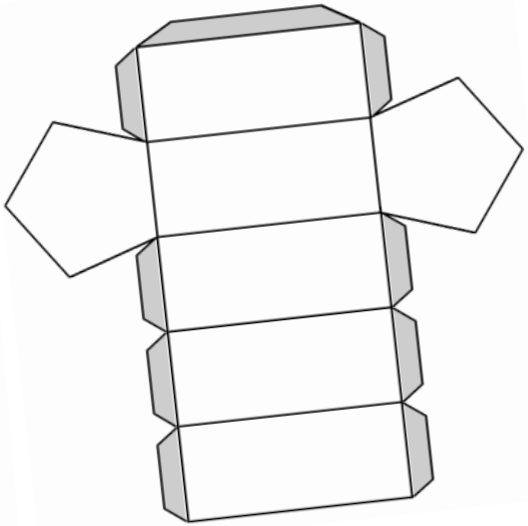


Purposeful Practice

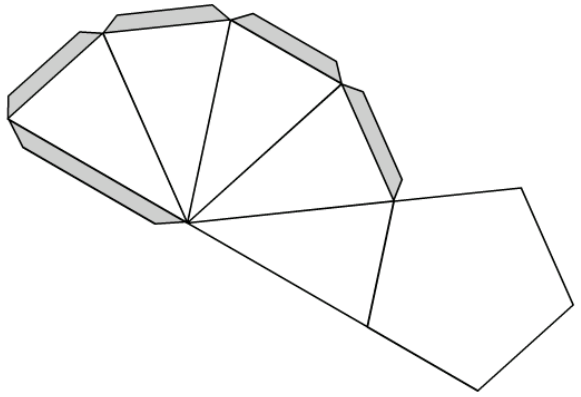
Prism or Pyramid?



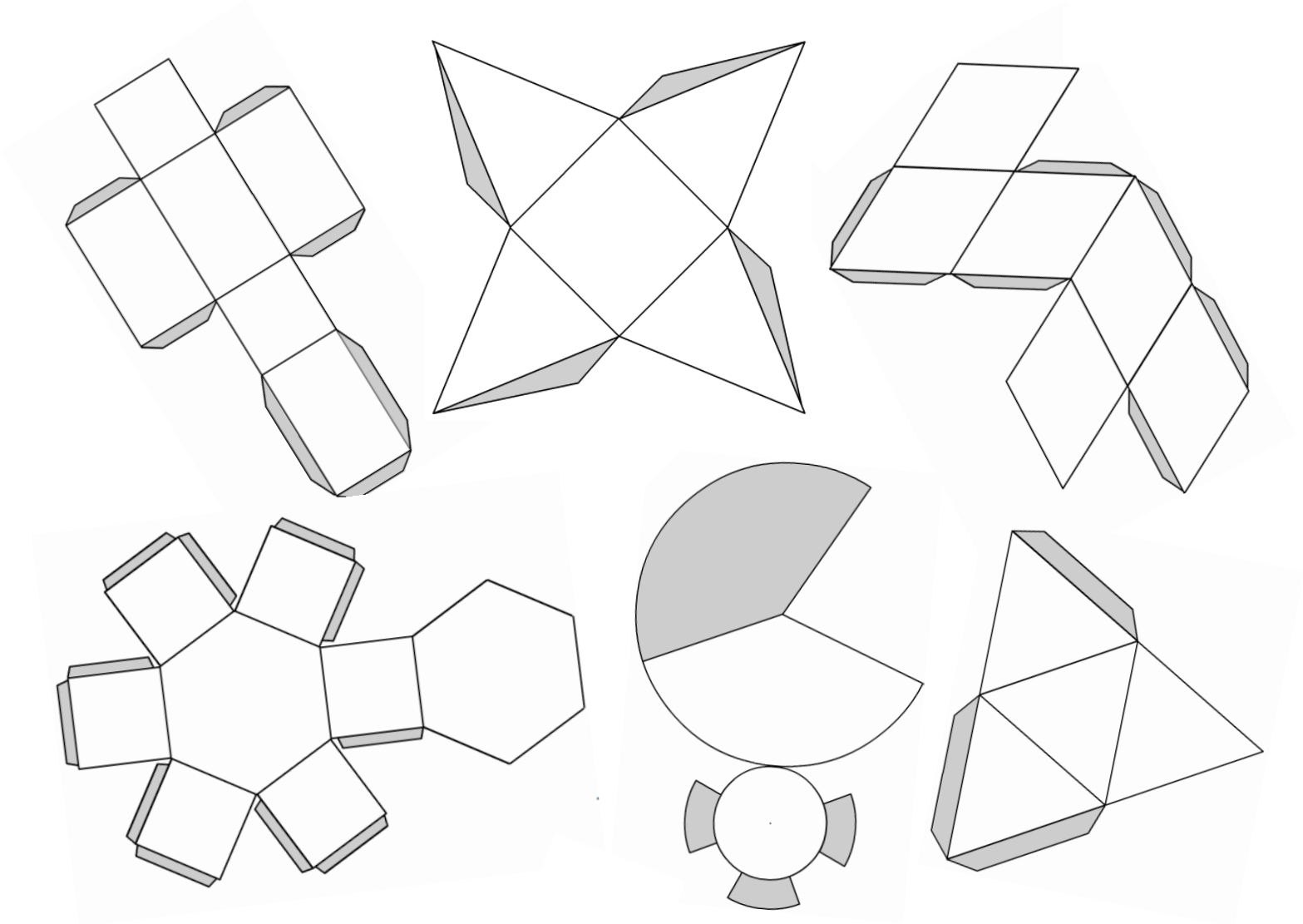




Cuboid	Cone
Pentagonal prism	Tetrahedron (triangle based pyramid)
Square based pyramid	Hexagonal prism
Rhombic prism	Pentagonal pyramid
Hexagonal pyramid	Triangular prism



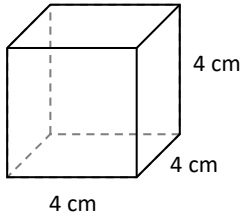
Purposeful Practice



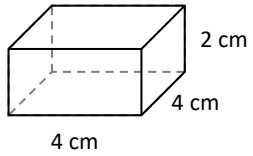
Fluency Practice

NETS Create an appropriate **scale** on grid paper & draw **nets** for these 3D shapes. not to scale

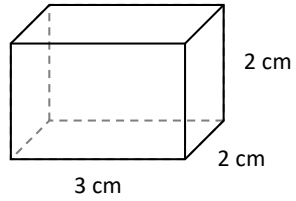
a)



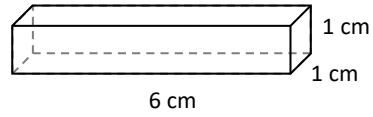
b)



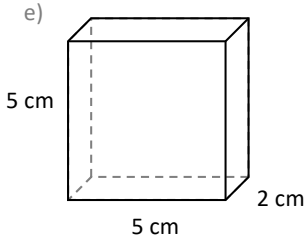
c)



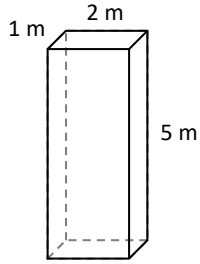
d)



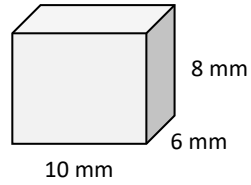
e)



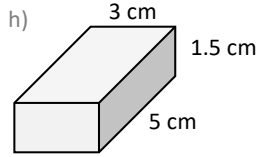
f)



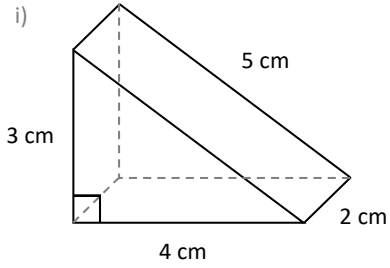
g)



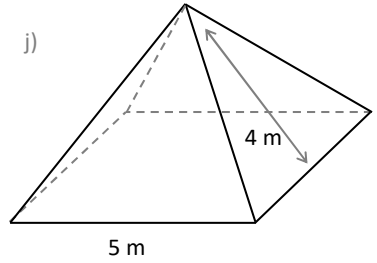
h)



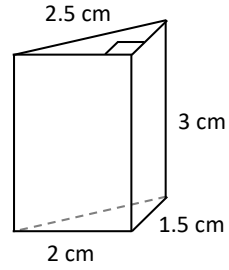
i)



j)



k)



Fluency Practice

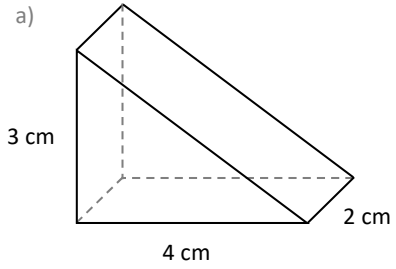
RAT Prisms

These solid shapes are prisms with a **R**ight-**A**ngled **T**riangle for a base.

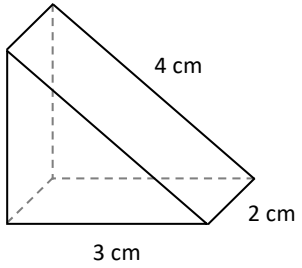
Sketch the **net** for each 3D shape & label any **missing lengths**.

NOT DRAWN ACCURATELY

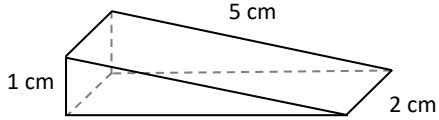
a)



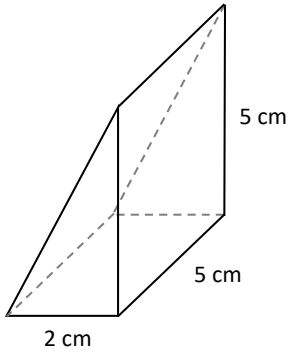
b)



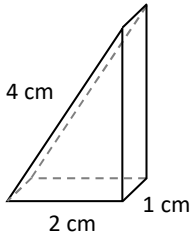
c)



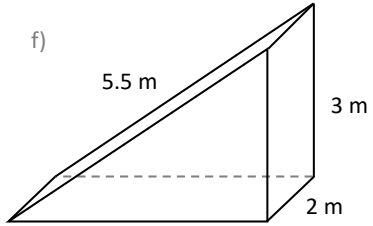
d)



e)

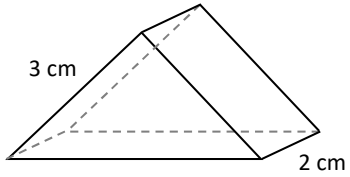


f)

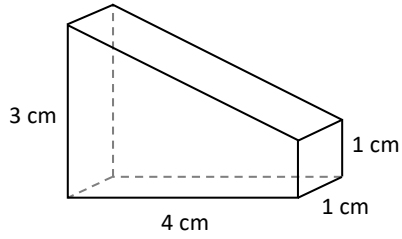


g)

isosceles base

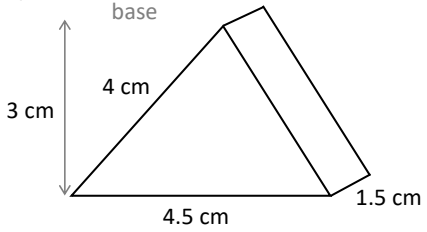


h)

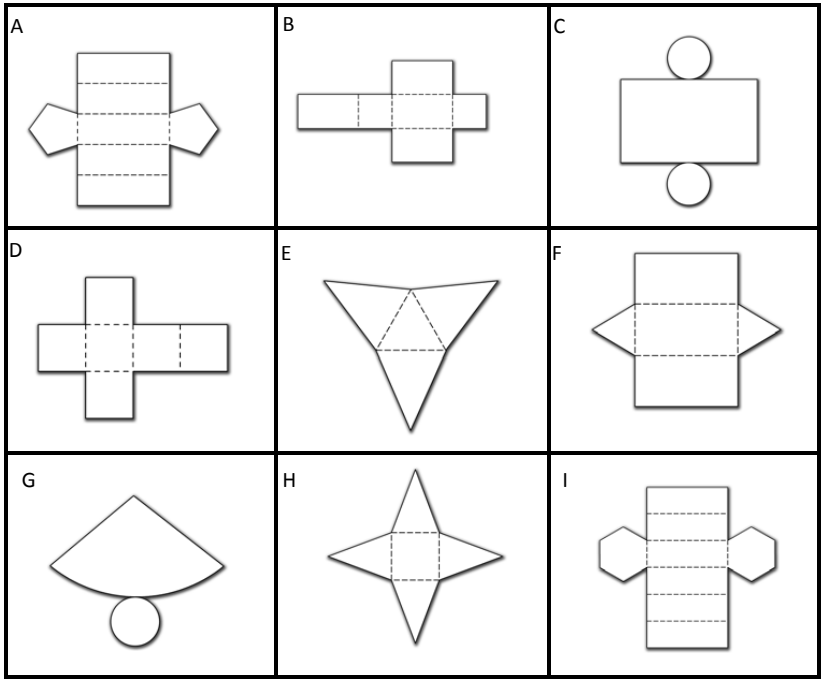


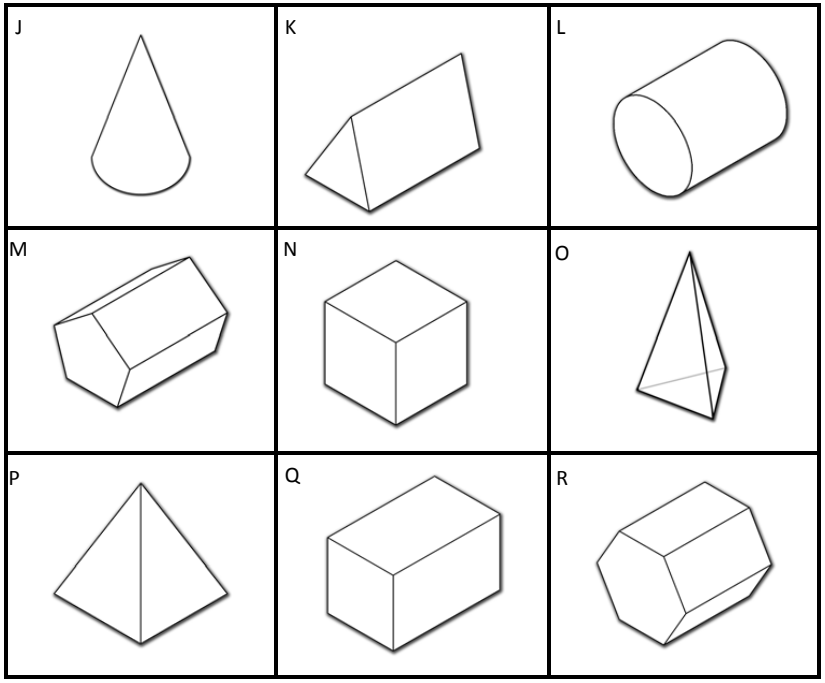
i)

scalene base



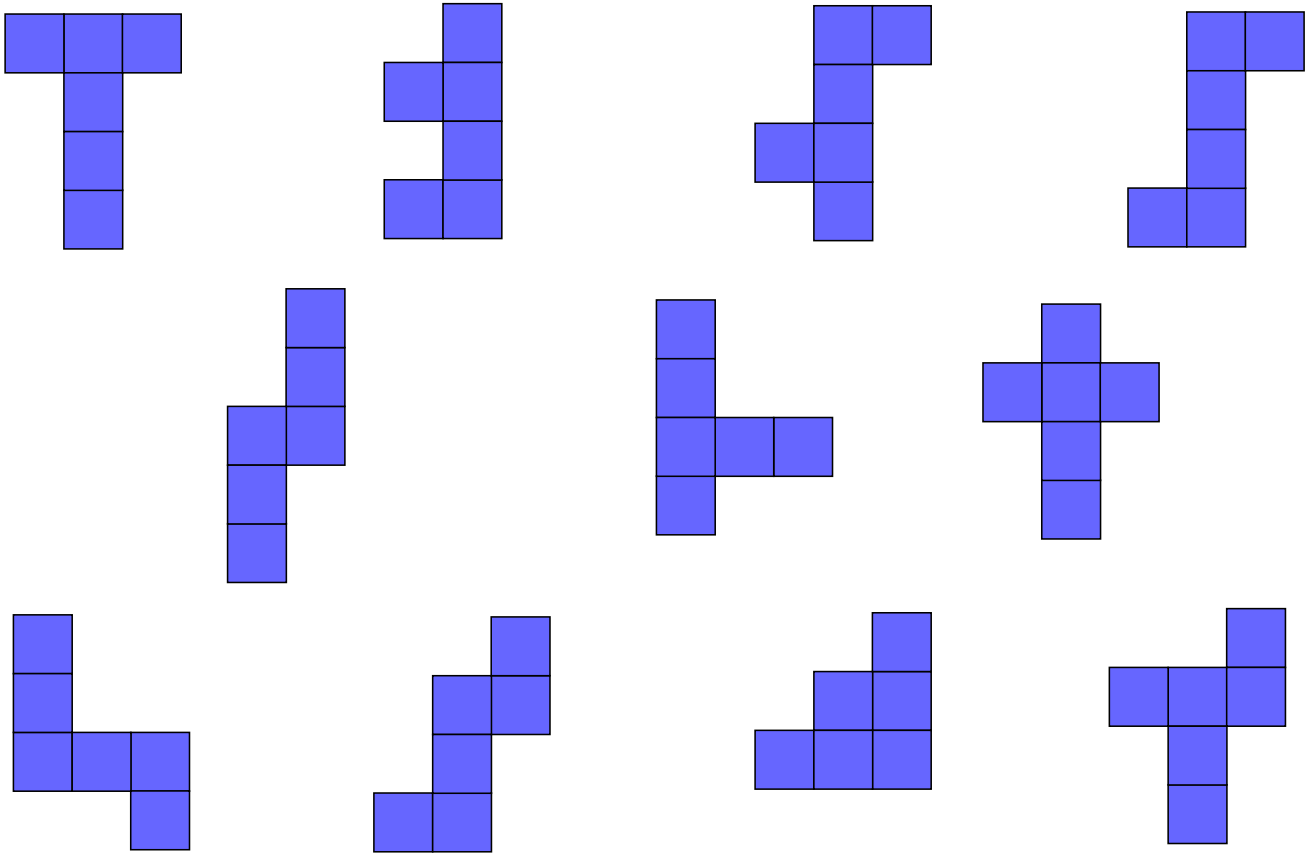
Fluency Practice





Net	A	B	C	D	E	F	G	H	I
Solid									
Name?									
Faces									
Vertices									
Edges									

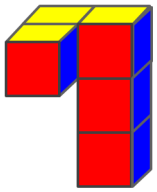
Which four of these are not real nets of a cube?



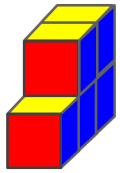
3 Plans and Elevations

Fluency Practice

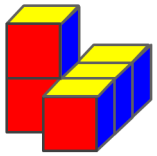
(1)



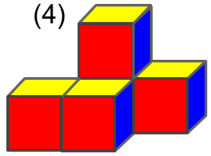
(2)



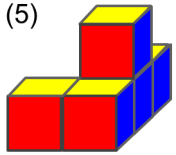
(3)



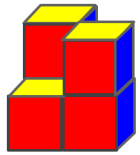
(4)



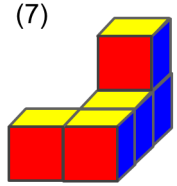
(5)



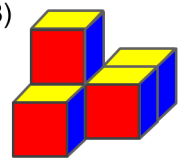
(6)



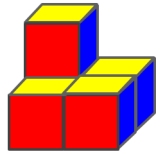
(7)



(8)

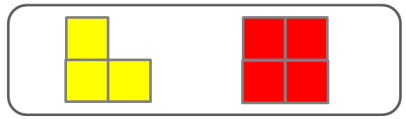


(9)

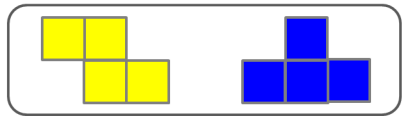


match the solid to the correct plan and elevation

(a)

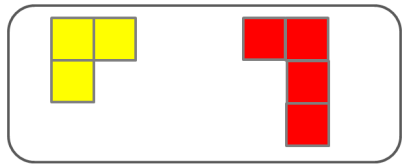


(b)



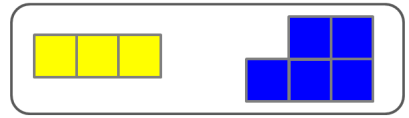
(c)

(d)



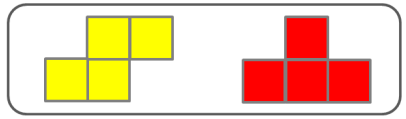
(e)

(f)

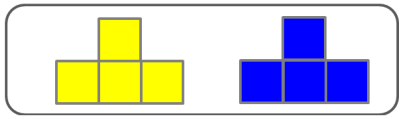


(g)

(h)

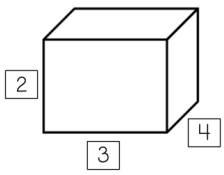
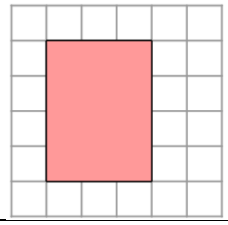
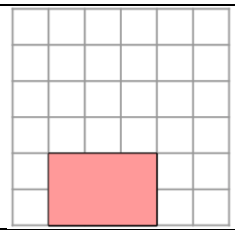
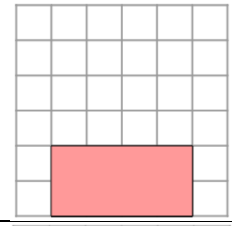
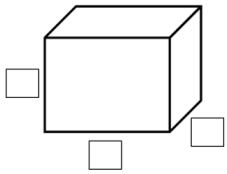
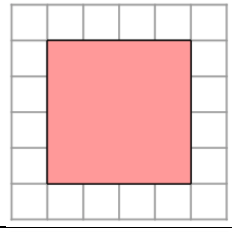
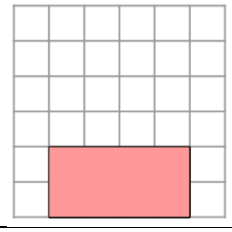
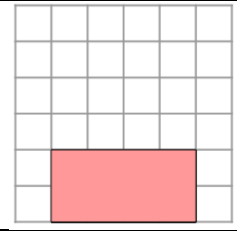
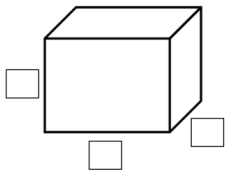
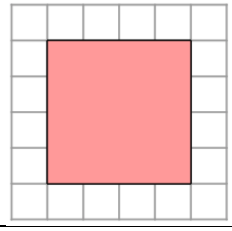
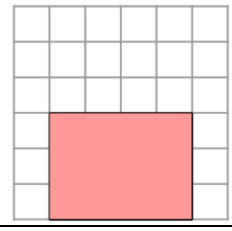
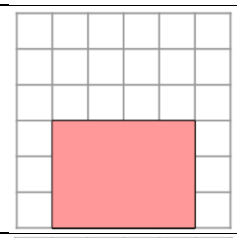
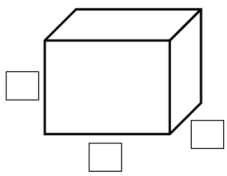
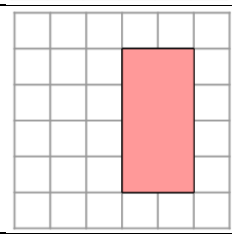
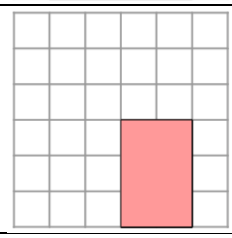
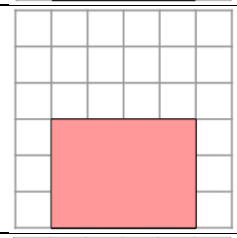
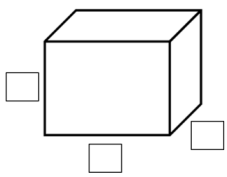
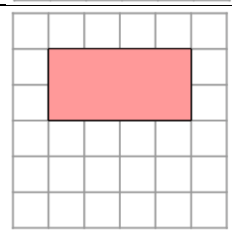
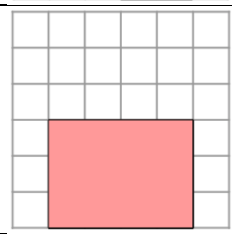
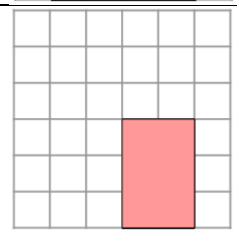
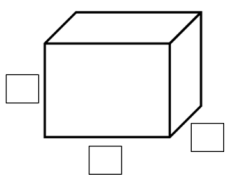
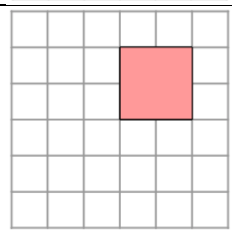
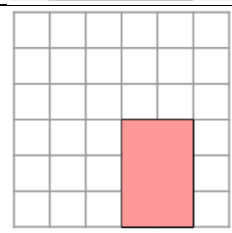
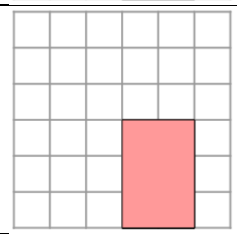


(i)



2 The table below shows the plan, front and side view for a cube or cuboid.

Add the dimensions of the shape to the original shape. The first one has been done for you.

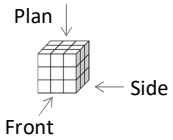
		Plan View	Front View	Side View
Example				
a				
b				
c				
d				
e				

f Describe what happened to the shape from part **c** to part **d**.

_____

Fluency Practice

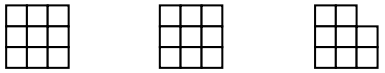
Counting Cubes



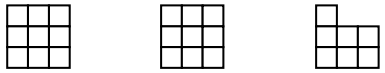
The plans & elevations for different shapes are shown.

How many cubes are in each shape?

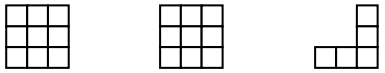
a) Plan Side Elevation Front Elevation



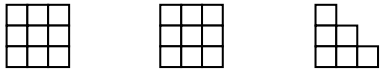
b) Plan Side Elevation Front Elevation



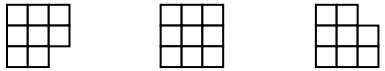
c) Plan Side Elevation Front Elevation



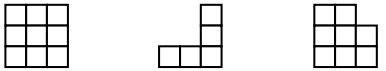
d) Plan Side Elevation Front Elevation



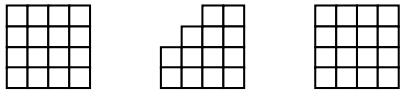
e) Plan Side Elevation Front Elevation



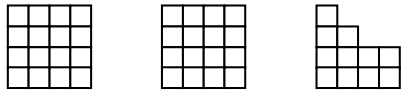
f) Plan Side Elevation Front Elevation



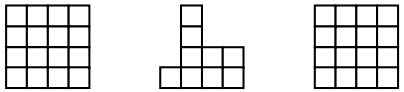
g) Plan Side Elevation Front Elevation



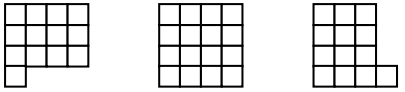
h) Plan Side Elevation Front Elevation



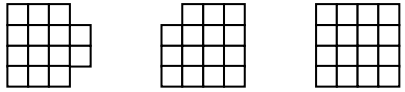
i) Plan Side Elevation Front Elevation



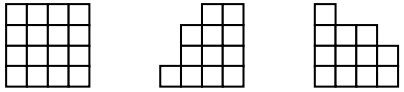
j) Plan Side Elevation Front Elevation



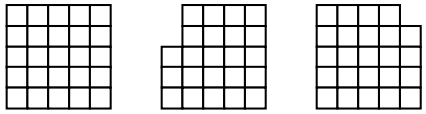
k) Plan Side Elevation Front Elevation



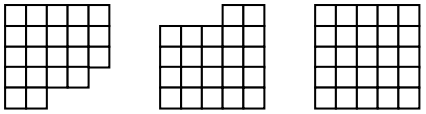
l) Plan Side Elevation Front Elevation



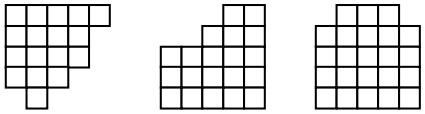
m) Plan Side Elevation Front Elevation



n) Plan Side Elevation Front Elevation



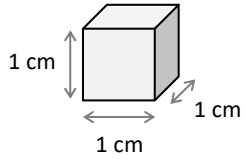
o) Plan Side Elevation Front Elevation



4 Volume and Surface Area of Prisms

Fluency Practice

This is a cube with 1 centimetre sides.

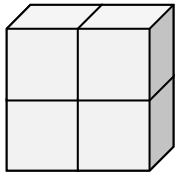


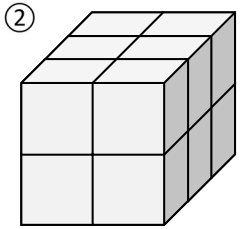
Its volume (inside space) is 1 cm^3.

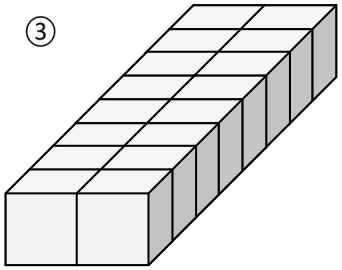
Volume

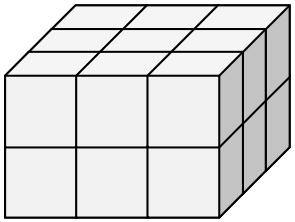
These shapes are made from 1 cm^3 cubes.
Calculate their **volume**.

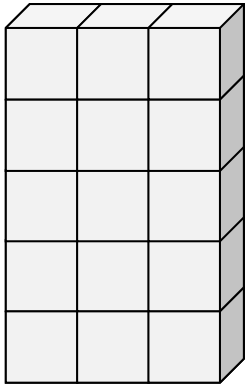
Instead of counting each cube, are there any shortcuts you can take?

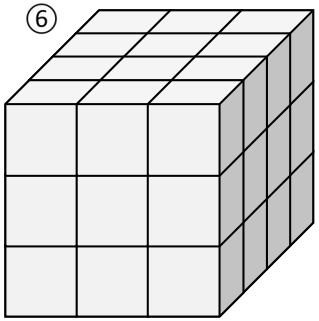
① 

② 

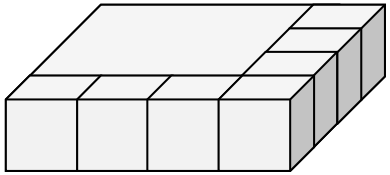
③ 

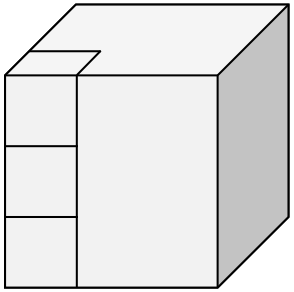
④ 

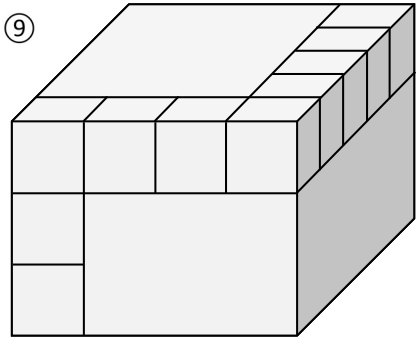
⑤ 

⑥ 

In these shapes only some of the 1 cm^3 cubes are shown.

⑦ 

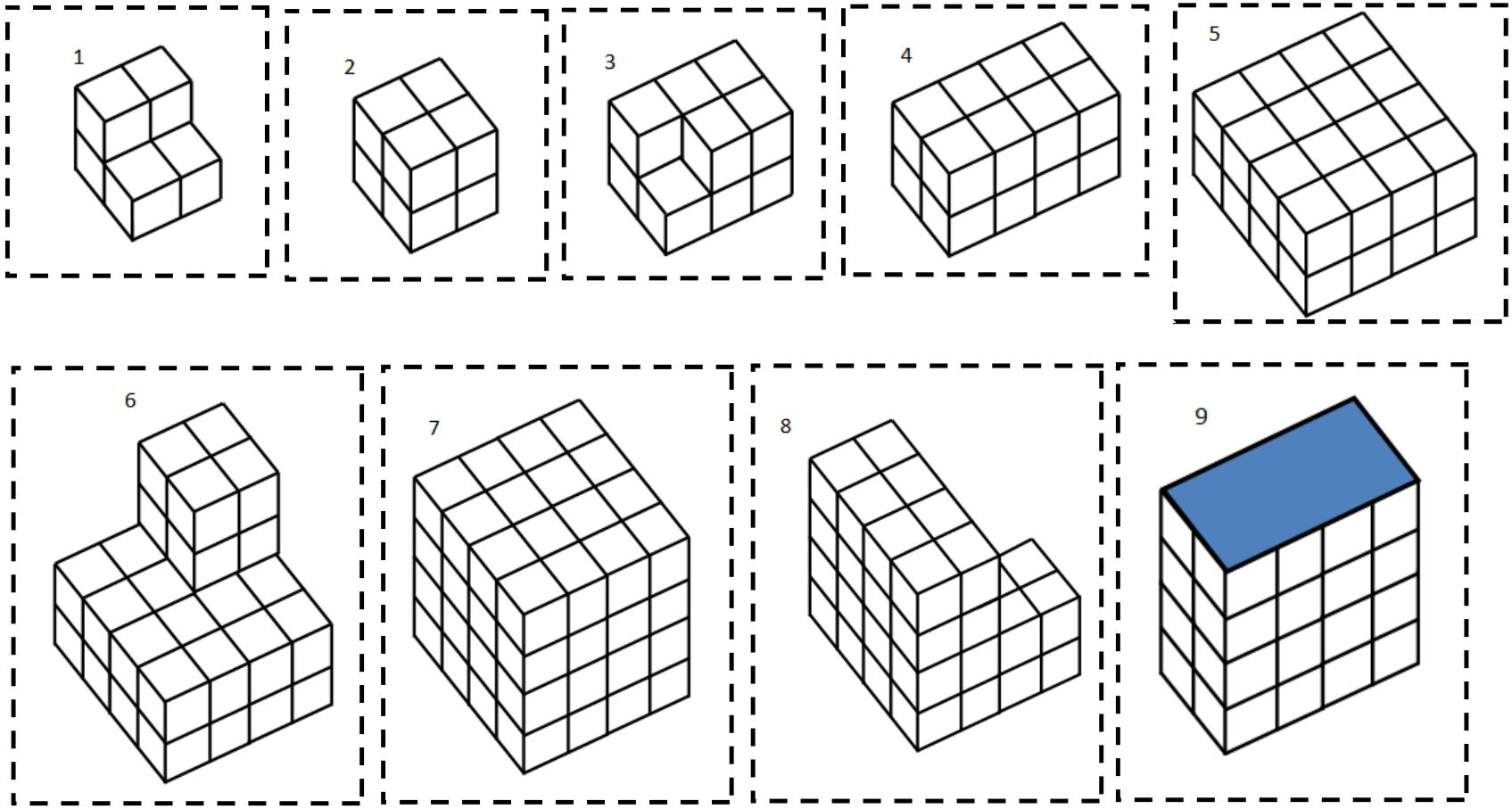
⑧ 

⑨ 

Fluency Practice

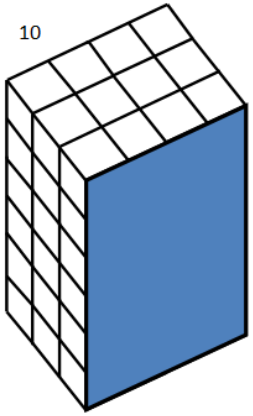
how many cubes?

Assume that each of the cubes in these pictures are 1cm by 1cm by 1cm.
Calculate the volume of each picture.

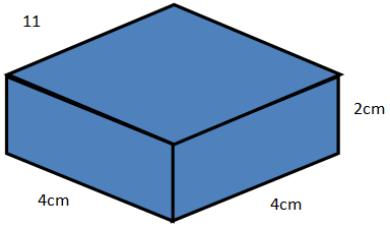


Purposeful Practice

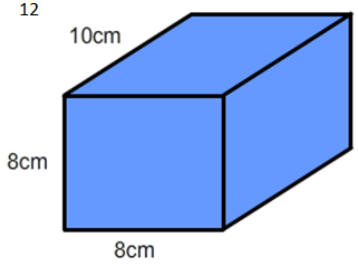
10



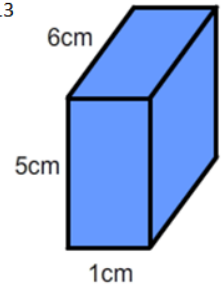
11



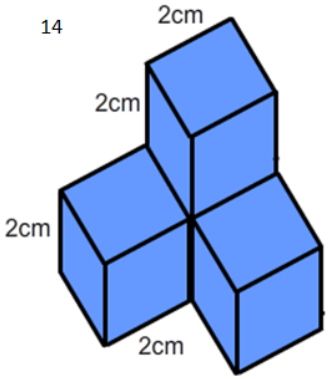
12



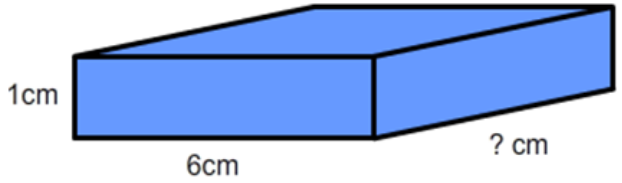
13



14



15 The volume of this cuboid is $216cm^3$.
What is the missing side length?



challenge!

design three different cuboids with a volume of exactly $20cm^3$.

can you make your cuboids out of paper?

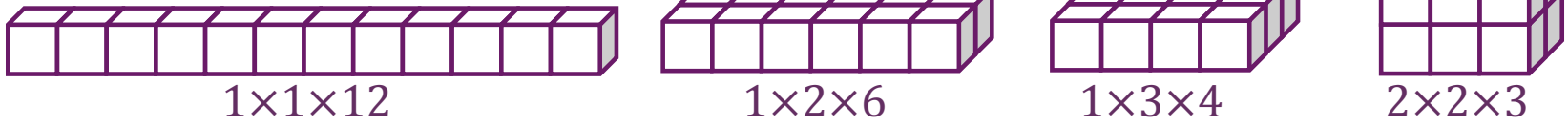
which cuboid uses the least amount of paper?

Jumbled Up Answers

$6cm^3$ $32\ cm^3$ $64\ cm^3$ $40\ cm^3$ $8cm^3$ $32\ cm^3$ $72\ cm^3$ $40\ cm^3$ $36\ cm$ $12\ cm^3$ $640\ cm^3$ $32\ cm^3$ $11\ cm^3$ $32\ cm^3$ $30\ cm^3$

Investigation into… **Factors and Volumes**

With 12 cubes, you can make 4 different cuboids:



12 has 4 non-prime factors: 1, 4, 6, and 12.

12 has the same number of non-prime factors as there are cuboids made from 12 cubes.

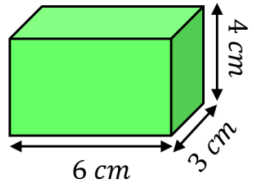
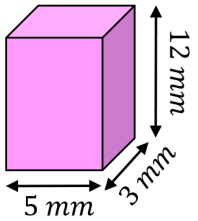
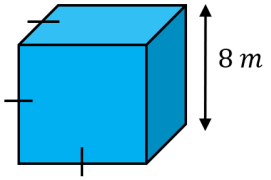
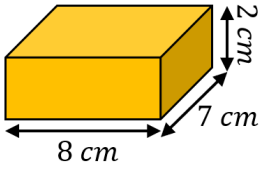
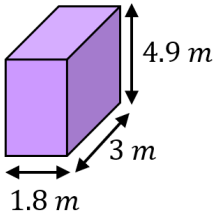
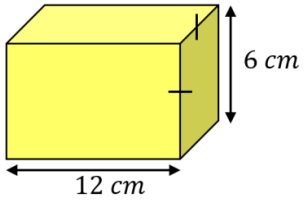
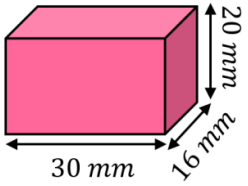
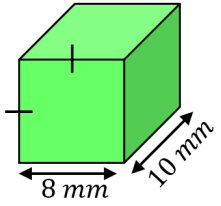
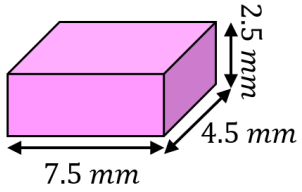
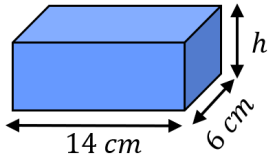
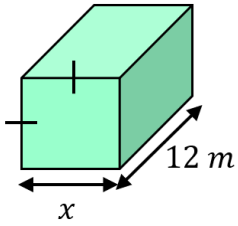
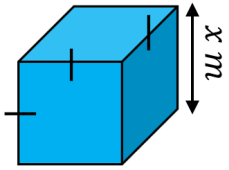
Investigation prompts:

a) *How many cuboids can be made from 16 cubes? How many non-prime factors does 16 have?*

b) *Find numbers of cubes that can be made into exactly:*
i) 1 cuboid *ii) 2 cuboids* *iii) 3 cuboids* *iv) 5 cuboids* *v) 6 cuboids*
How many non-prime factors do each of your answers have?

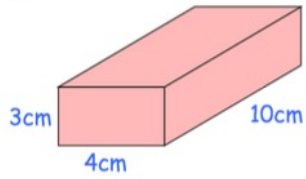
c) *It is **not** always true that the number of non-prime factors is equal to the number of possible cuboids. Find an example that shows this.*

Fluency Practice

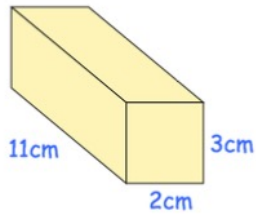
Find the volume of each of these cuboids. Include units with your answers.		
		
		
		
Find the missing measurements in these cuboids.		
$Volume = 210\ cm^3$ 	$Volume = 507\ m^3$ 	$Volume = 1331\ m^3$ 

Question 1: Work out the volume of each cuboid.
Include suitable units.

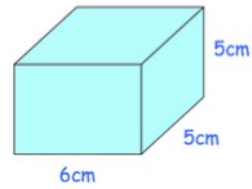
(a)



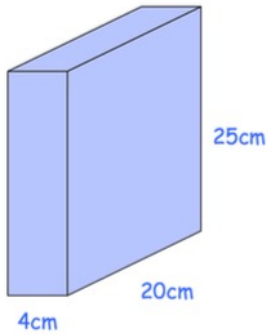
(b)



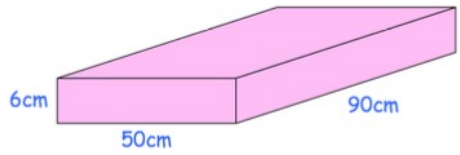
(c)



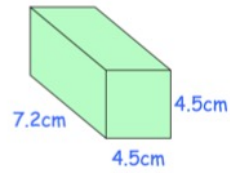
(d)



(e)

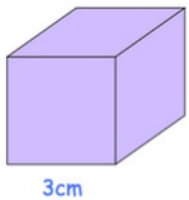


(f)

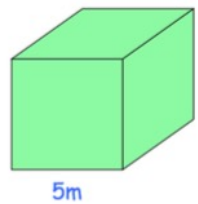


Question 2: Work out the volume of each cube.
Include suitable units.

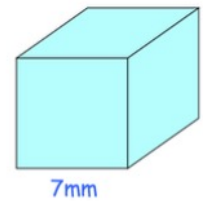
(a)



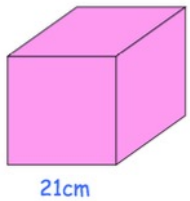
(b)



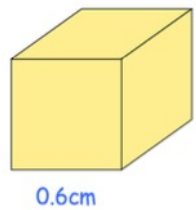
(c)



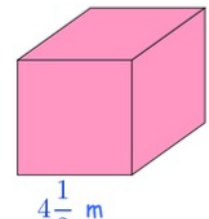
(d)



(e)

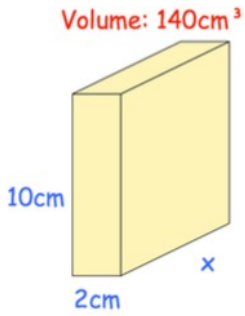


(f)

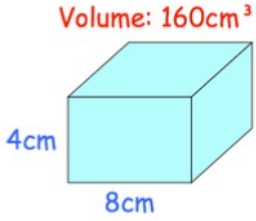


Question 3: Find the length of each cuboid.

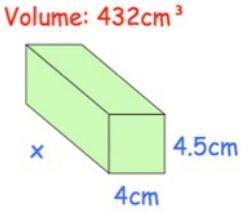
(a)



(b)

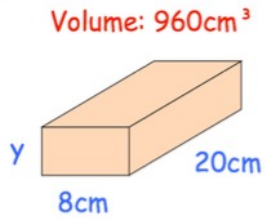


(c)

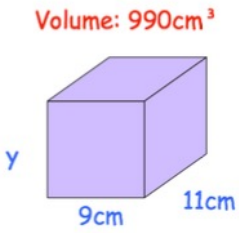


Question 4: For each cuboid below, find the missing measurement, y.

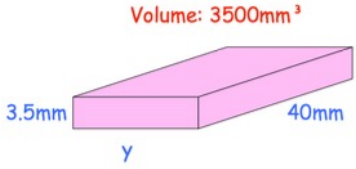
(a)



(b)

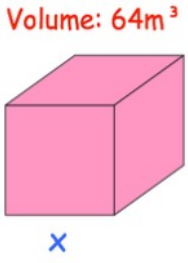


(c)

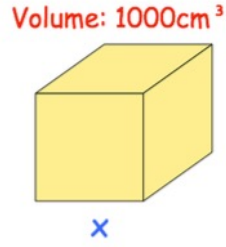


Question 5: The volume of each cube is given.
Find the length of each side, x.

(a)



(b)



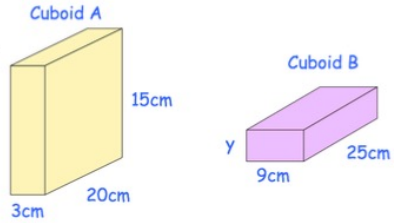
(c)

Question 1: Find the volume of a water tank that is 80cm long, 40cm wide and 20cm high.

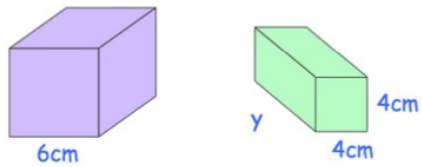
Question 2: A wooden beam measures 4 inches wide by 4 inches high by 60 inches long.
Work out the volume of the wooden beam.

Question 3: The cube on the TV show "The Cube" is a cube with each side measuring 4m.
Work out the volume of the cube.

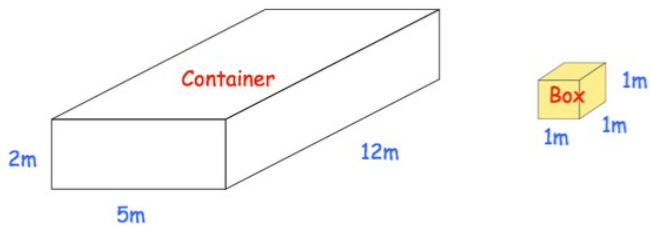
Question 4: Both cuboids below have the same volume.
Find the height of cuboid B.



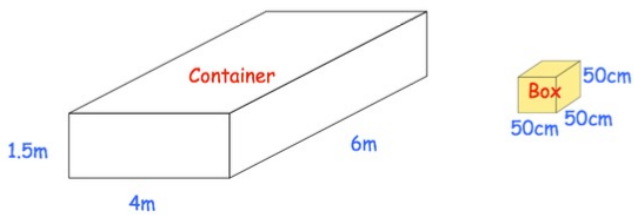
Question 5: The volume of the cube is twice the volume of the cuboid.
Find the length of the cuboid.



Question 6: The cuboid container below is used to store boxes.
Each box is a cube with side length 1m.
How many boxes can be stored in the container?

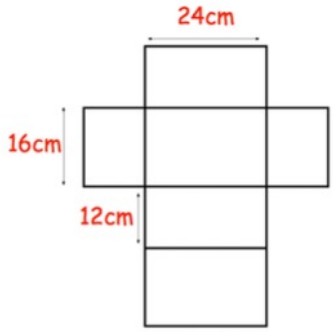


Question 7: The cuboid container below is used to store boxes.
Each box is a cube with side length 50cm.
How many boxes can be stored in the container?

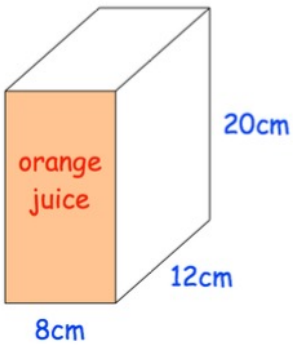


Question 8: An empty swimming pool is going to be filled with water.
The swimming pool is a cuboid, that is 25 metres long, 10 metres wide and 2 metres deep.
It is being filled at a rate of 800 litres per minute
Given $1m^3 = 1000$ Litres, how long it will take to fill the swimming pool?
Give your answer in hours and minutes.

Question 9: Shown is a net of a cuboid.
Calculate the volume of the cuboid.



Question 10: A carton of orange juice is shown below.
The carton is in the shape of a cuboid.

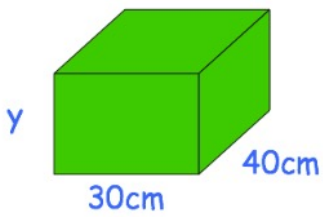


The depth of the orange juice is 6cm.

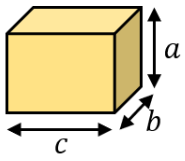
The carton is turned so that it stands the shaded (orange) face.

Work out the depth of the orange juice now.

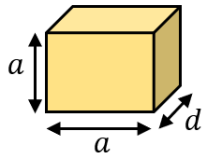
Question 11: Peter is making green paint by mixing blue and yellow paint in a cuboid container, shown below.
The container has a width of 30cm and length of 40cm and is full.
He mixes blue paint and yellow paint in the ratio 2:3.
Peter uses 8.4 litres of blue paint.
Calculate the height of the container.



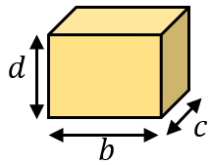
Given the volumes of these six cuboids, can you work out the measurements, a, b, c and d? Explain how you got your answers.



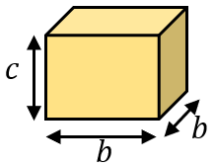
$Volume = 1512\ cm^3$



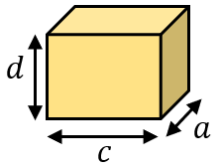
$Volume = 648\ cm^3$



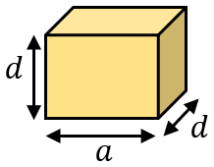
$Volume = 1344\ cm^3$



$Volume = 2016\ cm^3$



$Volume = 1008\ cm^3$



$Volume = 576\ cm^3$

$a =$

$b =$

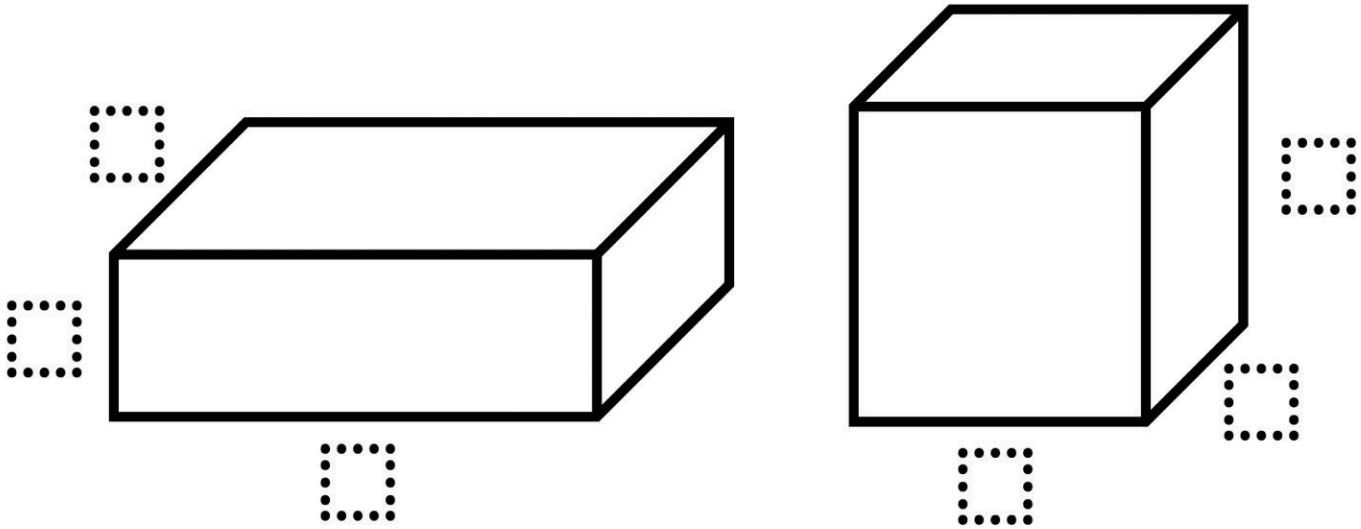
$c =$

$d =$

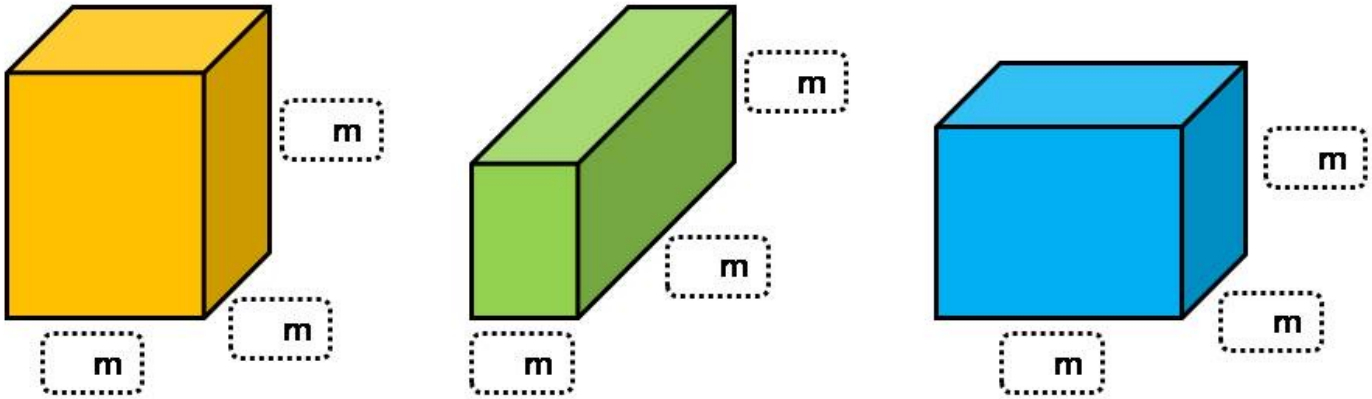
How many more cubes and cuboids can you create using only these four dimensions. Find the volume of each cube or cuboid you find.

CLUE 1	CLUE 2	CLUE 3
The order of measurements from smallest to biggest is d, a, b, c	A rectangle with width b and length c has an area of $168\ cm^2$.	The volume of a cube with side length a is $729\ cm^3$.

Using digits 0 to 9, without repetition, fill the blanks to create two rectangular prisms with the same volume.

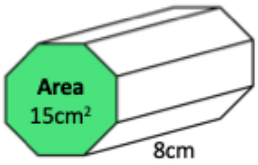


Using the numbers 1 to 9, without repetition, can you fill the blanks so that the volumes of these cuboids are equal?
If not equal, how close can you get?

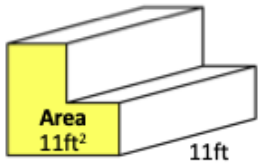


Q1 Work out the volume of each of the following prisms.

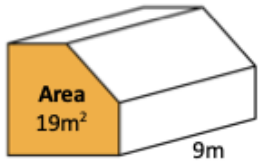
[a]



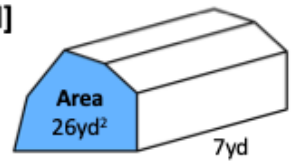
[b]



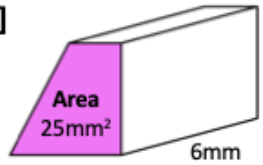
[c]



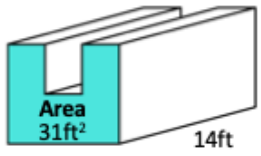
[d]



[e]

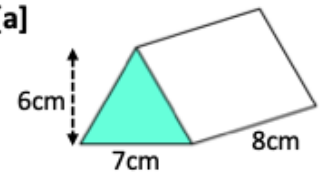


[f]

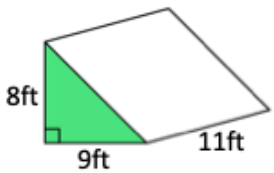


Q2 Calculate the volume of the following triangular prisms.

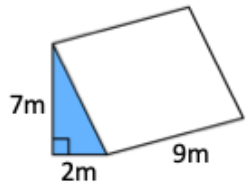
[a]



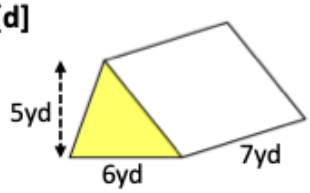
[b]



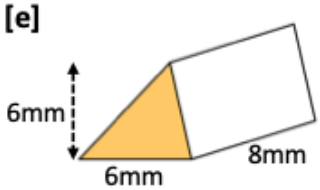
[c]



[d]



[e]



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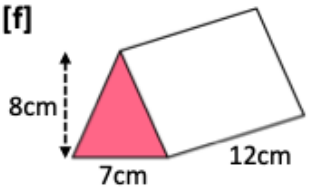
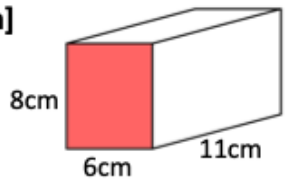
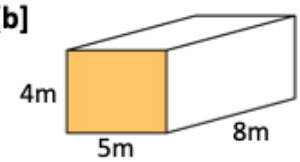


Q3 Calculate the volume of the following prisms.

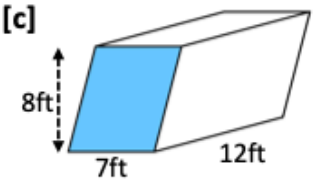
[a]



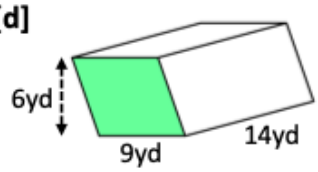
[b]



[c]



[d]



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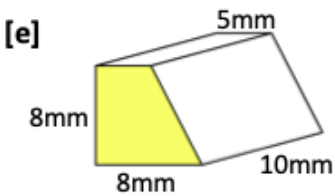
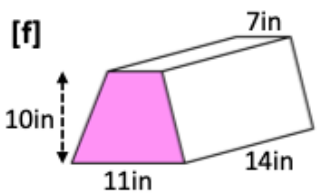
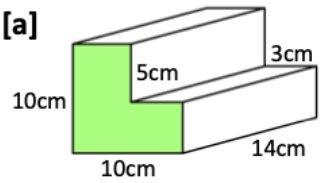


[f]

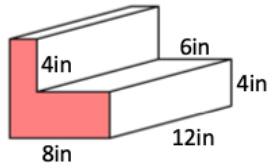


Q1 Calculate the volume of the following L-shape prisms.

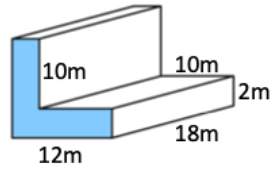
[a]



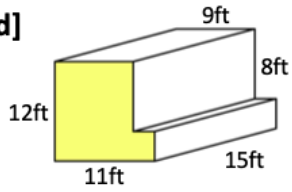
[b]



[c]



[d]



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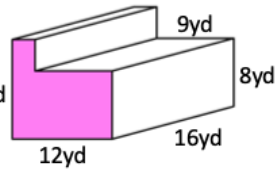

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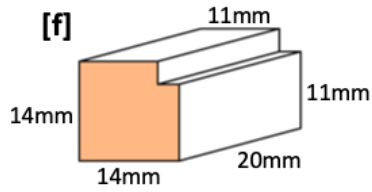
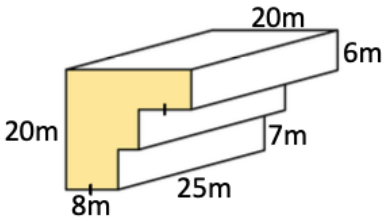
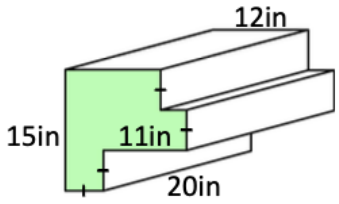


Q2 Calculate the volume of the following prisms

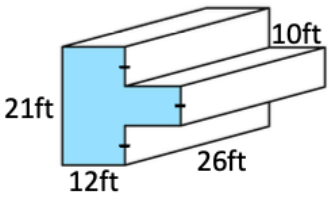
[a]



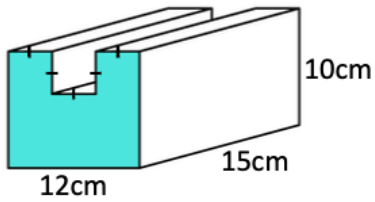
[b]



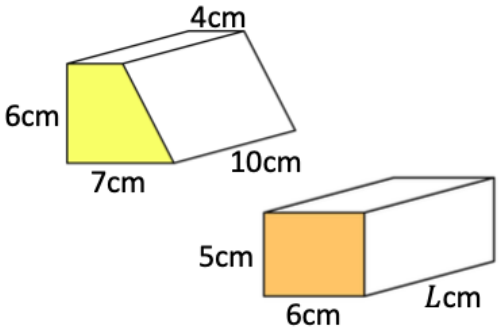
[c]



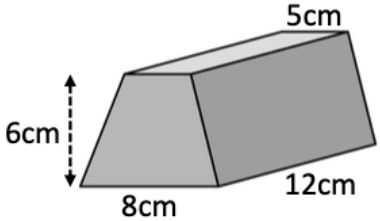
[d]



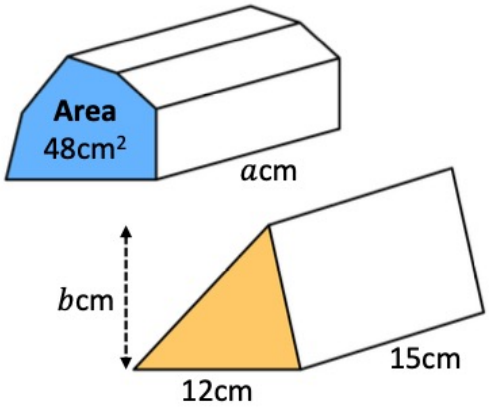
Q3 Both of the following prisms have the same volume. Find the missing length.



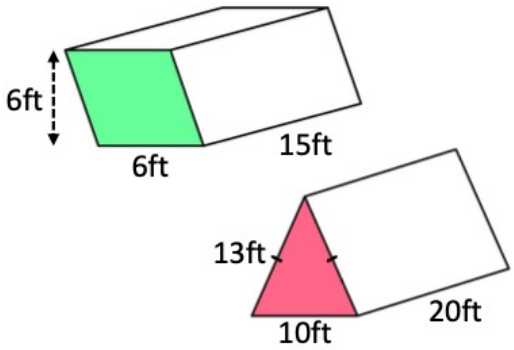
Q4 25 kilograms of metal is melted and moulded into prisms. The density of the metal is $10g/cm^3$. How many prisms can be made?



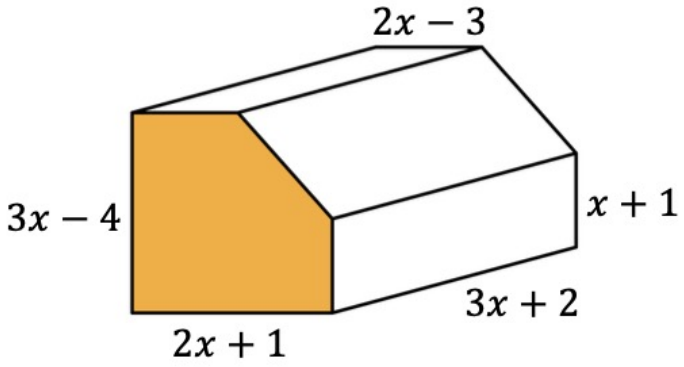
Q5 Each prism has a volume of 720cm^3. Find the values of a and b.



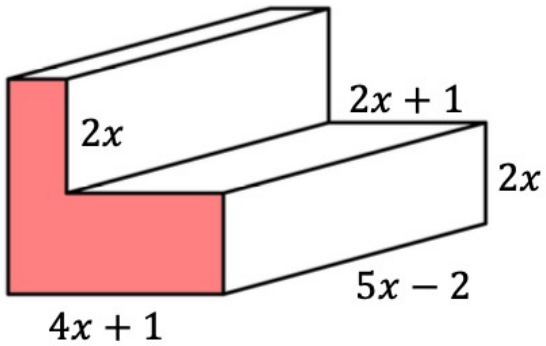
Q6 Find the ratio of the volume of the triangular prism to the volume of the parallelepiped. Give your answer in its simplest form.



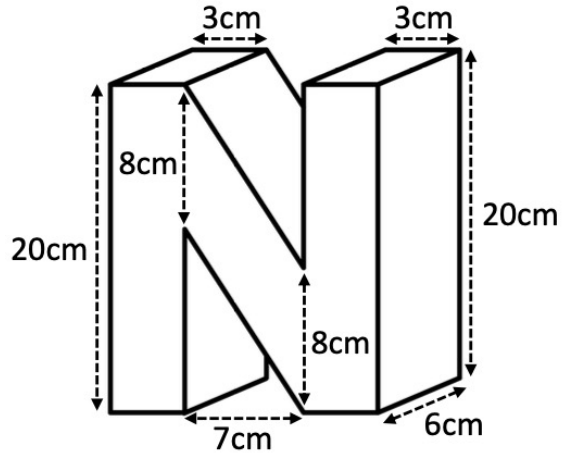
Q7 Find an expression, in terms of x, for the volume of the prism. Give your answer in its simplest form.



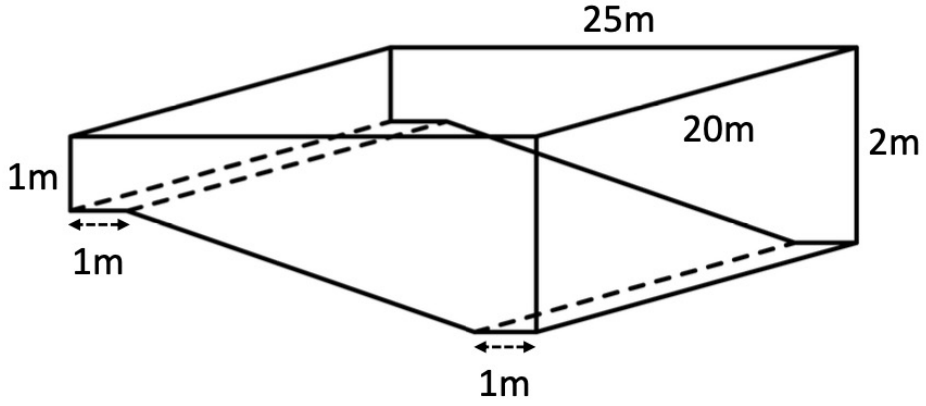
Q8 Find an expression, in terms of x, for the volume of the prism. Give your answer in its simplest form.



Q9 Work out the volume of the following prism.

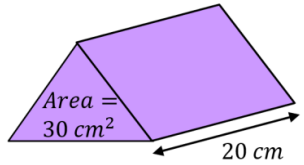


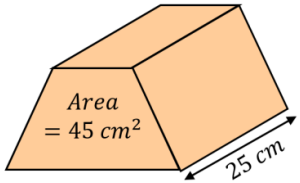
Q10 A leisure centre's swimming pool is shown below. The swimming pool is empty. A tap is turned on and water flows into the swimming pool at a constant rate. After 20 hours, the water level is 50cm below the top of the pool. Water continues to flow into the pool at the same rate. Work out how much longer it takes to completely fill the pool.

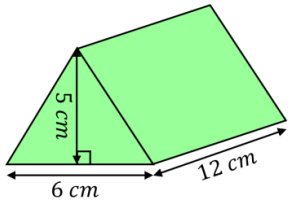


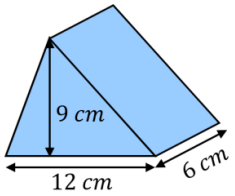
Fluency Practice

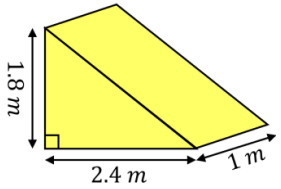
Find the volume of each of these prisms. Include units with your answers.

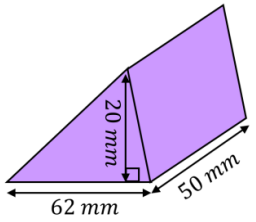


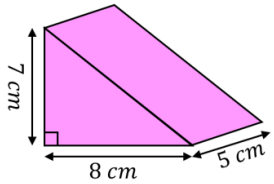


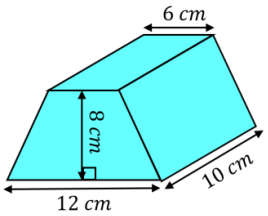


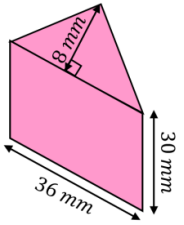






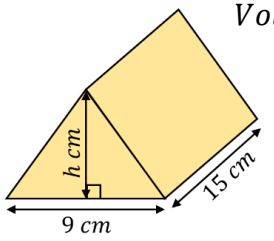




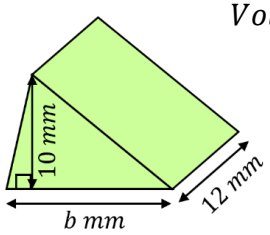


Find the missing measurements in these prisms.

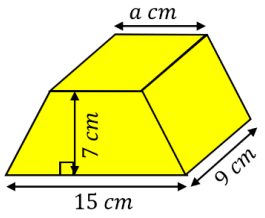
$Volume = 810\ cm^3$



$Volume = 900\ mm^3$

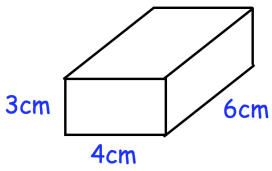


$Volume = 693\ cm^3$

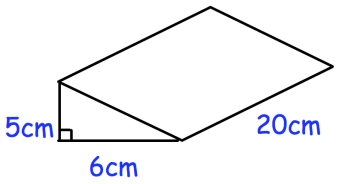


Question 1: Calculate the volume of each prism below

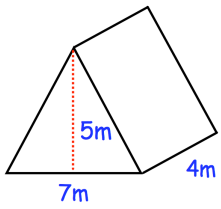
(a)



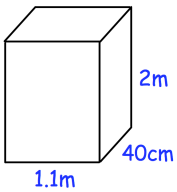
(b)



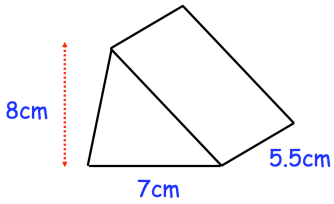
(c)



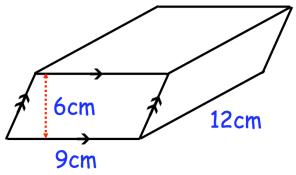
(d)



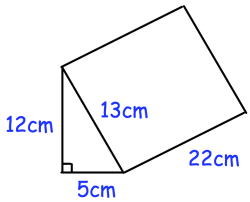
(e)



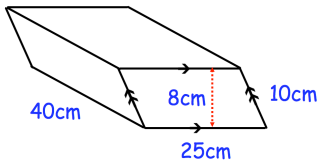
(f)



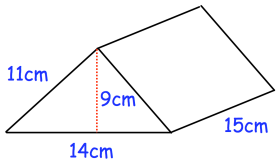
(g)



(h)

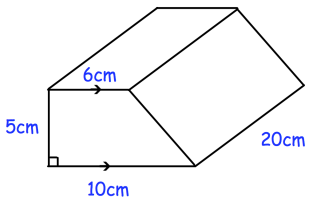


(i)

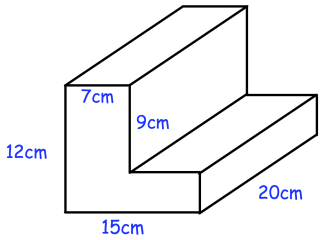


Question 2: Calculate the volume of each prism below

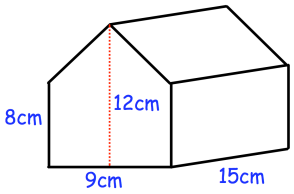
(a)



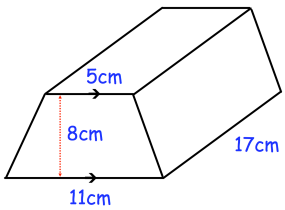
(b)



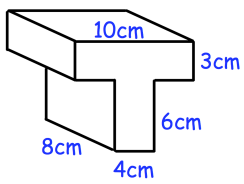
(c)



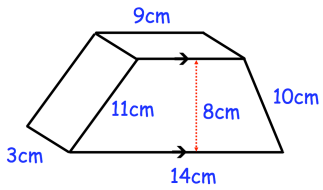
(d)



(e)

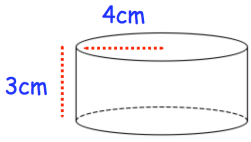


(f)

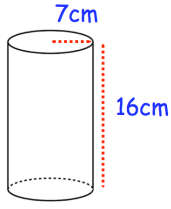


Question 3: Calculate the volume of each cylinder below

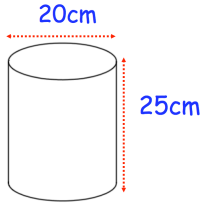
(a)



(b)

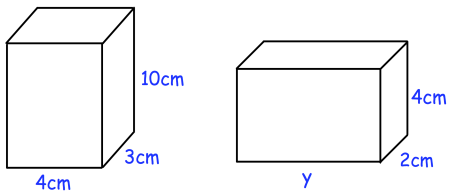


(c)

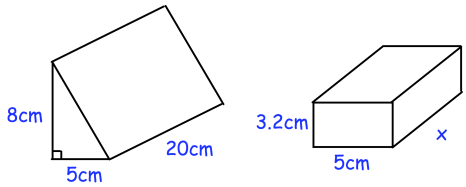


Apply

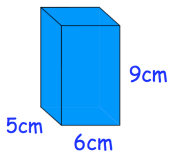
Question 1: Cillian makes two cuboids out of clay.
Both cuboids have the same volume.
Find y

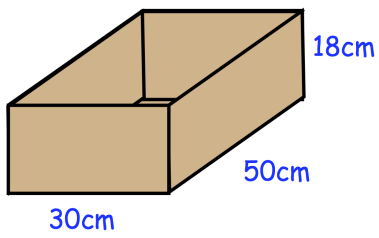


Question 2: The cuboid and the triangular prism have the same volume.
Find x.

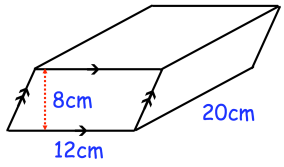


Question 3: Boxes of coffee are placed into a crate.
Each box of coffee is a cuboid and the crate is also a cuboid.
How many boxes of coffee fit into the crate?

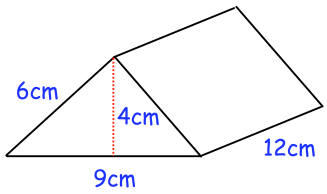


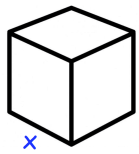


Question 4: James wants to fill an empty flowerpot with soil.
He has 2 litres of soil.
Given 1 litre = $1000cm^3$
Does James have enough soil to fill the flowerpot?

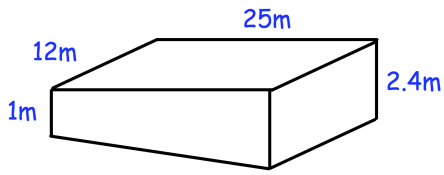


Question 5: The solid triangular prism shown below is made from metal.
The prism is melted down and the metal is used to create a solid cube.
Find the side length of the cube.

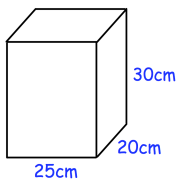




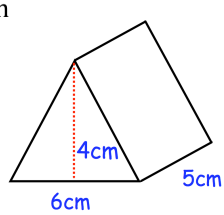
Question 6: The swimming pool in a leisure centre is shown below.
The length of the swimming pool is 25m and the width is 12m.
The depth of the shallow end is 1m and the depth of the deep end is 2.4m.
Given $1m^3 = 1000$ litres
Work out how much water, in litres, the swimming pool holds.



Question 7: A fish tank is ¼ full of water.
Harry pours a 400ml glass of water into the fish tank.
Given $1ml = 1cm^3$
What will the depth of the water of the fish tank then be?

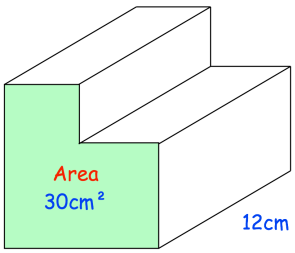


Question 8: A solid glass paperweight is in the shape of a triangular prism
The density of the glass is $2.4g/cm^3$
Work out the mass of the paperweight.

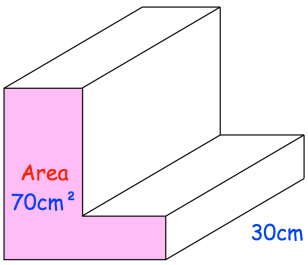


Question 1: Work out the volume of each of the prisms below.
The area of the front of each prism has been given.

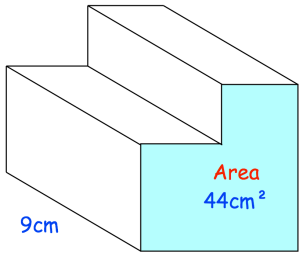
(a)



(b)

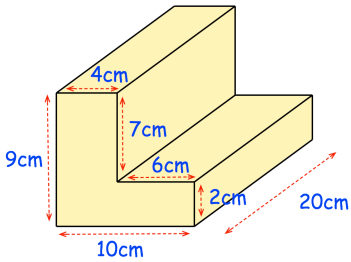


(c)

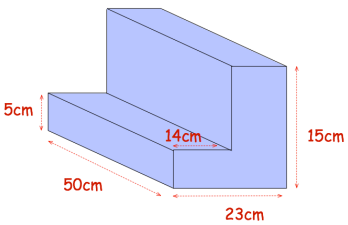


Question 2: Work out the volume of each of the prisms below.

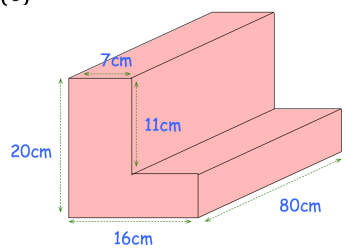
(a)



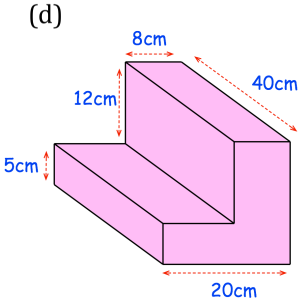
(b)



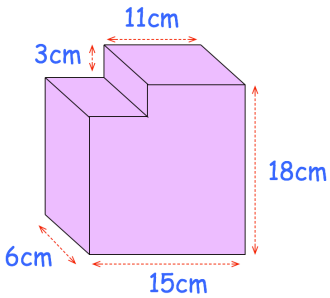
(c)



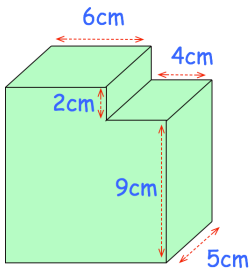
(d)



(e)

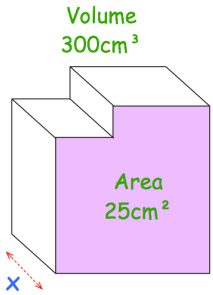


(f)

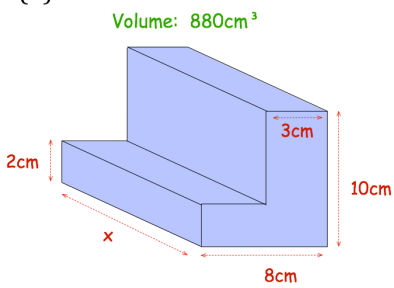


Question 3: Work out the length of each of these prisms.

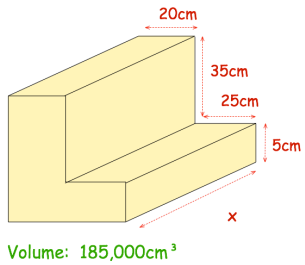
(a)



(b)

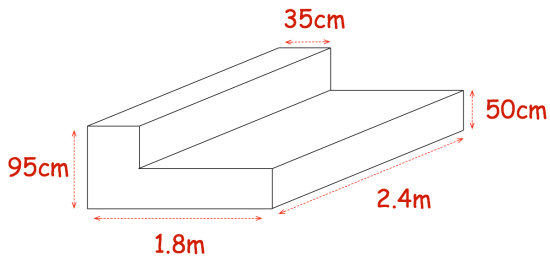


(c)

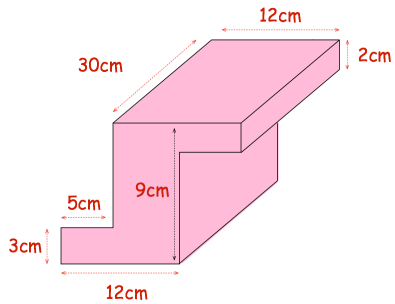


Apply

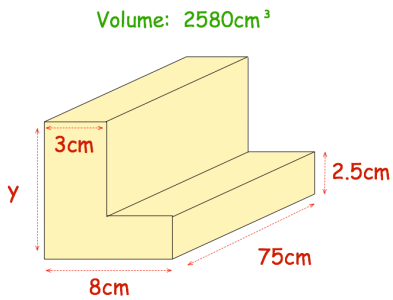
Question 1: Shown below is a prism.
Find the volume of the prism.
Give your answer in m^3.



Question 2: Find the volume of the prism.



Question 3: Find y

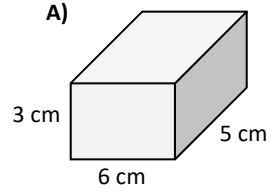


Fluency Practice

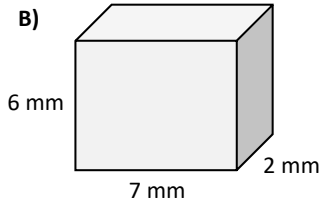
Volume of a Cuboid

Calculate the volume of these cuboids.

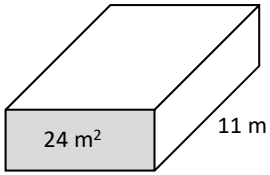
A)



B)

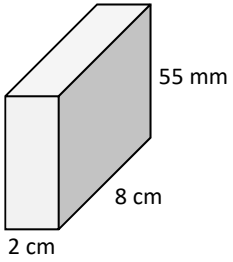


C)



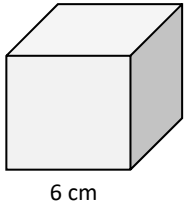
The area of the face of this prism is 24 m^2.

D)



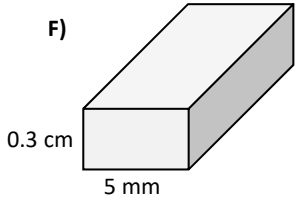
This is a cube.
What is its volume?

E)



The volume of this cuboid is 105 mm^3.
What is the cuboid's length?

F)



G)

The volume of a cuboid is 64 m^3.
Its height is twice its width.
Its length is twice its height.
What are the cuboid's dimensions?

Complete the table for cuboids **A** to **E**.

Cuboid	Width	Height	Length	Volume
A	5 cm	7 cm	5.5 cm	
B	6 cm	45 mm		189 cm^3
C		6 m	450 cm	94.5 m^3
D	8.5 mm		7 mm	148.75 mm^3
E	2.4 cm	32 mm	0.067 m	

F) These are the side lengths of cubes. Calculate their volumes.

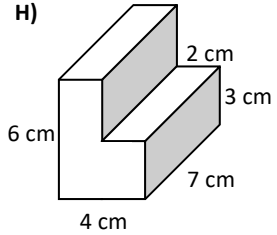
a) 8 cm
b) 5 mm
c) 3.5 m
d) 0.5 cm

G) These are the volumes of cubes. Calculate their side lengths.

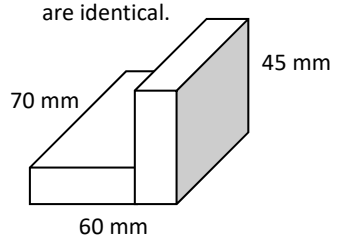
a) 64 cm^3
b) 125 m^3
c) 343 mm^3
d) 729 cm^3

Calculate the volume of these 3 compound cuboids.

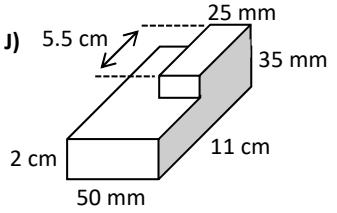
H)



I) These two attached cuboids are identical.



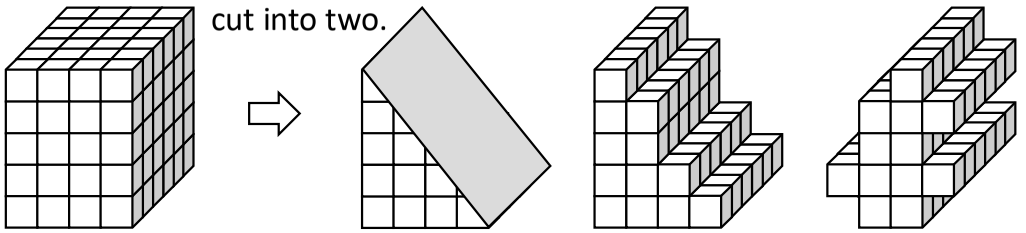
J)



Volume of a Prism

= 1 cm^3

The prism has been cut into two.

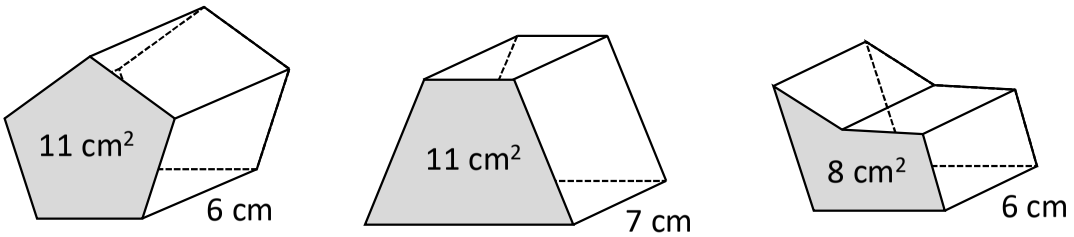


A) Volume = cm^3

B) V =

C) V =

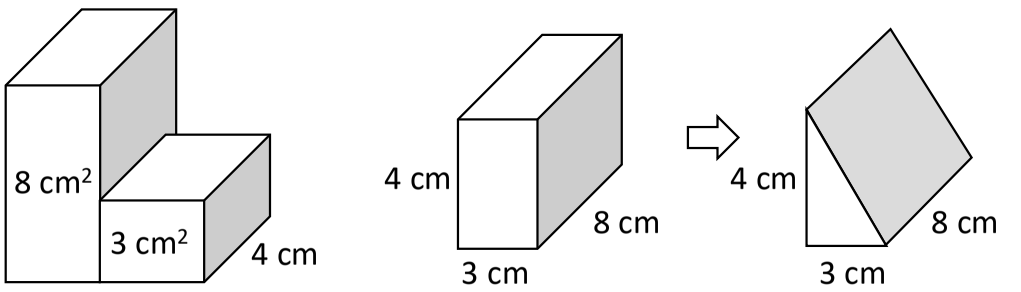
D) V =



E) V =

F) V =

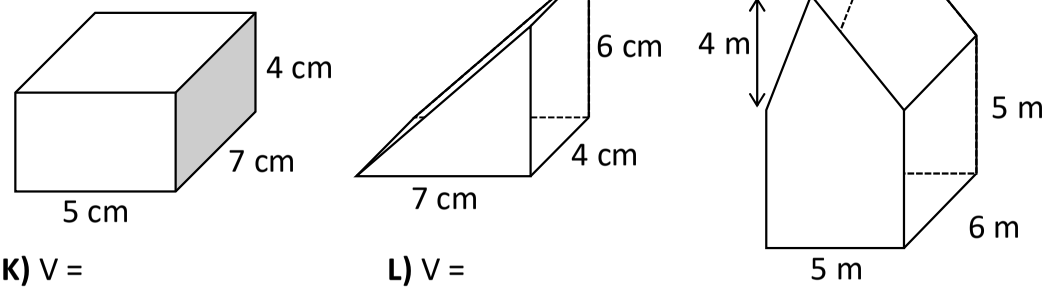
G) V =



H) V =

I) V =

J) V =



K) V =

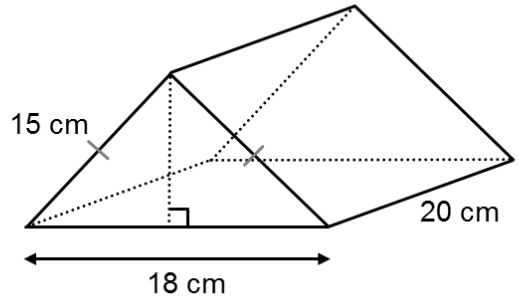
L) V =

M) V =

Fluency Practice

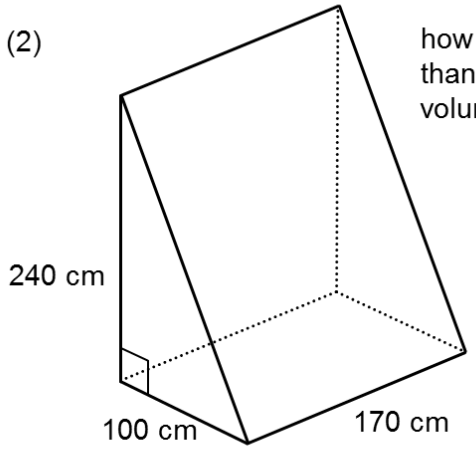
volume of a triangular prism

(1)



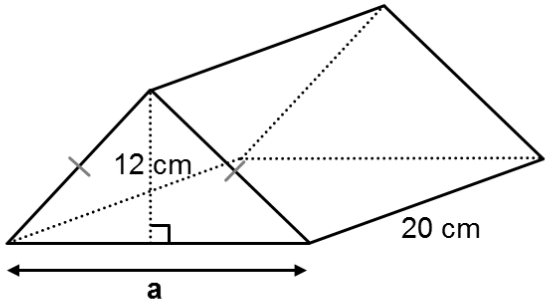
what is the volume?

(2)



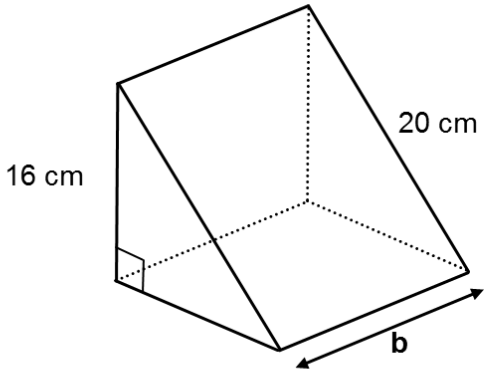
how much bigger than 2 m^3 is the volume?

(3)



volume = 1200 cm^3
what is **a**?

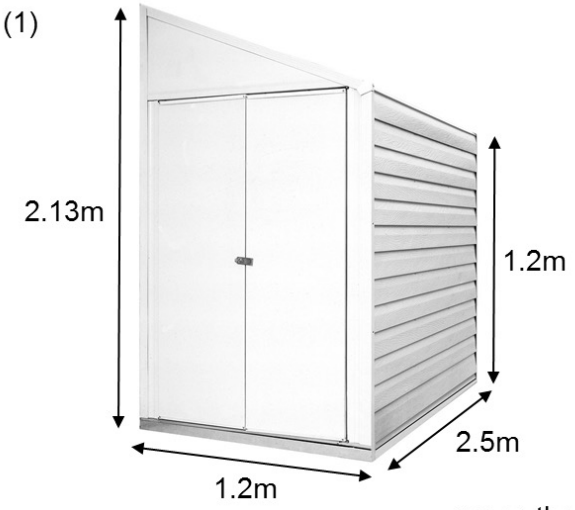
(4)



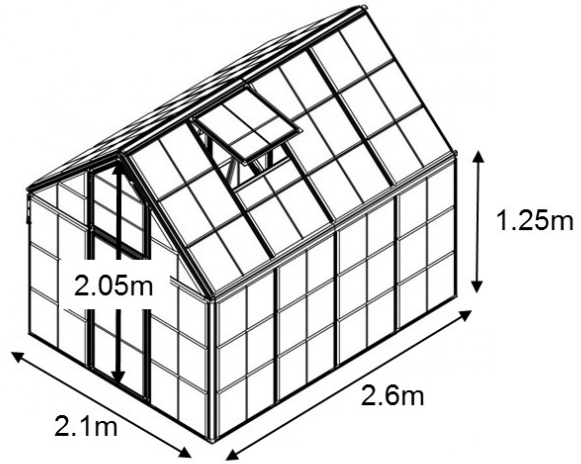
volume = 960 cm^3
what is **b**?

Purposeful Practice

(1)

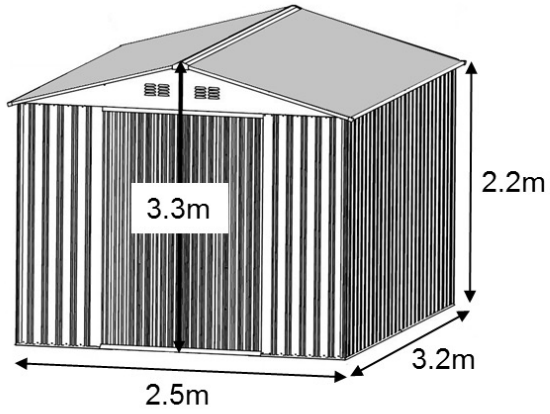


(2)

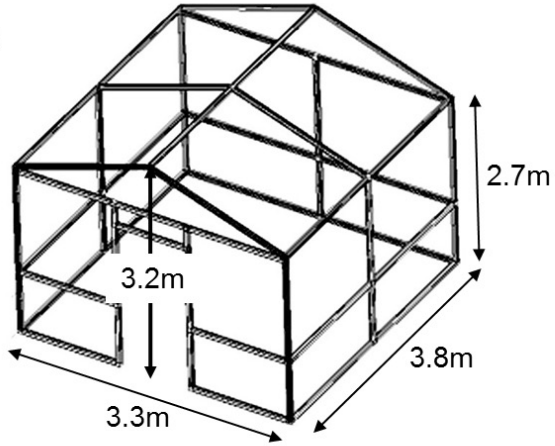


guess the volumes of the sheds to the nearest m^3 and then work them out

(3)

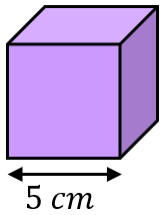


(4)

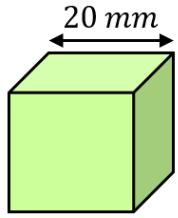


Find the surface area of each of these cubes.

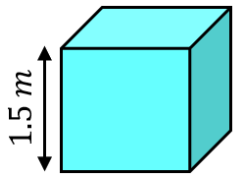
(a)



(b)

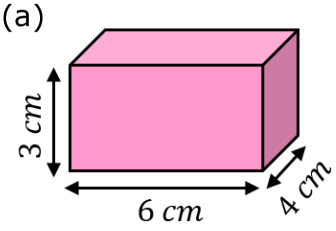


(c)

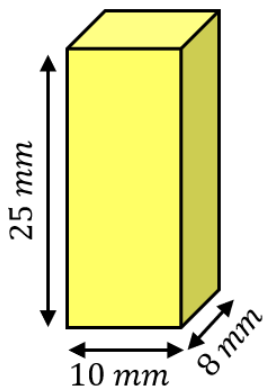


Find the surface area of each of these cuboids.

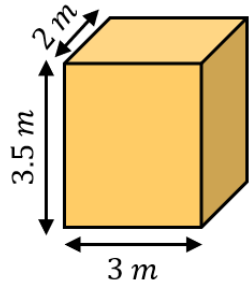
(a)



(b)

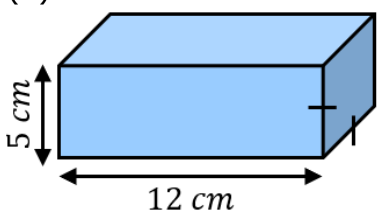


(c)

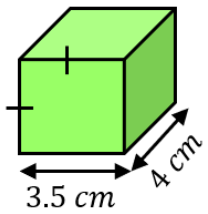


Find the surface area of these cuboids.

(a)



(b)

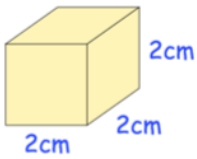


(a) A cube has a side length of x cm and a surface area of $337.5\ cm^2$. Find x.

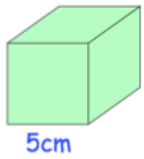
(b) A cuboid has side lengths $5\ cm$, $8\ cm$ and $y\ cm$. Its surface area is $314\ cm^2$. Find y.

Question 1: Work out the surface area of each of the following cubes.

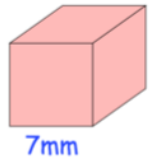
(a)



(b)

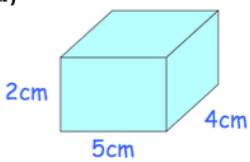


(c)

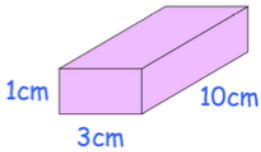


Question 2: Work out the surface area of each of the following cuboids.

(a)



(b)



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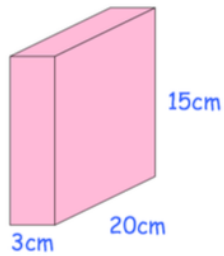
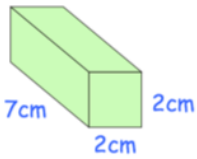
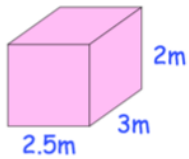


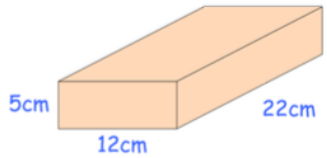
(d)



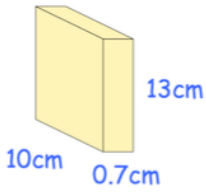
(e)



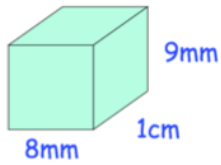
(f)



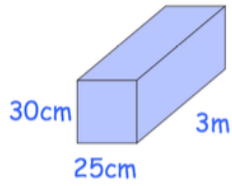
(g)



(h)



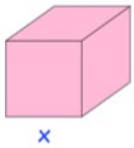
(i)



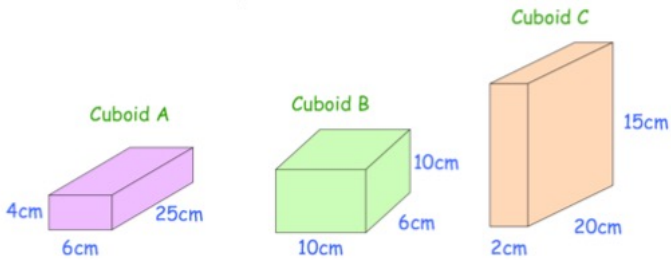
Question 3: Calculate the surface area of a cube with side length 12cm

Question 4: Calculate the surface area of a cube with side length ½ cm

Question 1: A cube has a surface area of $54cm^2$
Find the side length, x, of the cube



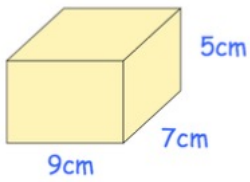
Question 2: A company is designing a new box to hold coffee.
They have 3 designs, cuboids A, B and C.
All 3 designs have the same volume of $600cm^3$
The company want to choose the design with the smallest surface area.
Which cuboid should they choose?



Question 3: A cube has a volume of $1000cm^3$.
Work out the surface area of the cube.

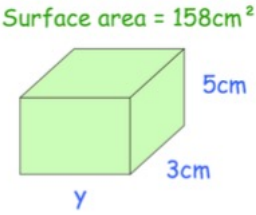
Question 4: Jamie is trying to work out the surface area of the cuboid below.
Can you spot any mistakes?

$$9 \times 5 = 45$$
$$7 \times 5 = 35$$
$$9 \times 7 = 63$$
$$45 + 35 + 63 = 143cm^3$$

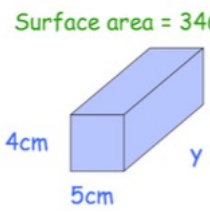


Question 5: Find y for each of the cuboids below

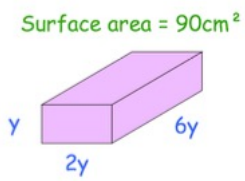
(a)



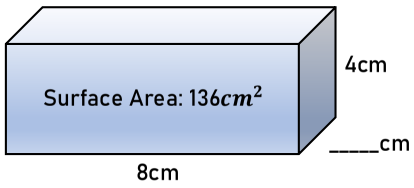
(b)

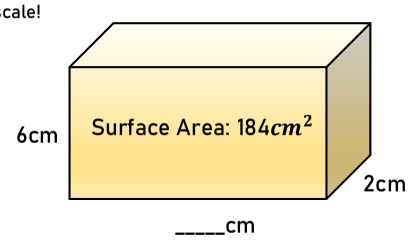


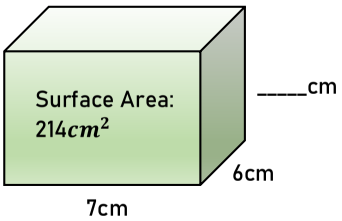
(c)

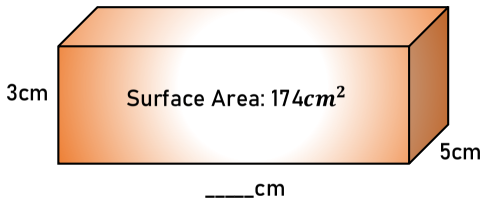


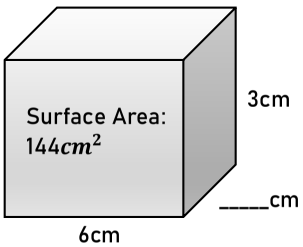
Diagrams not to scale!

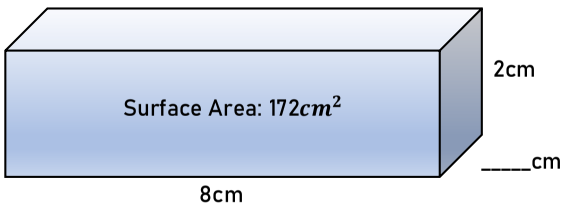


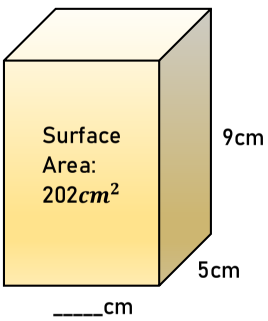


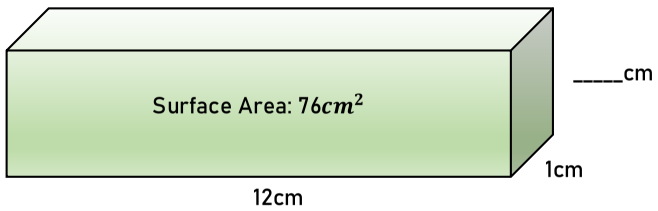


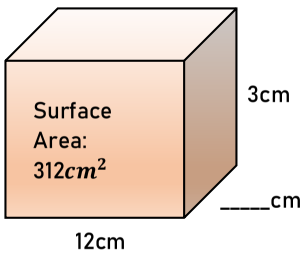


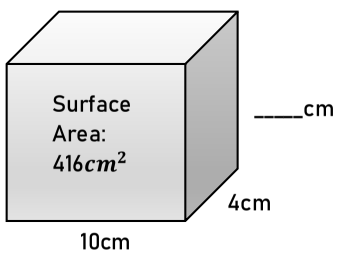












Instructions

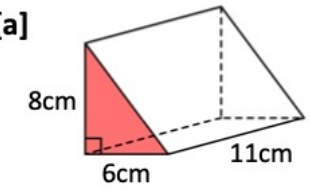
These are the missing lengths of each cuboid. Where should they go to give the required surface areas?

2 3 4 5 6

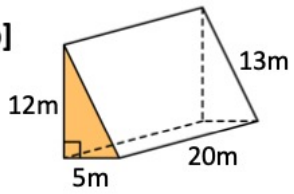
7 8 9 10 12

Q1 Calculate the surface area of the following prisms.

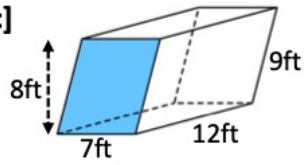
[a]



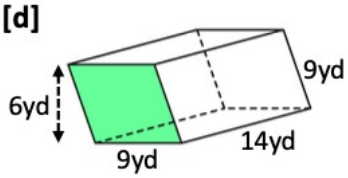
[b]



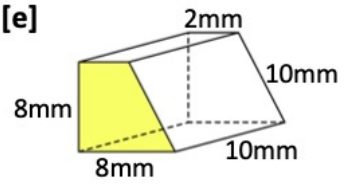
[c]



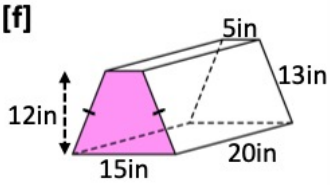
[d]



[e]

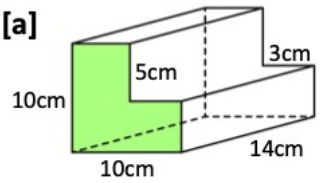


[f]

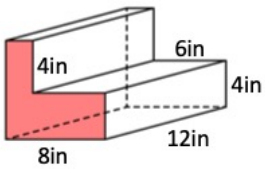


Q2 Calculate the volume of the following L-shape prisms.

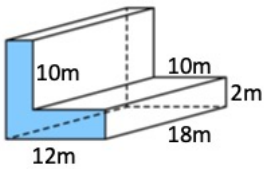
[a]



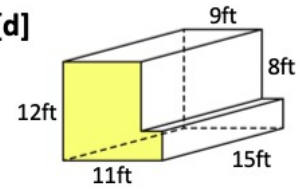
[b]



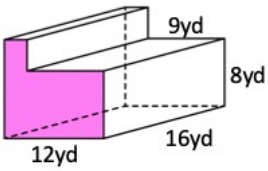
[c]



[d]



[e]



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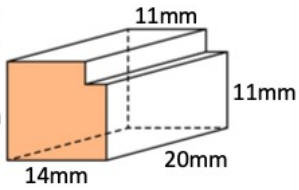
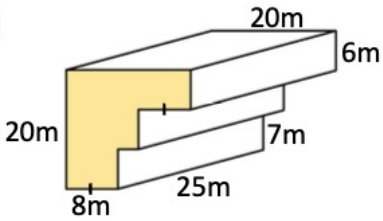
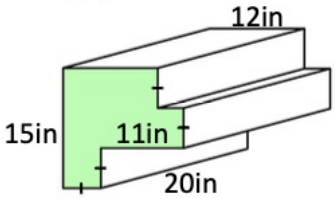


Q3 Calculate the surface area of the following prisms.

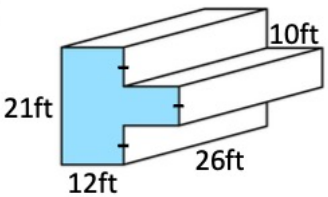
[a]



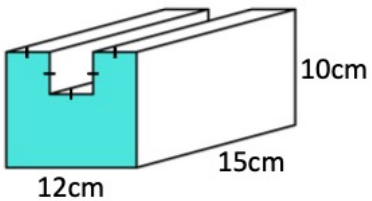
[b]



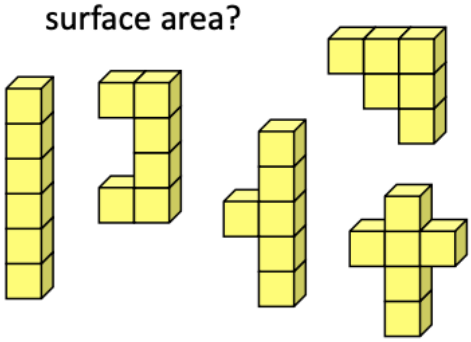
[c]



[d]



Q4 Each of the four shapes shown below is made from 6 unit cubes. Which has the smallest surface area?

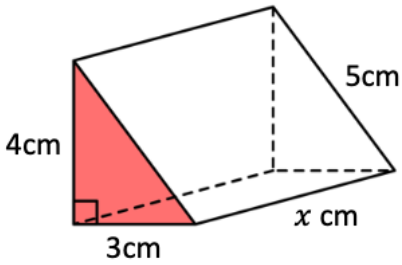


Q5 A cube has a surface area of 96cm^2. Find the side length of the cube.

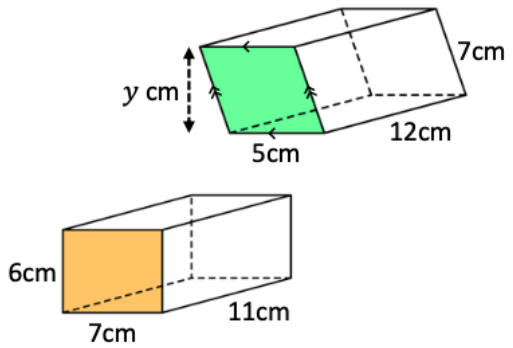
Q6 A cube has a surface area of 294cm^2. Find the side length, x, of the cube.

Q7 A cube has a surface area of 150cm^2. Find the volume of the cube.

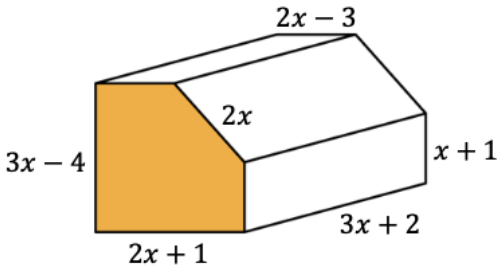
Q8 Given that the surface are of the triangular prism below is 96cm^2, find x.



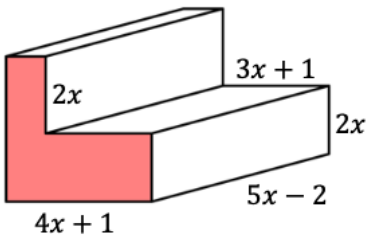
Q9 Given that the surface area of the following prisms are equal, find y.



Q10 Find an expression, in terms of x, for the surface area of the prism. Give your answer in its simplest form.



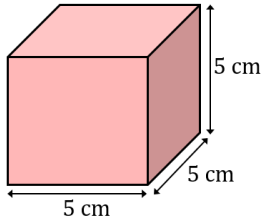
Q11 Given that the surface area of the following L-shape prism is 194cm^2, find the perimeter of its cross section. Give your answer in its simplest form.



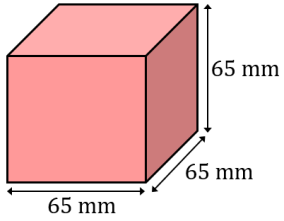
Fluency Practice

Find the total surface area of each of these 3D shapes. Give units with your answers.

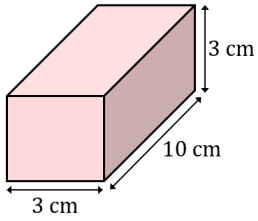
(a)



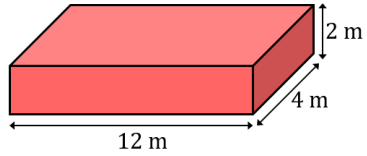
(b)



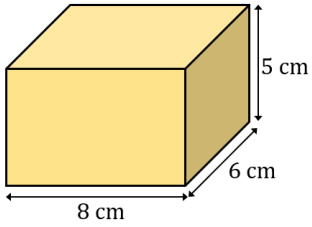
(c)



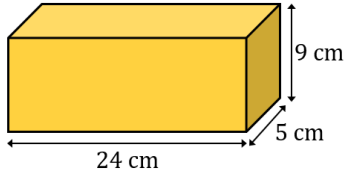
(d)



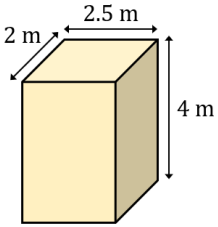
(e)



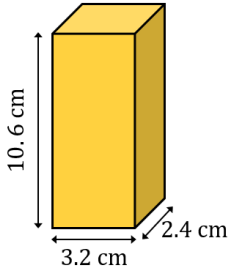
(f)



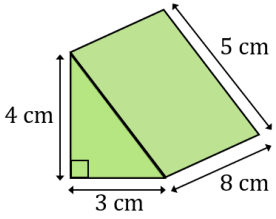
(g)



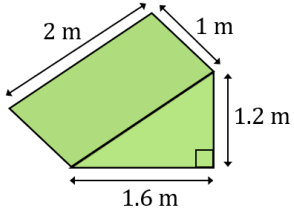
(h)



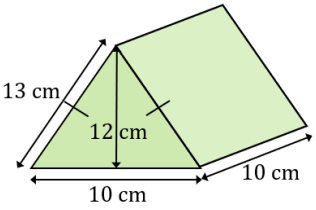
(i)



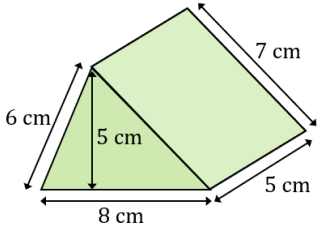
(j)



(k)

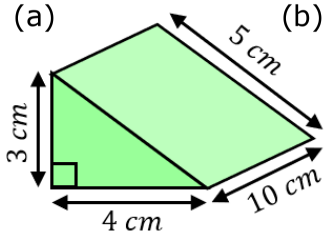


(l)

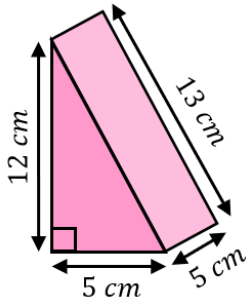


Find the surface area of each of these triangular prisms.

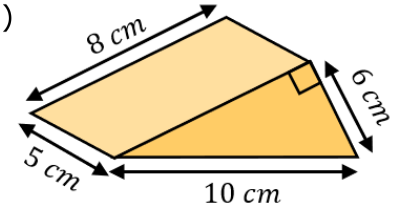
(a)



(b)

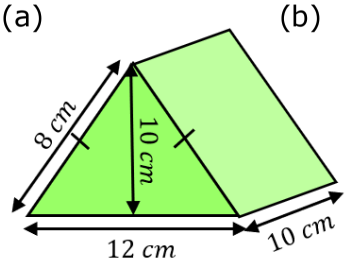


(c)

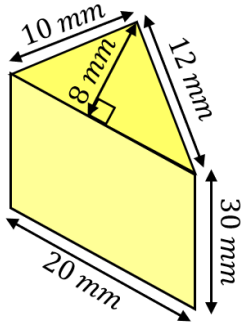


Find the surface area of each of these triangular prisms.

(a)

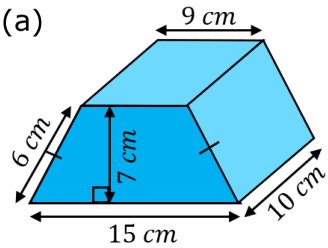


(b)

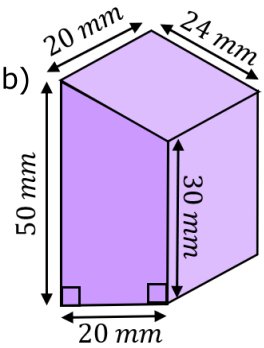


Find the surface areas of these trapezoidal prisms.

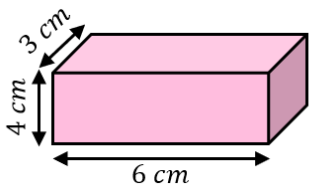
(a)

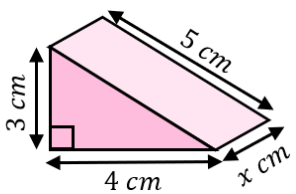


(b)



These two 3D shapes have the same surface area. Find the missing length.





Fluency Practice

RAT Prisms

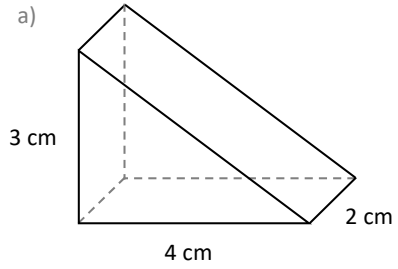
These solid shapes are prisms with a **R**ight-**A**ngled **T**riangle for a base.

Calculate the **surface area** of each shape.

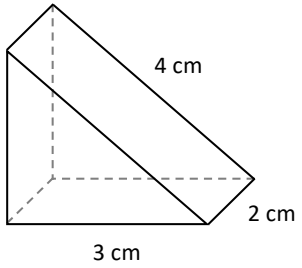
(Begin by finding the missing length to 1 dp. Use that figure in your calculations.)

NOT DRAWN ACCURATELY

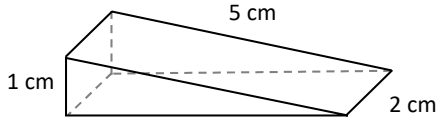
a)



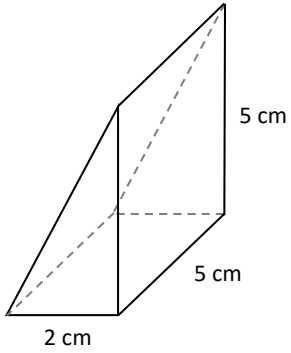
b)



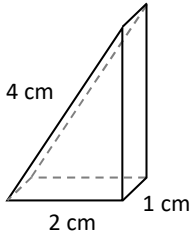
c)



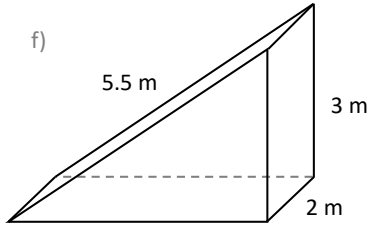
d)



e)

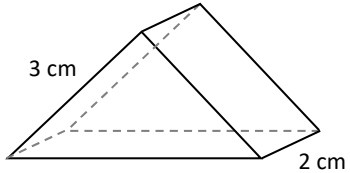


f)

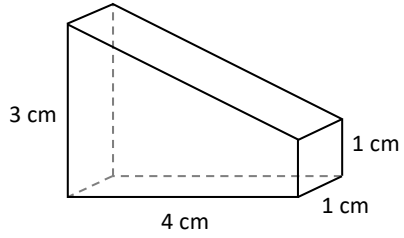


g)

isosceles base

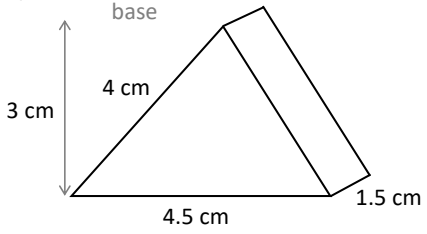


h)



i)

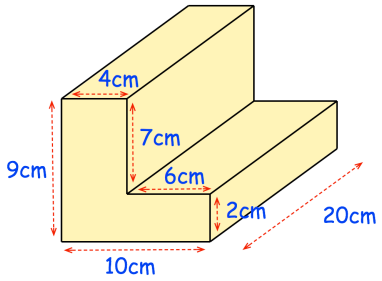
scalene base



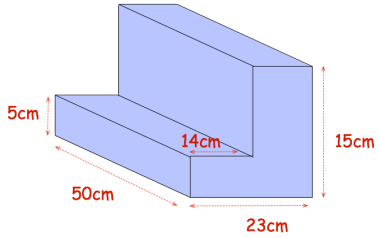
Fluency Practice

Question 1: Work out the surface area of each of the prisms below.

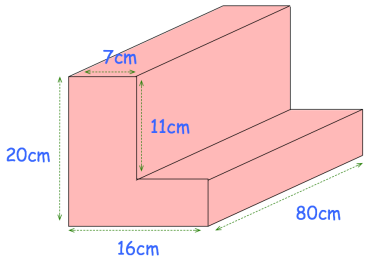
(a)



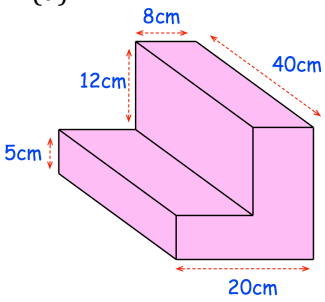
(b)



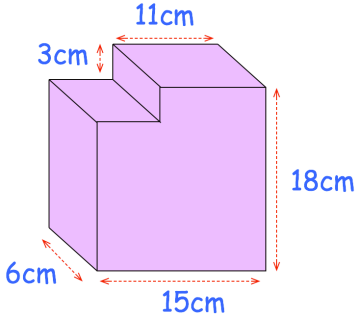
(c)



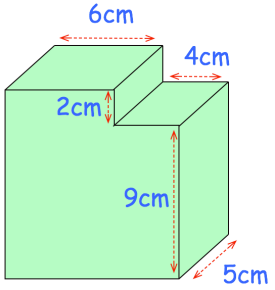
(d)



(e)

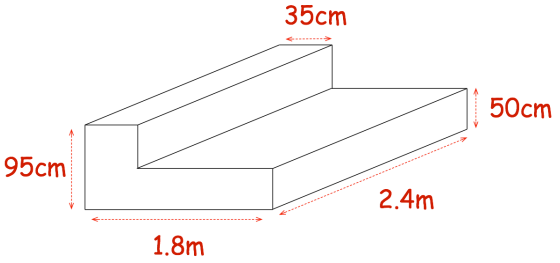


(f)



Apply

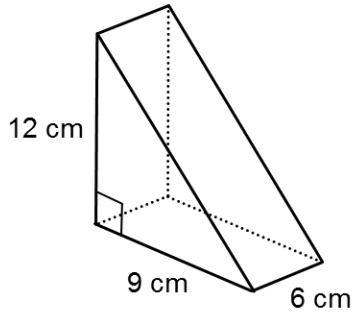
Question 1: Shown below is a prism.
Find the surface area of the prism.
Give your answer in m^2.



Fluency Practice

surface area and volume of triangular prisms

(1)

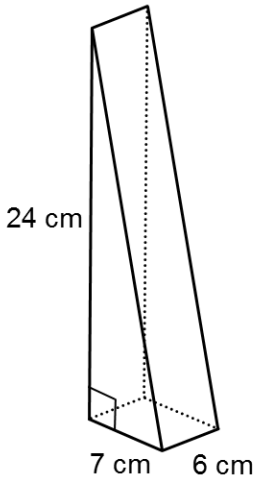


find the volume of the triangular prism

also find the surface area of the prism

make sure that you state the units

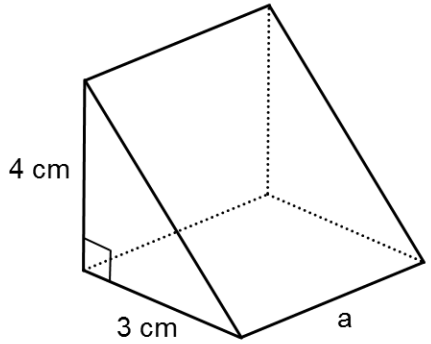
(2)



find the volume of the triangular prism

and find the surface area of the prism, stating the units

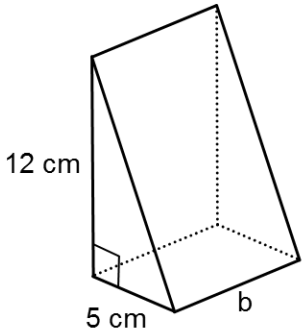
(3)



show that the surface area is always a multiple of 12

find a relationship between the surface area and the volume

(4)

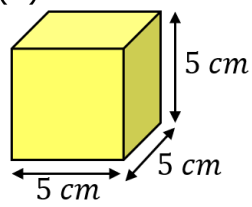


show that the surface area is always a multiple of 30

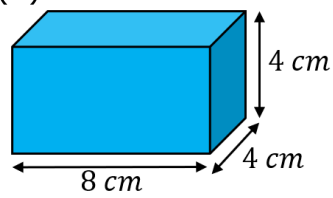
show that the surface area value is a always a constant number more than the value for the volume

Find the volume and surface area of each of these cubes or cuboids.

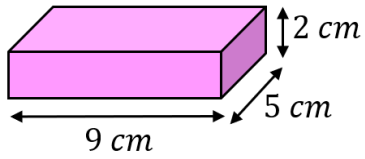
(a)



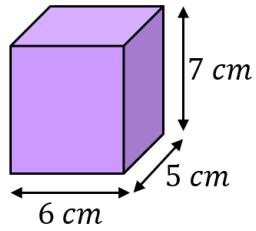
(b)



(c)

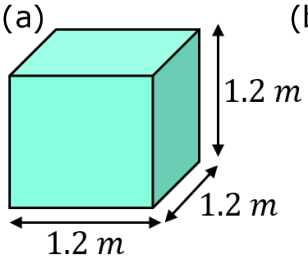


(d)

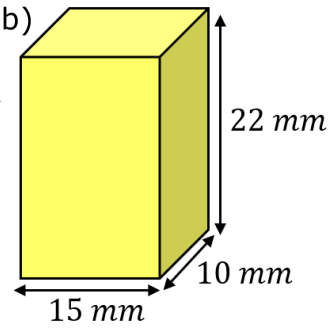


Find the volume and surface area of each of these cubes or cuboids.

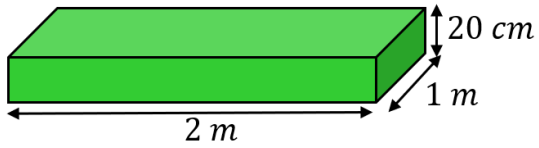
(a)



(b)

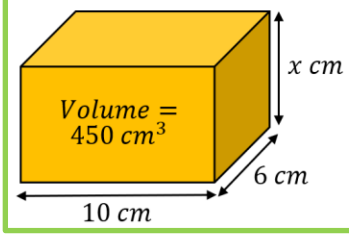


(c)

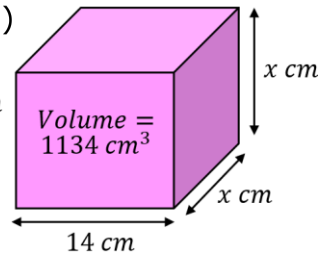


Find the missing lengths in these cubes and cuboids.

(a)

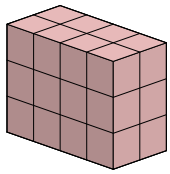


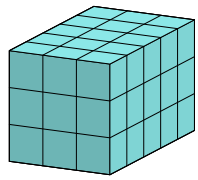
(b)

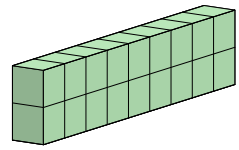


(a) A cube has a volume of $5832\ cm^3$.
Find its side length.
(b) A cuboid with side lengths, $x\ cm$, $5\ cm$ and $8\ cm$ has a surface area of $197\ cm^2$.
Find x.

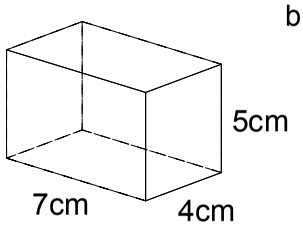
1. Work out the **volume** and **surface area** of each shape made of 1cm cubes:

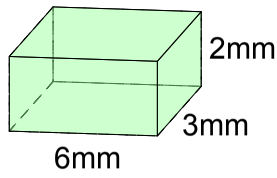
a) 

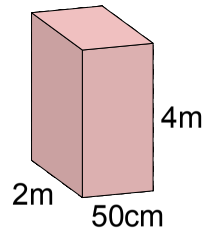
b) 

c) 

2. Work out the **volume** and **surface area** of each cuboid:

a) 

b) 

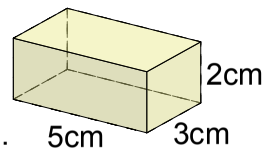
c) 

3. A cuboid has dimensions 0.8cm, 0.2cm and 6mm.
Work out the volume and surface area of this cuboid.

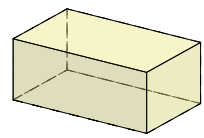
4. a) Work out the side length of a cube with a volume of 64cm^3.

b) Work out the side length of a cube with a surface area of 54cm^2.

5. John has two congruent cuboids as shown.

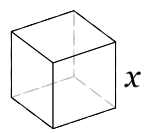


He joins the two cuboids together to make a larger cuboid by sticking together two identical faces.

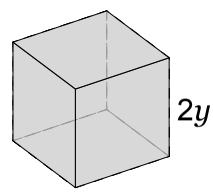


Work out the largest possible surface area the larger cuboid could have.

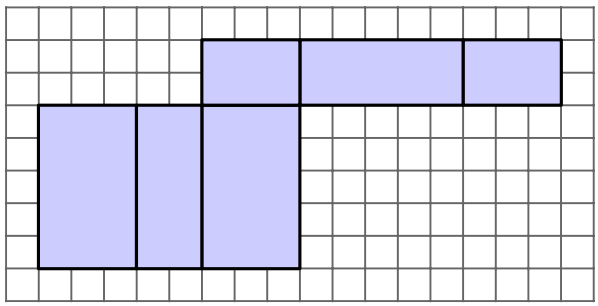
6. a) A cube has a side length of x.
Find expressions for the volume and surface area of this cube in terms of x.



b) A different cube has a side length of $2y$.
Find simplified expressions for the volume and surface area of this cube in terms of y.



7. The net of a cuboid is shown on a square grid, where each square has an area of 1cm^2.



Work out the volume and surface area of this cuboid.

8. a) Work out the surface area of a cube with a volume of 125cm^3.

b) Work out the volume of a cube with a surface area of 600cm^2.

9. A cuboid has integer side lengths a, b and c.

a) Robert says: 'The volume of the cuboid must be an even number.' Find an example to show that Robert is wrong.

b) Natalie says: 'The surface area of the cuboid must be an even number.' Prove that Natalie is correct.

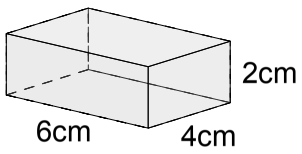
10. A cuboid has a volume of 36cm^3. The dimensions of the cuboid are all different integers. Work out all the possible sets of dimensions the cuboid could have.

11. A cuboid has side lengths p cm, q cm and r cm, where p, q and r are all prime numbers.
Which of the following are possible volumes of the cuboid?

a) 15cm^3 b) 17cm^3 c) 24cm^3 d) 27cm^3 e) 30cm^3

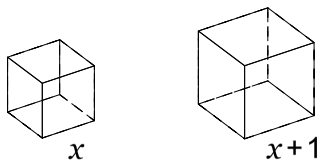
12. A cuboid has dimensions 2cm, 4cm and 6cm.

One of the dimensions is to be increased by 1cm.
Another of the dimensions is to be reduced by 1cm.



Work out the smallest and largest possible volumes of the resulting cuboid.

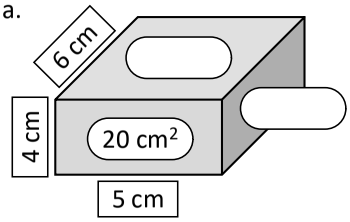
13. Two cubes have side lengths of x and $x+1$ as shown.



Show that the difference betweeen their volumes is given by: $3x^2 + 3x + 1$.

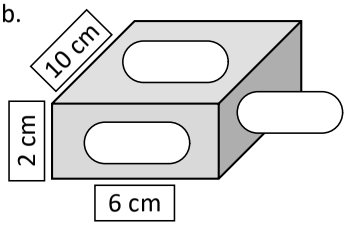
Calculate the volume and surface area of each cuboid:

a.



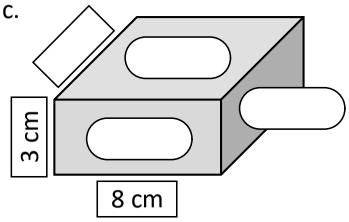
V: SA:

b.



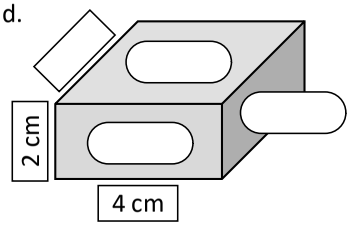
V: SA:

c.



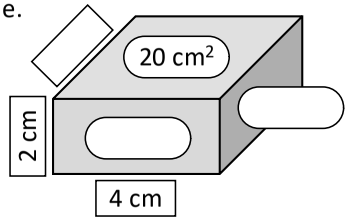
V: 120 cm³ SA:

d.



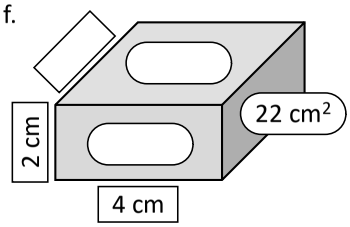
V: 24 cm³ SA:

e.



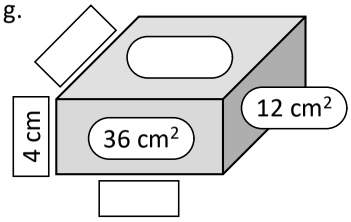
V: SA:

f.



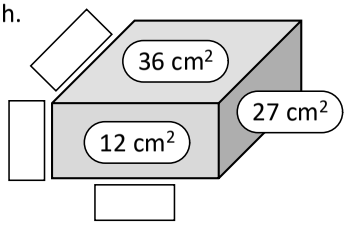
V: SA:

g.



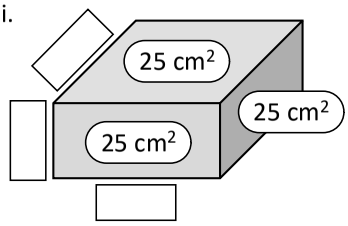
V: SA:

h.



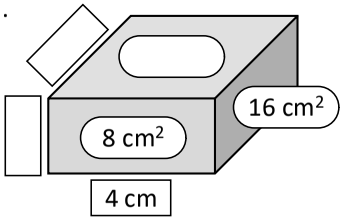
V: SA:

i.



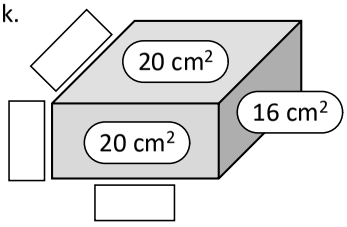
V: SA:

j.



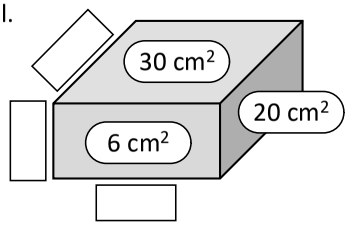
V: SA:

k.



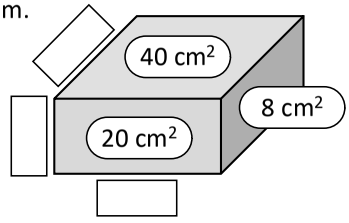
V: SA:

l.



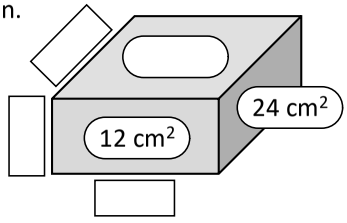
V: SA:

m.



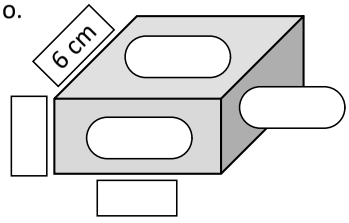
V: SA:

n.



V: SA: 136 cm²

o.



V: 84 cm³ SA: 136 cm²

A	A cuboid with a volume greater than $100\ \text{cm}^3$	
B	A cube with a volume less than $75\ \text{cm}^3$	
C	A cuboid with a volume of exactly of $240\ \text{cm}^3$	
D	A cuboid with a volume of $360\ \text{cm}^3$ where two of the dimensions are equal	
E	A cube where the surface area is greater than $200\ \text{cm}^2$	
F	A cuboid where the surface area is less than $100\ \text{cm}^2$	
G	A cuboid where the volume is less than $1\ \text{m}^3$	
H	A cuboid where two of the surfaces each have an area of $30\ \text{cm}^2$	
I	A cube where the surface area in cm^2 is less than the volume in cm^3	
J	A cuboid where the surface area in cm^2 is greater than the volume in cm^3	
K	A cuboid where four of the surfaces have the same area	
L	A cuboid with a volume of $120\ \text{cm}^3$ that has a surface area greater than $200\ \text{cm}^2$	
M	A cuboid where the volume is a multiple of $25\ \text{cm}^3$ and the surface area is a multiple of $40\ \text{cm}^2$	

Kellogg's Corn Flakes Investigation

Which size is the most eco-friendly?

Which size gives the best value, and by how much?

Kellogg's Corn Flakes come in various sizes of box. The main ones are listed below. Use the measurements given for each type to calculate the volume and surface area.

Box Size	Weight (g)	Cost	Height	Width	Depth	Volume	Surface Area
Small	250	£1.39	***25cm***	***19cm***	***5.5cm***		
Medium	500	£1.98	***29.5cm***	***23cm***	***7cm***		
Large	750	£2.68	***35cm***	***24.5cm***	***9cm***		

Remember:

- To calculate volume, *multiply all 3 dimensions together*.
- To calculate surface area, *find the area of all 6 faces and add them together.*

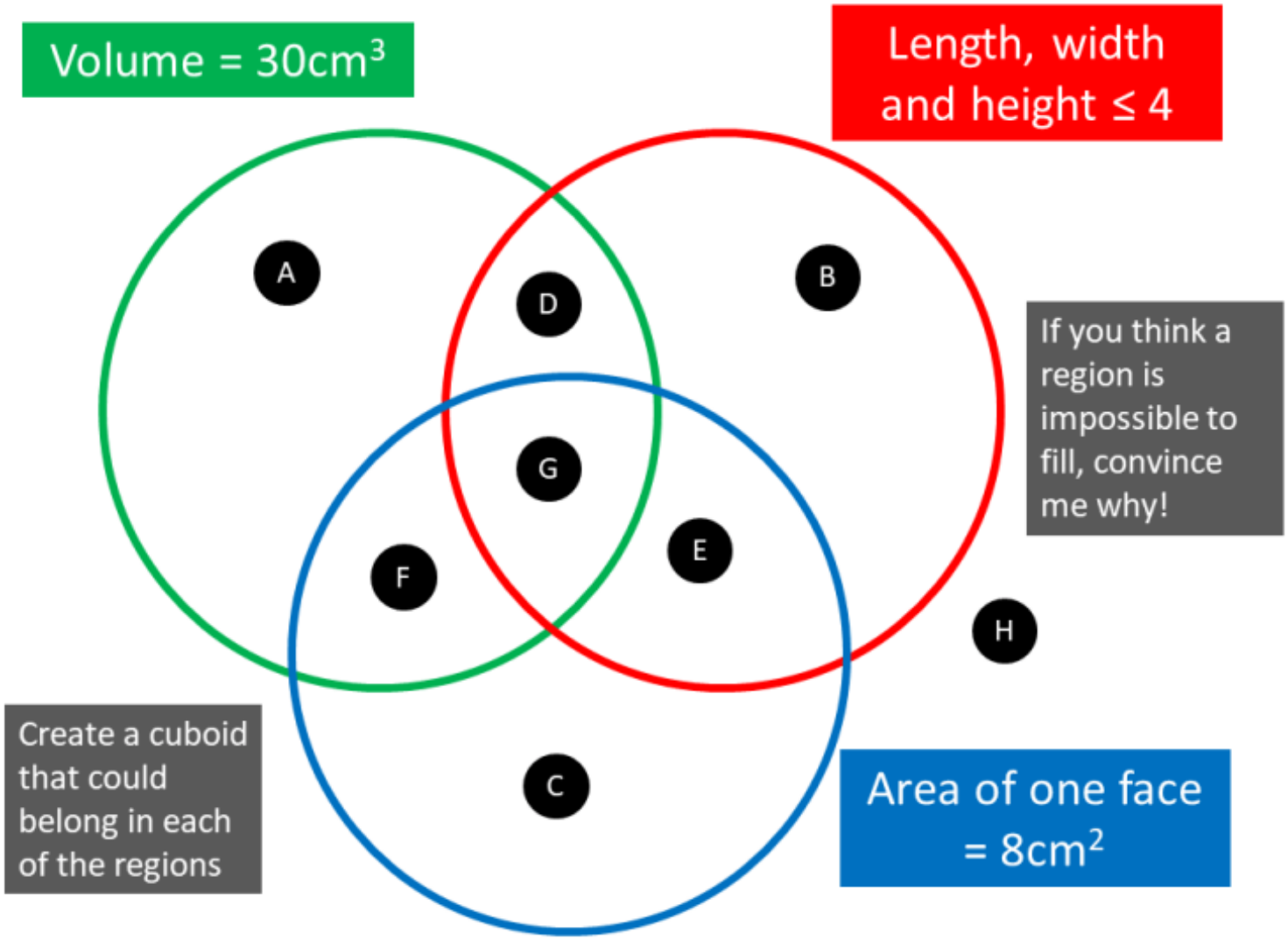
1. How much cardboard per gram of cornflakes does the most efficient box use?

2. Which box gives the best value (most cornflakes for your money)?

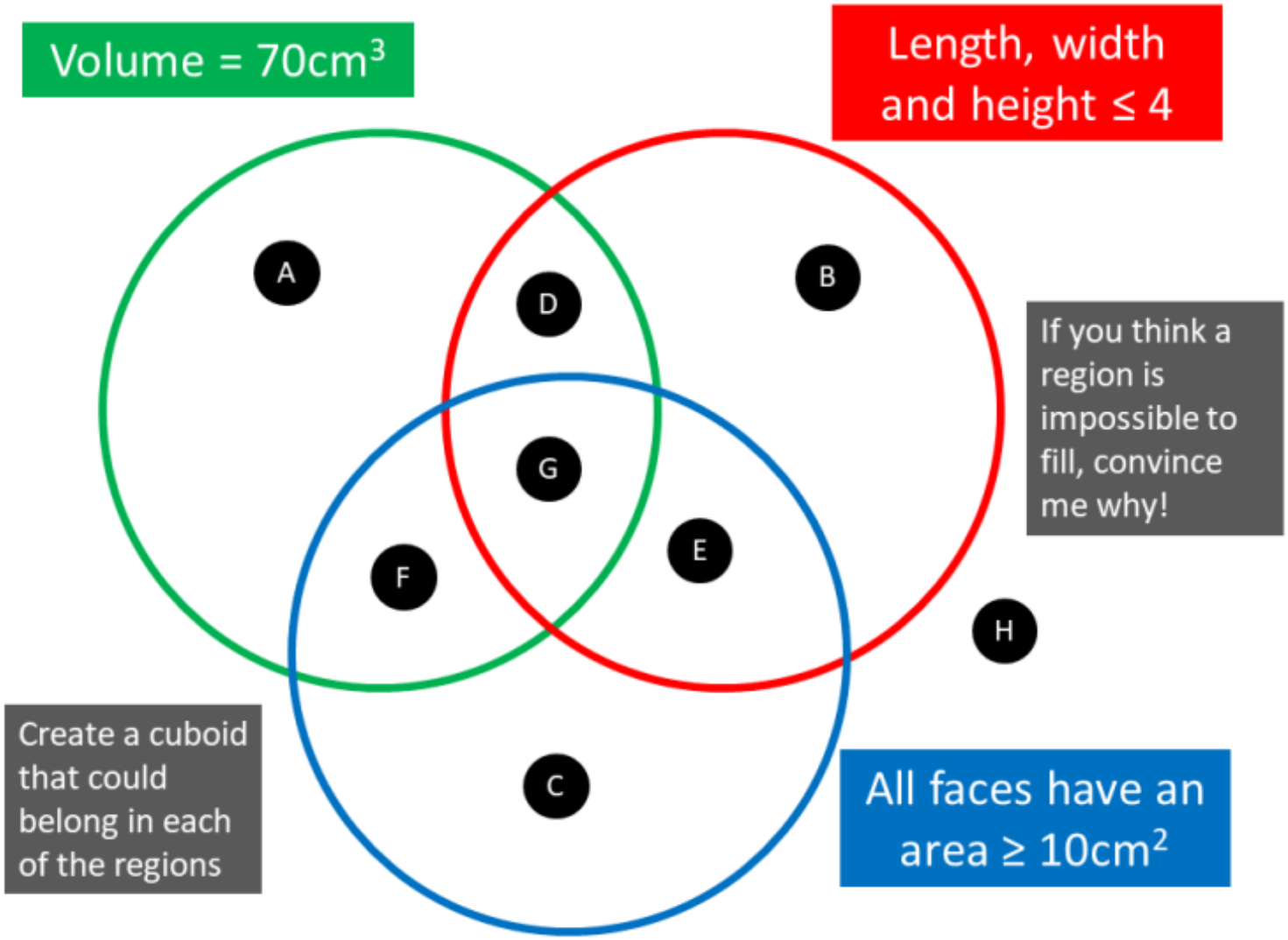
3. If you planned to make a 1500g box of cereal by doubling *one* of the dimensions of the 750g box, which dimension would you double to minimise the surface area, and what would the resulting surface area of the box be?

Extension: If you could choose the dimensions of your 1500g box, how would you minimise surface area? If you could choose *any* shape whatsoever, what would be best?

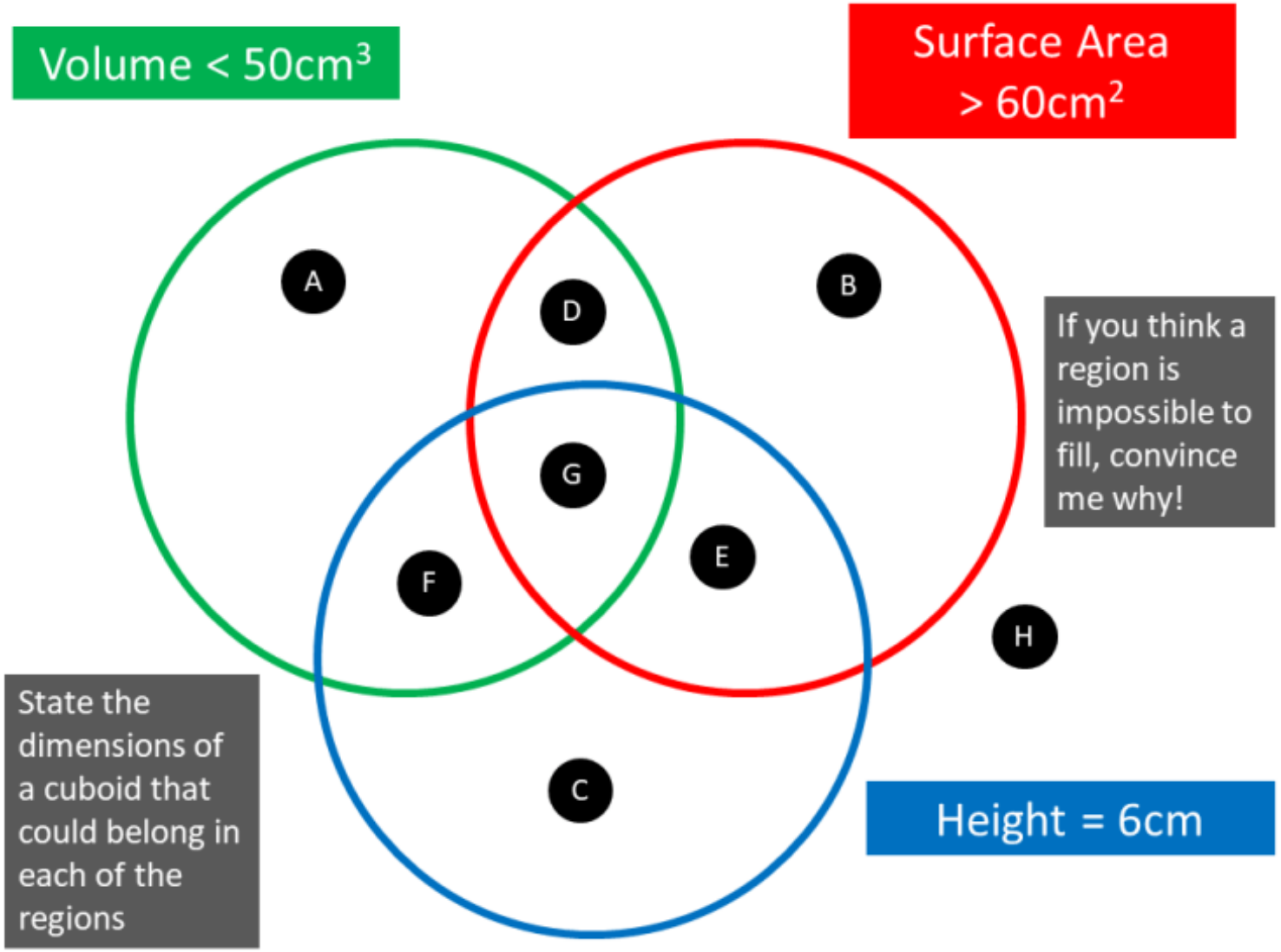
Problem Solving



Problem Solving

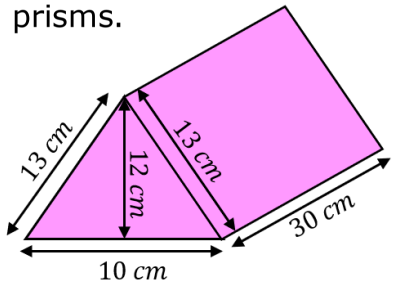


Problem Solving

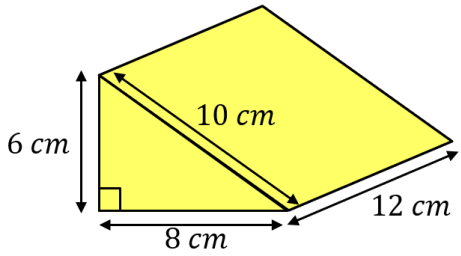


Find the volume and surface area of each of these prisms.

(a)



(b)



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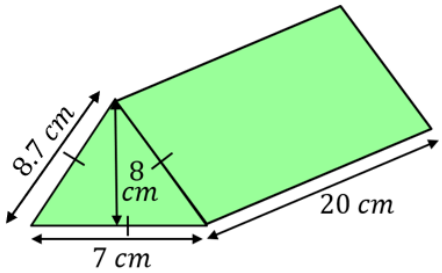
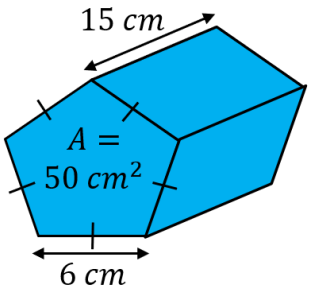
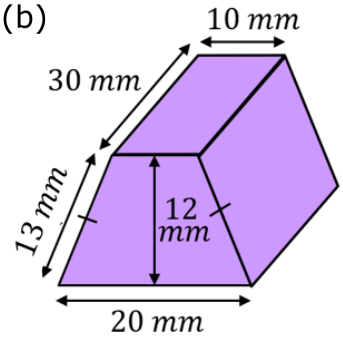


Find the volume and surface area of these prisms.

(a)

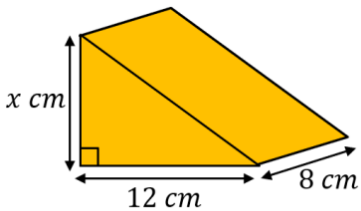


(b)



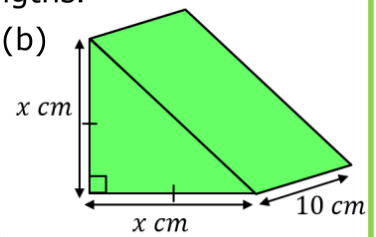
Find the missing lengths.

(a)



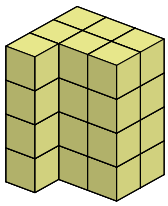
Volume = 432 cm^3

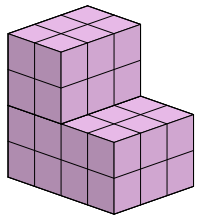
(b)

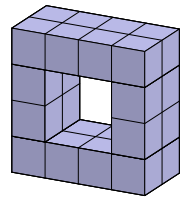


Volume = 361.25 cm^3

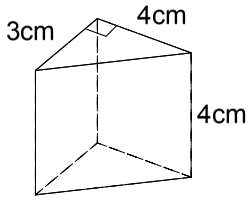
1. Work out the **volume** and **surface area** of each prism made of 1cm cubes:

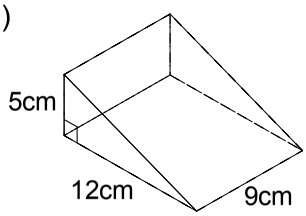
a) 

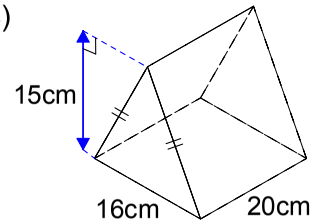
b) 

c) 

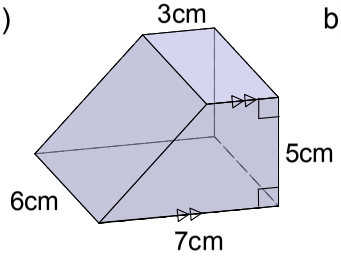
2. Work out the **volume** and **surface area** of each prism:

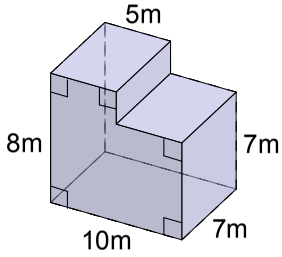
a) 

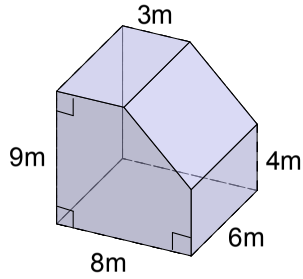
b) 

c) 

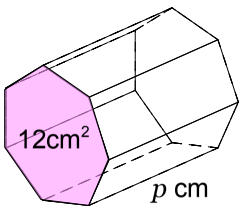
3. Work out the volume of each of these prisms:

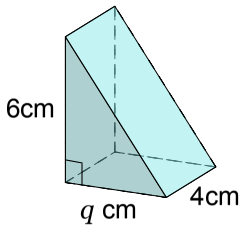
a) 

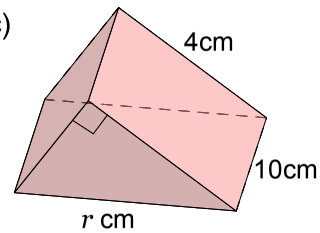
b) 

c) 

4. Each of these prisms has a volume of 60cm^2. Work out p, q and r.

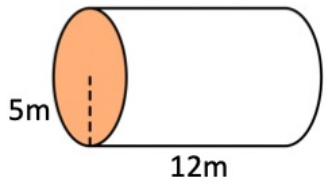
a) 

b) 

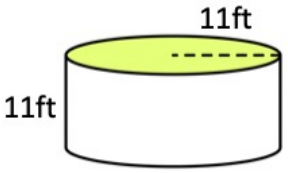
c) 

Q1 Work out the volume of each of the following cylinders:
[i] in terms of π, **[ii]** to 3sf.

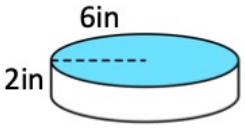
[a]



[b]

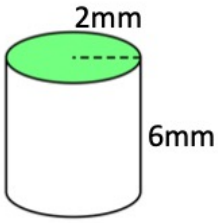


[c]

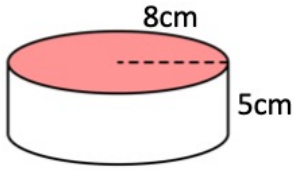


[d]

[e]

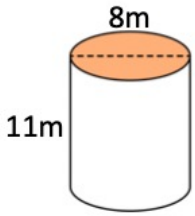


[f]

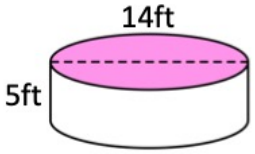


Q2 Work out the volume of each of the following cylinders:
[i] in terms of π, **[ii]** to 3sf.

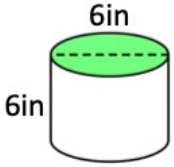
[a]



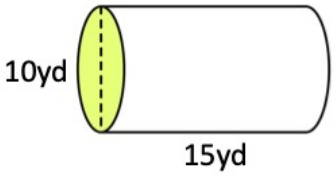
[b]



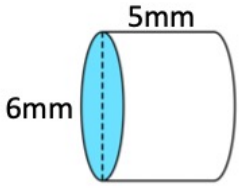
[c]



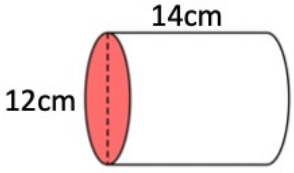
[d]



[e]

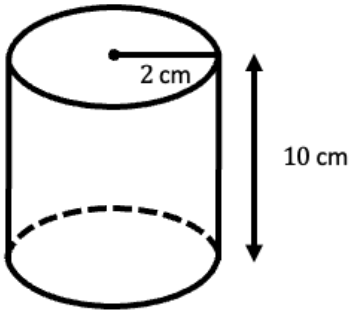


[f]

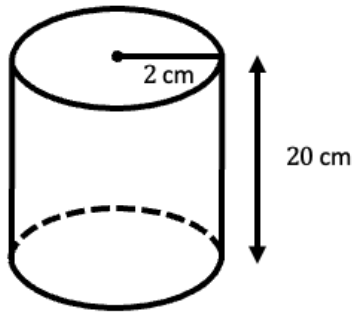


Calculate the volume. Give your answers in terms of π and to 1 decimal place.

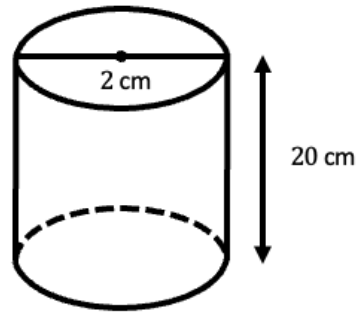
Question 1



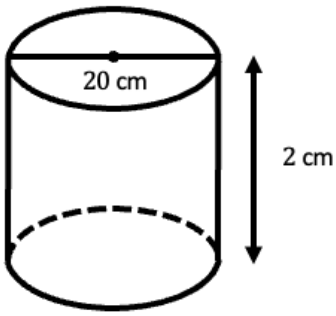
Question 2



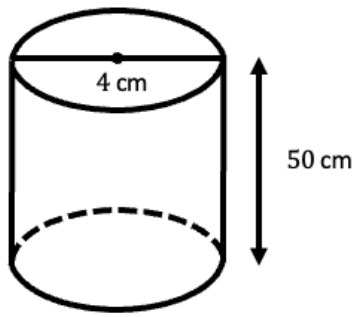
Question 3



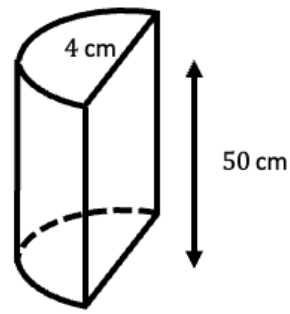
Question 4



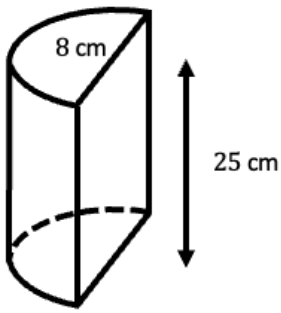
Question 5



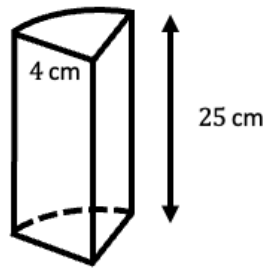
Question 6



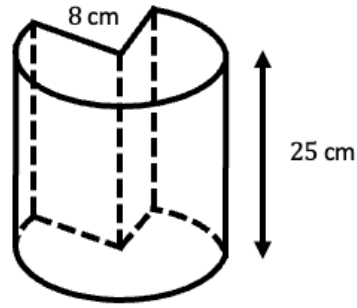
Question 7



Question 8



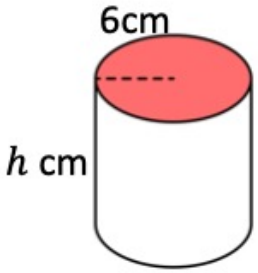
Question 9



Fluency Practice

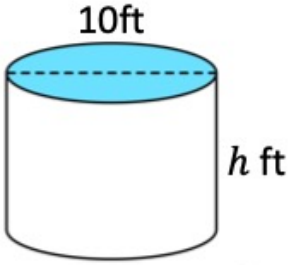
Q3 Work out the height of each cylinder.
Give your answer to one decimal place.

[a]



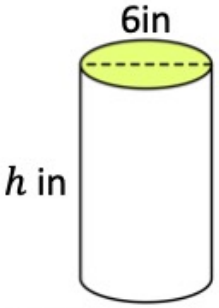
Volume = 1600m³

[b]



Volume = 630ft³

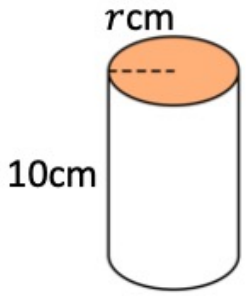
[c]



Volume = 300in³

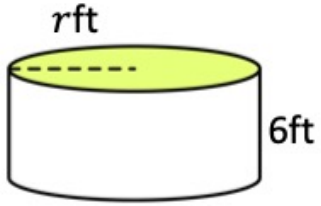
Q4 Work out the radius of each cylinder.
Give your answer to one decimal place.

[a]



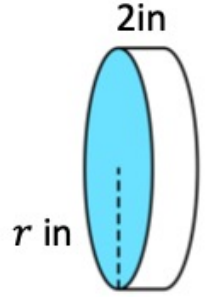
Volume = 300m³

[b]



Volume = 900ft³

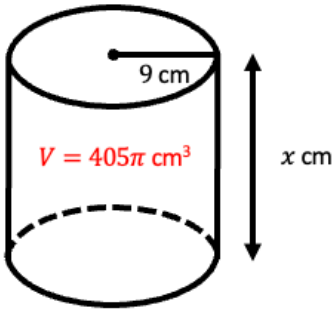
[c]



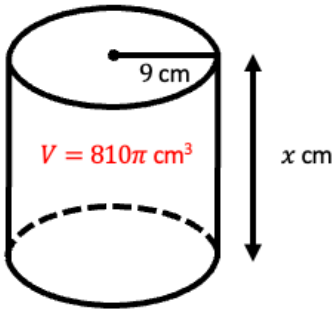
Volume = 250in³

Find x given the volume. Give your answers to 1 decimal place if required.

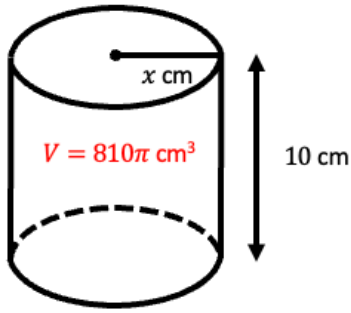
Question 1



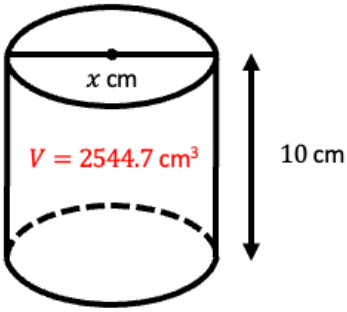
Question 2



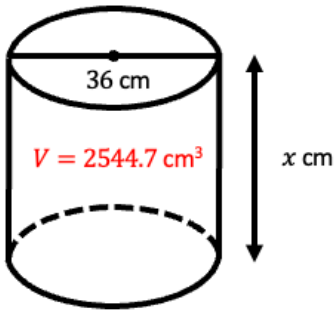
Question 3



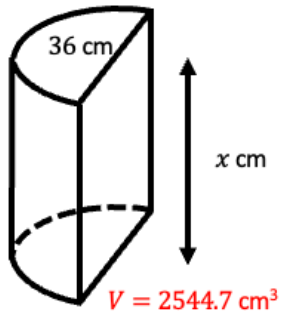
Question 4



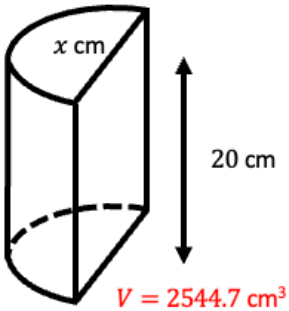
Question 5



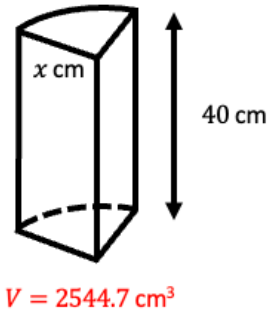
Question 6



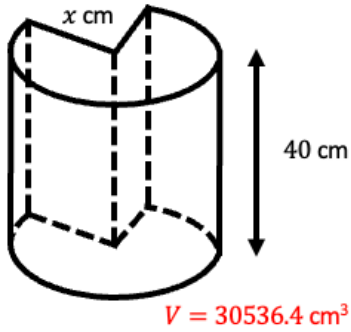
Question 7



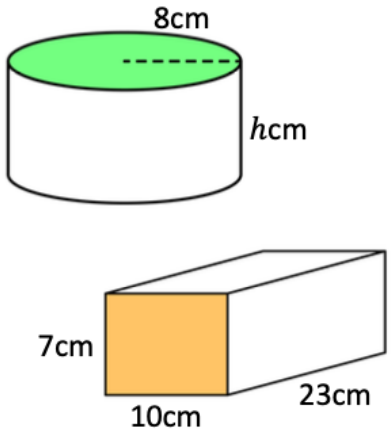
Question 8



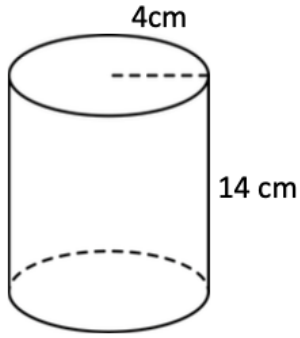
Question 9



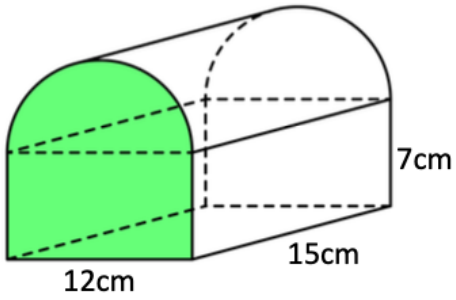
Q5 The cylinder and the cuboid have the same volume.
Find the value of h.



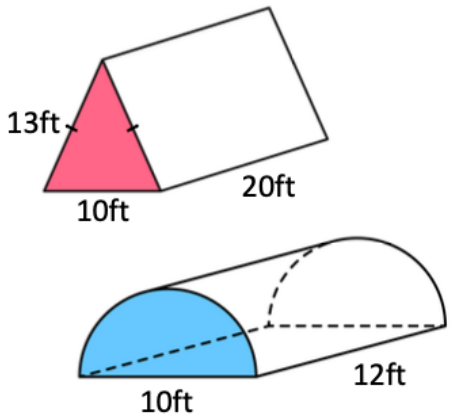
Q6 Callum is filling cups with water. Each cup is a cylinder with radius 4cm and height 14cm. Callum has 10 litres of water. How many cups can Callum fill?



Q7 The cross-section of the following prism is made by joining a semicircle and rectangle. Calculate the volume of the prism giving your answer to two significant figures.

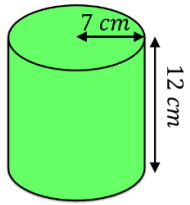


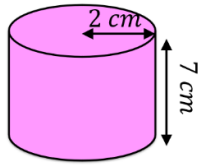
Q8 Find the ratio of the volume of the triangular prism to the volume of the semi-cylinder. Give your answer in its simplest form.

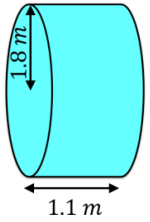


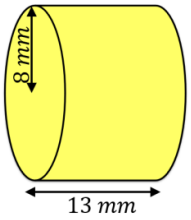
Fluency Practice

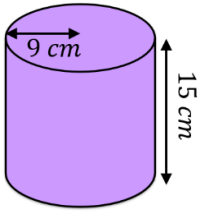
Find the volume of each of these cylinders. Give your answers to 1 decimal place and include units.

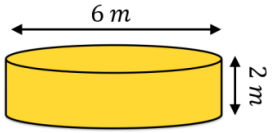


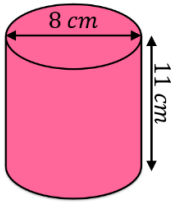


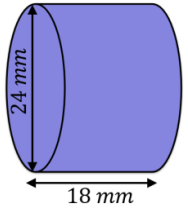


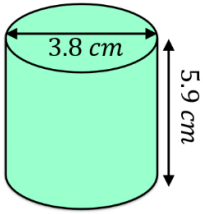




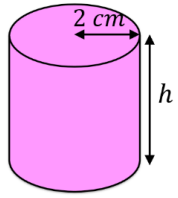




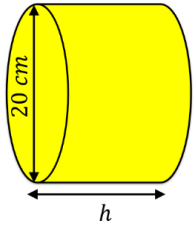




Find the missing measurements in these cylinders.

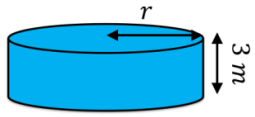


$Volume = 113\ cm^2$



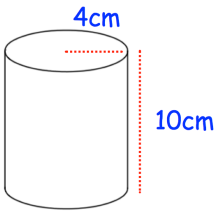
$Volume = 4084\ cm^2$

$Volume = 236\ m^2$

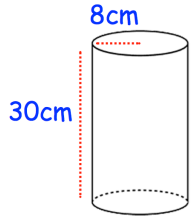


Question 1: Work out the volume of each cylinder.
Give each answer to one decimal place.

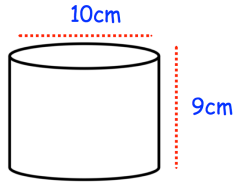
(a)



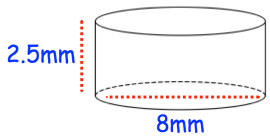
(b)



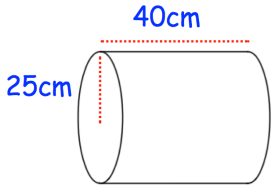
(c)



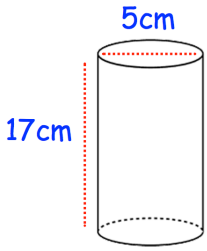
(d)



(e)

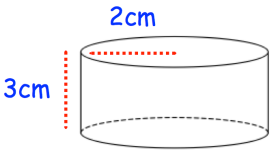


(f)

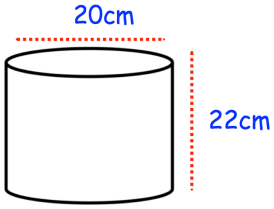


Question 2: Work out the volume of each cylinder.
Give each answer in terms of **π**.

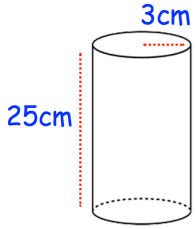
(a)



(b)

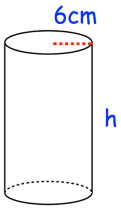


(c)



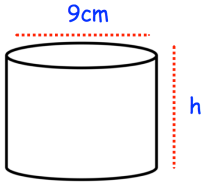
Question 3: Work out the height of each cylinder.
Give each answer to one decimal place.

(a)



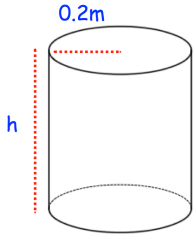
Volume = 1600cm³

(b)



Volume = 800cm³

(c)

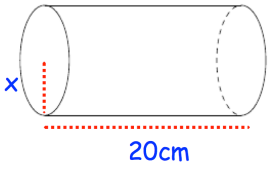


Volume = 0.11m³

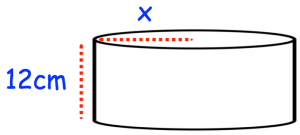
Question 4: Work out the value of x.
Give each answer to one decimal place.

(a)

Volume = 725cm³

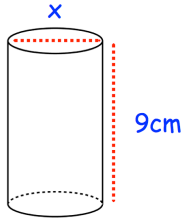


(b)



Volume = 9000cm³

(c)



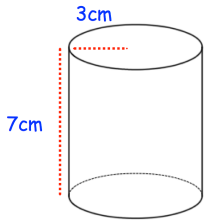
Volume = 170cm³

Question 1: A cylindrical oil drum has a diameter of 48cm and a height of 92cm.
Calculate the volume of the oil drum.

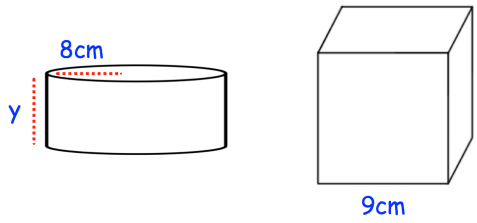
Question 2: A cylinder has a radius of 2m and a height of 5cm.
Work out the volume of the cylinder in terms of **π**.

Question 3: Timothy is filling cups with orange juice.
Each cup is a cylinder with radius 3cm and height 7cm.
Timothy has 2 litres of orange juice.
1 litre = $1000cm^3$

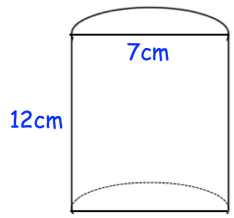
How many cups can be filled?



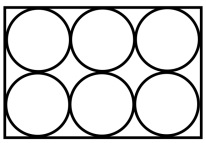
Question 4: Shown below is a cylinder and a cube.
The volume of the cylinder is equal to the volume of the cube.
Find y.



Question 5: Calculate the volume of this shape.

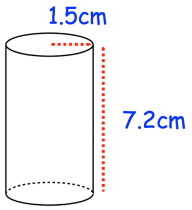


Question 6: 6 cylinders are placed in a crate as shown below.
The radius of each cylinder is 4cm and the height of each cylinder is 14cm.
The crate also has a height of 14cm.



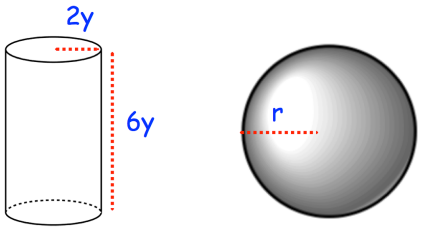
What percentage of space in the crate is empty?

Question 7: A solid glass cylinder has a radius of 1.5cm and a height of 7.2cm
The density of the glass is 2.61g/cm^3
Work out the mass of the cylinder.



Question 8: The diagram shows a solid cylinder.
The cylinder has radius of 2y and height of 6y.
The cylinder is melted down and made into a sphere of radius r.

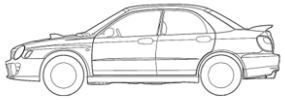
Express r in terms of y.



Purposeful Practice

cylinder volume

(1)

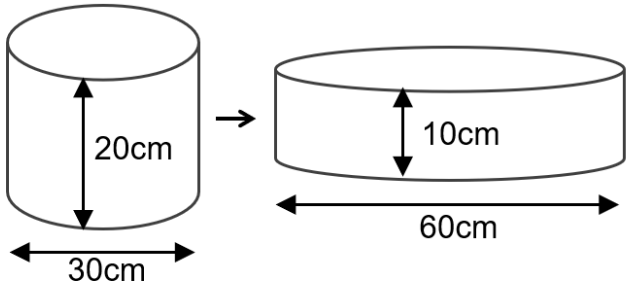


the Subaru Impreza 2.0i
has four cylinder heads, each with a diameter of 92mm and a stroke of 75mm

what is the total engine capacity?

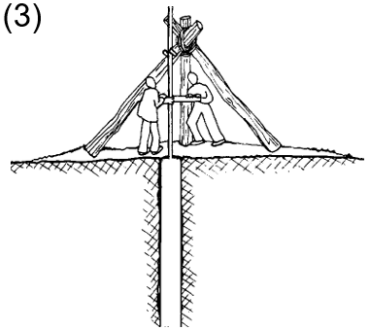
(2)

double the diameter, half the height



are the volumes the same?

(3)



a well is dug as a cylinder with a diameter of 3 ft

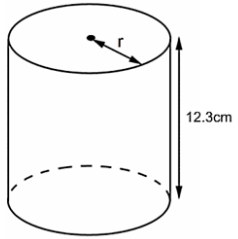
if the depth of the water is measured to be 150 ft, how many gallons of water are there in the well?

1 ft^3 = 7.5 gallons

(4)

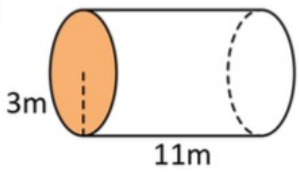
the volume of a cylinder is 1391.1cm^3
I forgot to write down the radius but do remember (since it was easy to remember) that the height was 12.3cm

what was the radius?

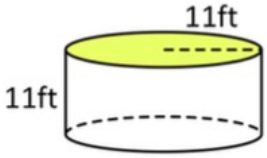


Q1 Calculate the surface of each of the following cylinders:
[i] in terms of π, **[ii]** to 1dp.

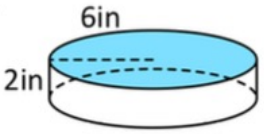
[a]



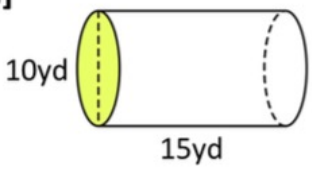
[b]



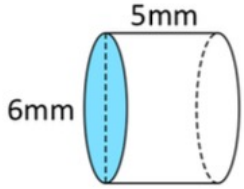
[c]



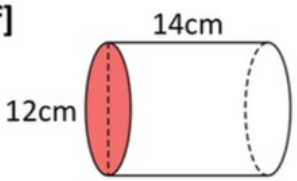
[d]



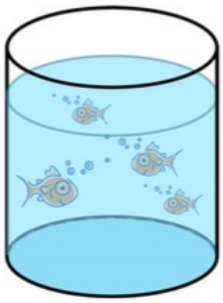
[e]



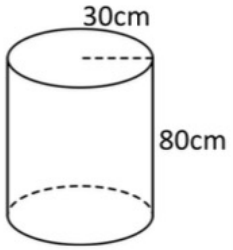
[f]



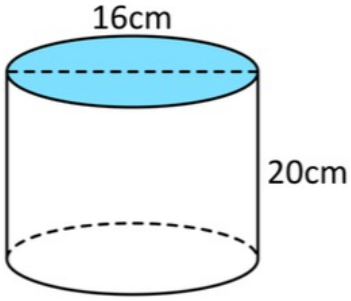
Q2
Sam has a cylindrical fish tank with an open top. The tank has height 30cm and radius 20cm.
What is the total surface area of the tank?



Q3
A company manufactures and paints cylindrical chimneys with radius 12cm and height 25cm.
The company has enough paint to cover a $12m^2$ area.
How many chimneys can the company paint?



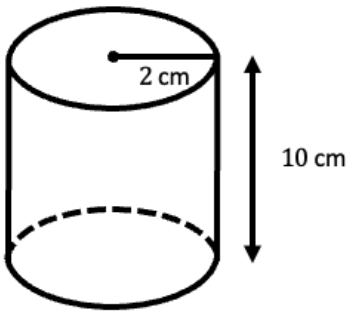
Q4
Calculate the curved surface area of the cylinder below. Give your answer to two decimal places.



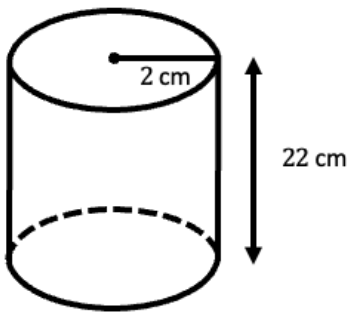
Q5
A cylindrical drinks bottle has a paper label wrapped around the outside. The label has a height of 7cm and the bottle has a radius of 3cm. The label also has a 1.5cm overlap so that it can be stuck together and held into place. Calculate the area of the label.

Calculate the total surface area. Give your answers in terms of π and to 1 decimal place.

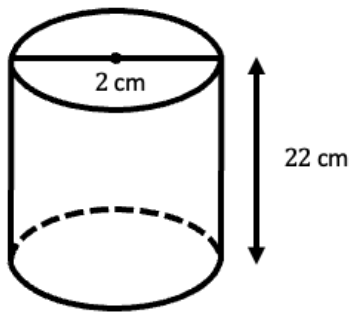
Question 1



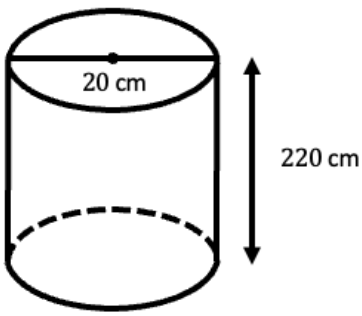
Question 2



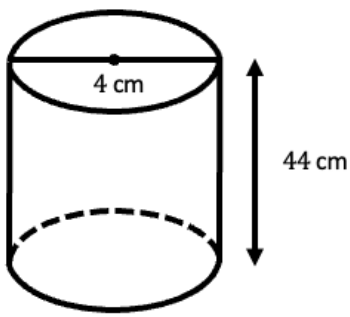
Question 3



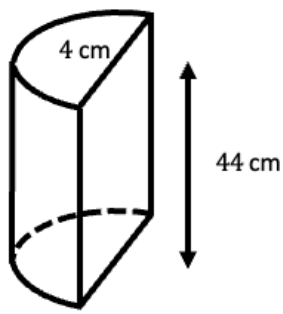
Question 4



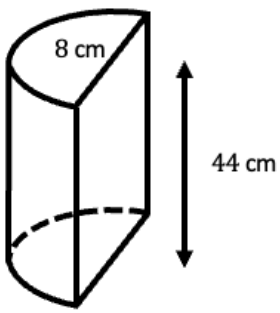
Question 5



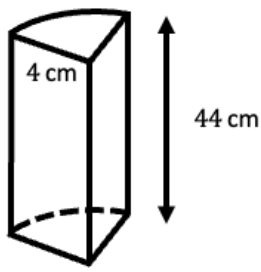
Question 6



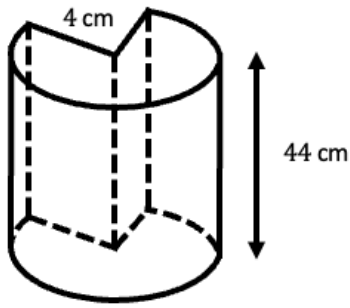
Question 7



Question 8



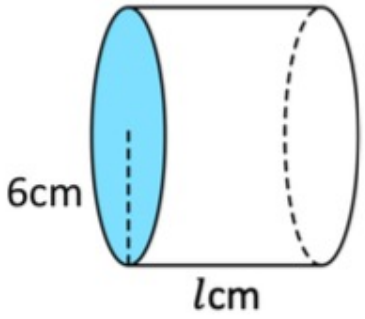
Question 9



Fluency Practice

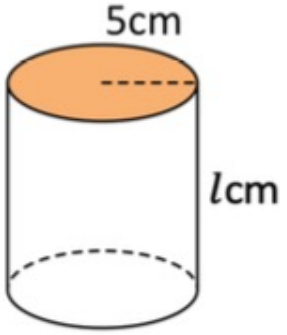
Ex3

The following cylinder has surface area $192\pi \text{cm}^2$. Find its length, $l$cm.



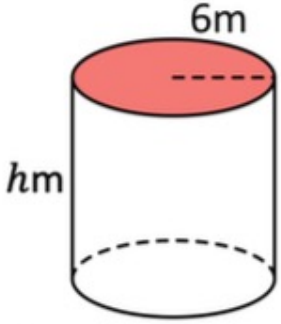
Q1

The following cylinder has surface area $160\pi \text{cm}^2$. Find its height, $h$cm.



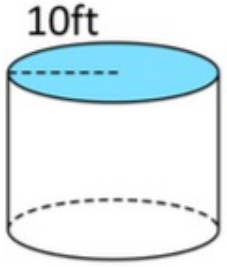
Q2 Find the height of each cylinder.

[a]



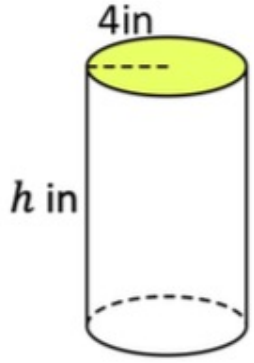
Surface area $= 240\pi \text{m}^2$

[b]



Surface area $= 380\pi \text{ft}^2$

[c]

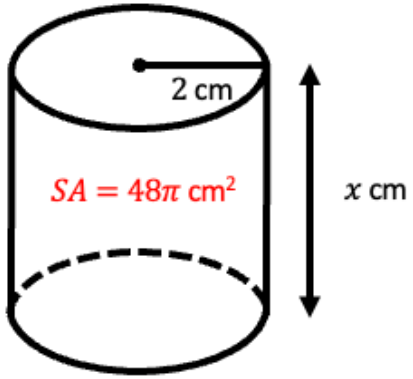


Surface area $= 176\pi \text{in}^2$

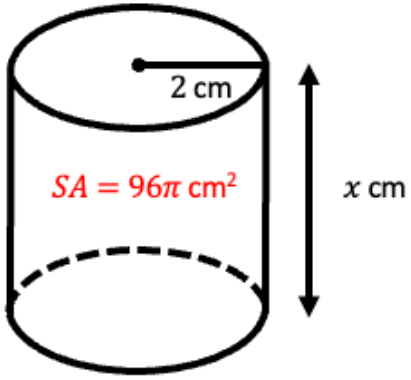
Intelligent Practice

Find x given the total surface area. Give your answers to 1 decimal place if required.

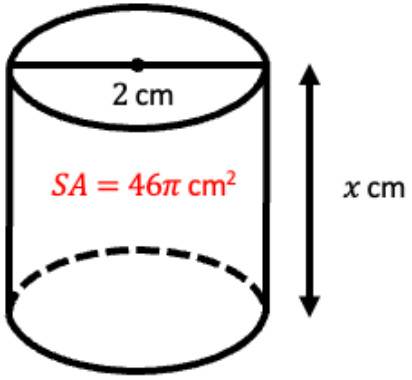
Question 1



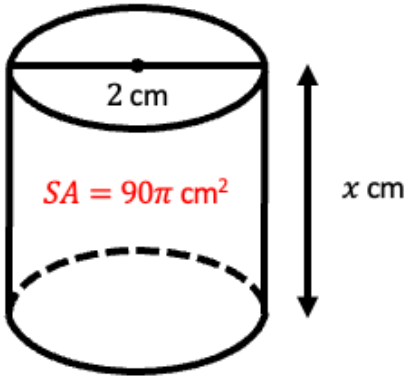
Question 2



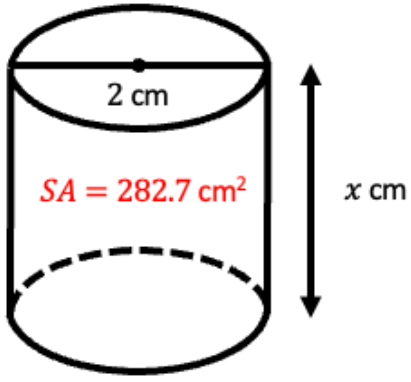
Question 3



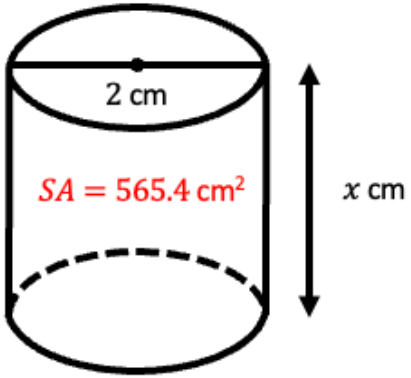
Question 4



Question 5

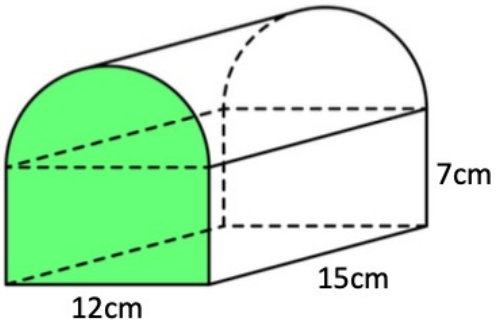


Question 6



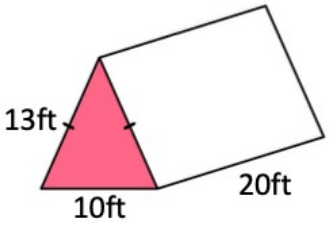
Q5

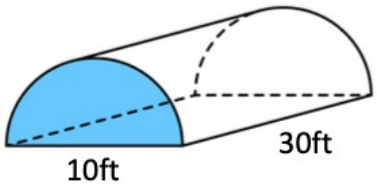
The cross-section of the following prism is made by joining a semicircle and rectangle.
Calculate the surface area of the prism giving your answer to three significant figures.



Q6

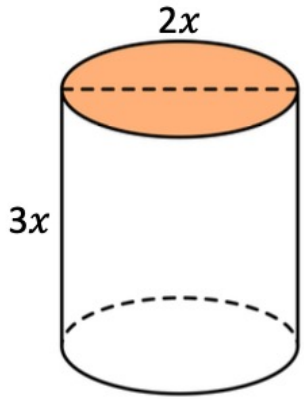
Shown is a triangular prism and a semi-cylinder. Which solid has the largest surface area?





Q7

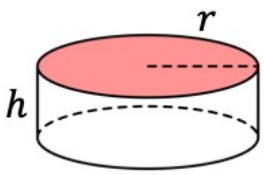
The following cylinder has surface area $392\pi \text{cm}^2$.

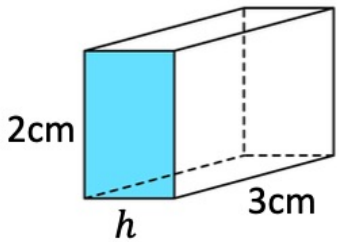


Find x.

Q8

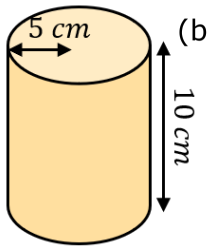
The cylinder and the cuboid have the same surface area.
Express h in terms of r.



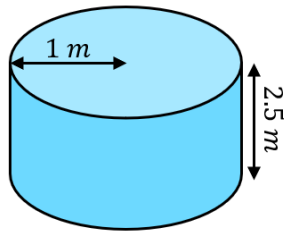


Find the total surface areas of these cylinders.

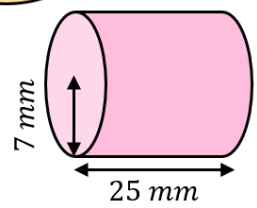
(a)



(b)

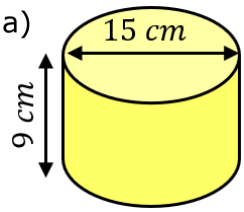


(c)

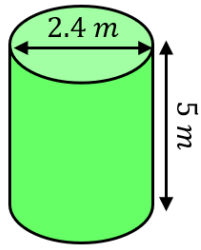


Find the total surface areas of these cylinders.

(a)

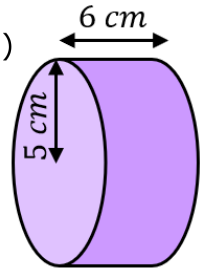


(b)

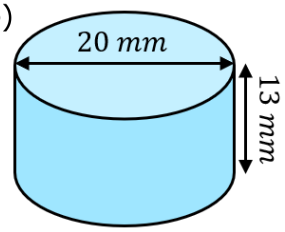


Find the total surface areas of these cylinders, leaving your answer in terms of π.

(a)

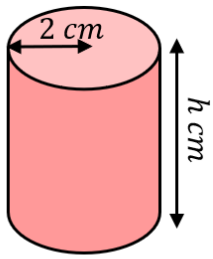


(b)



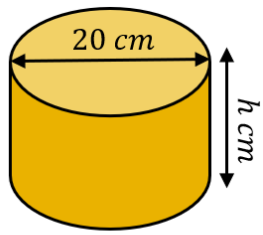
Find the missing lengths in these cylinders.

(a)



$Curved\ surface\ area = 54\pi\ cm^2$

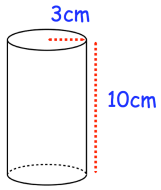
(b)



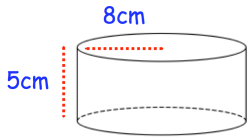
$Total\ surface\ area = 345\pi\ cm^2$

Question 1: Work out the surface area of each of the following cylinders.
Give each answer to 2 decimal places.

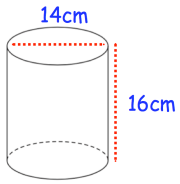
(a)



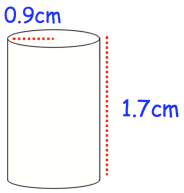
(b)



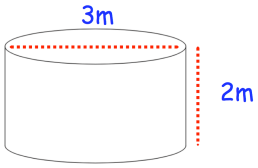
(c)



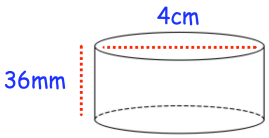
(d)



(e)

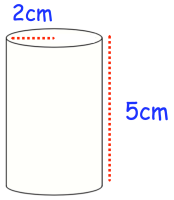


(f)

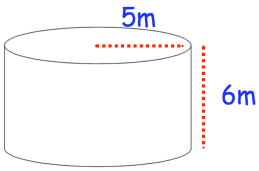


Question 2: Work out the surface area of each of the following cylinders.
Leave your answers in terms of **π**

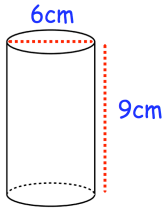
(a)



(b)

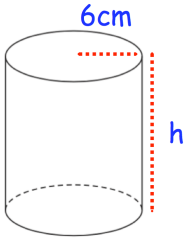


(c)



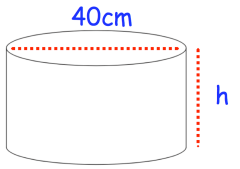
Question 3: Work out the height of each cylinder below

(a)



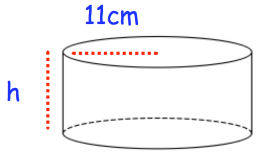
Surface area = 980.18cm²

(b)



Surface area = 4715cm²

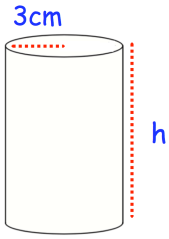
(c)



Surface area = 850cm²

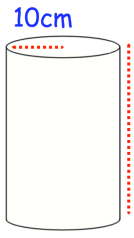
Question 4: Work out the height of each cylinder below

(a)



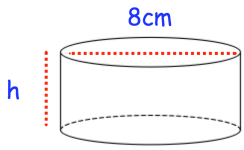
Surface area = 84π cm²

(b)



Surface area = 900π cm²

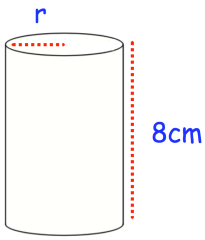
(c)



Surface area = 56π cm²

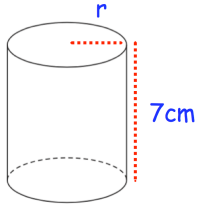
Question 5: Work out the radius of each cylinder below

(a)



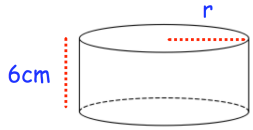
Surface area = 18π cm²

(b)



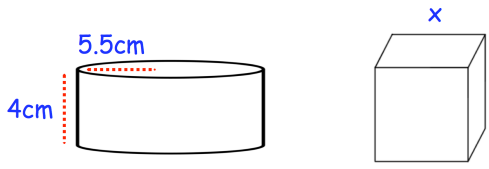
Surface area = 36π cm²

(c)

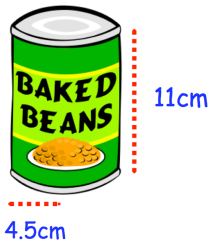


Surface area = 1040π cm²

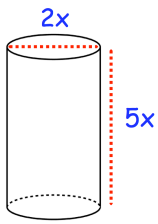
Question 1: The cylinder and cube below have the same surface area.
Find the side length of the cube, x.



Question 2: A can of baked beans has a paper label wrapped around the outside.
The can has a height of 11cm and radius of 4.5cm.
The label covers the entire height of the can.
The label has a 1cm overlap vertically so that it can be stuck together
Calculate the area of the label.

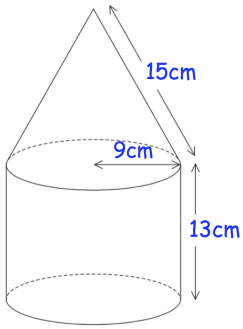


Question 3: The cylinder below has a surface area of 972π cm^2.
Find x.

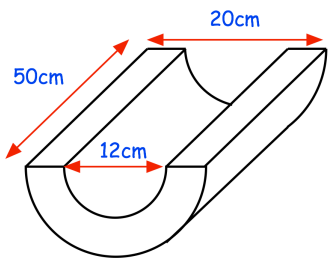


Question 4: A cylinder has a height of 18cm and volume of 1715cm^3.
Work out the surface area of the cylinder.

Question 5: A cylinder and a cone are joined together to make a solid.
The cylinder has a radius of 9cm and height of 13cm.
The cone has a slant height of 15cm.
Find the total surface area of the solid.

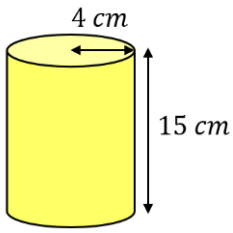


Question 6: Work out the surface area of the shape below.

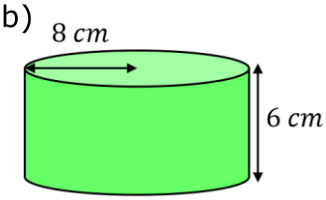


Find the volume and total surface area of each of these cylinders.

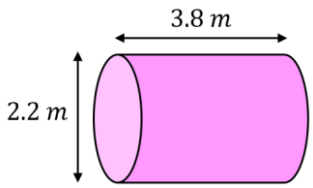
(a)



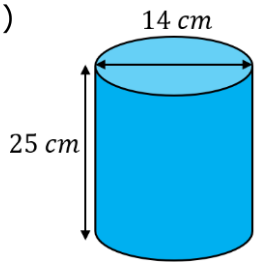
(b)



(c)



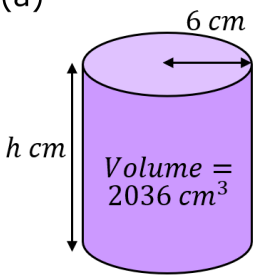
(d)



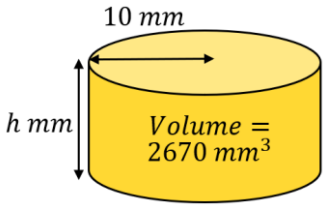
(a) Find the volume and surface area of a soup tin with a radius of 4.5 cm and a height of 12.5 cm.
(b) Find the volume and **curved** surface area of a glue stick with a diameter of 26 mm and a height of 70 mm.

Find the missing lengths.

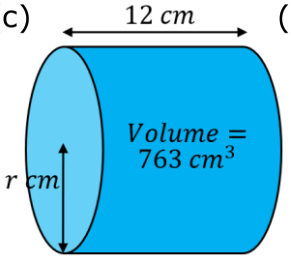
(a)



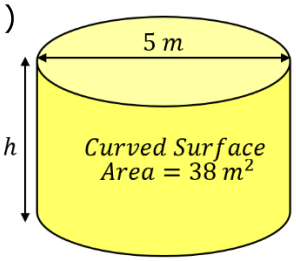
(b)



(c)



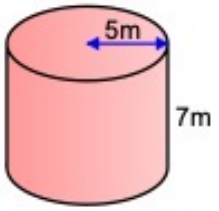
(d)



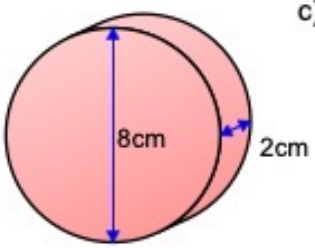
A cylinder has a height of $16\ cm$ and a curved surface area of $452\ cm^2$. Find its volume.

1. Work out the volume of each of these cylinders. Give your answers both in terms of π, and correct to 3 significant figures.

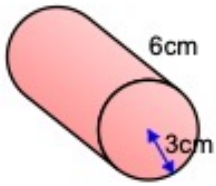
a)



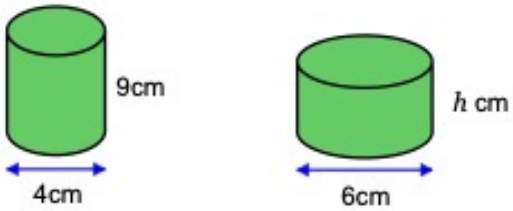
b)



c)

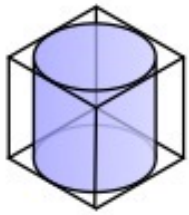


2. These two cylinders have the same volume. Work out the value of h.



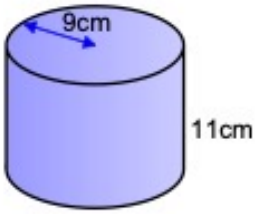
3. A cylinder fits snugly inside a cube, such that the cylinder touches each face of the cube.

Work out the percentage of the volume of the cube that is not taken up by the cylinder.

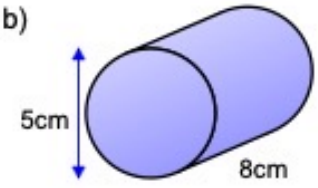


4. Work out the surface area of each of these cylinders, correct to 3 significant figures:

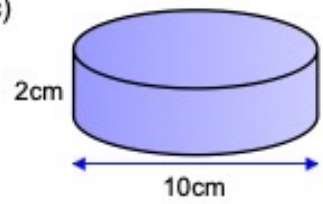
a)



b)



c)

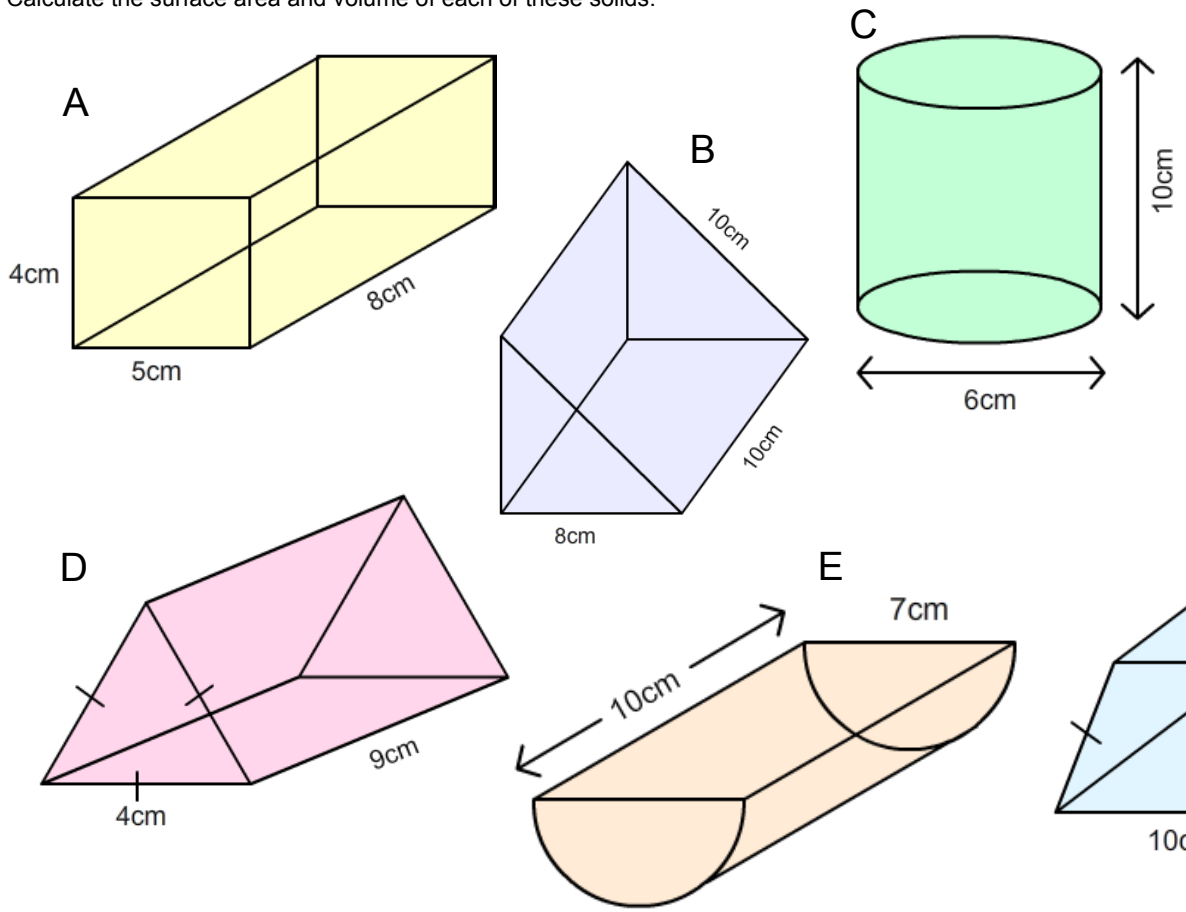


5. A cylindrical pipe has radius 5cm. The pipe is completely full of water that is moving along the pipe at a speed of 0.5m/s.

Work out the flow rate of the water in cm^3/s.

volume & surface area

Calculate the surface area and volume of each of these solids.

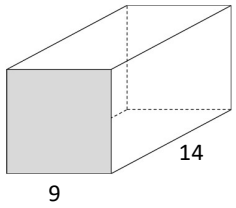


Shape	Volume (cm^3)	Surface Area (cm^2)
A		
B		
C		
D		
E		
F		

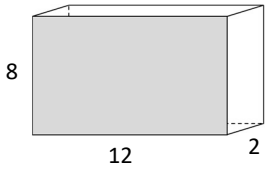
Fluency Practice

Volume & Surface Area of Cylinders & Prisms Find the volume & surface area of these solid shapes. Units are centimetres.

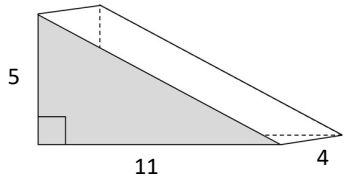
1) A square-based prism



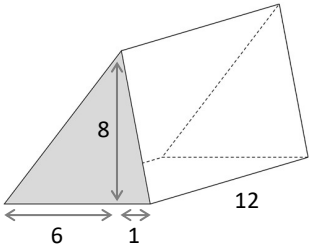
2)



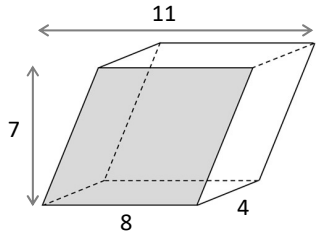
3)



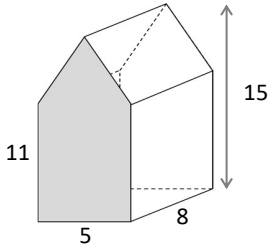
4)



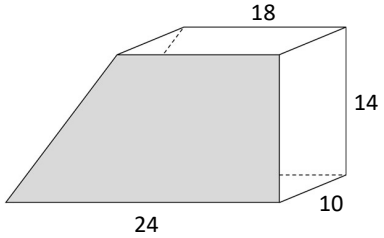
5) A right parallelepiped



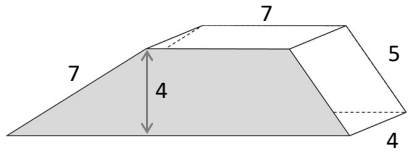
6)



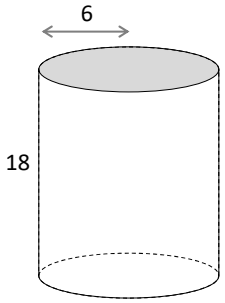
7) A right-trapezium-based prism



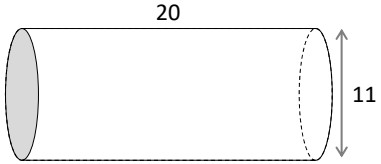
8) A trapezium-based prism



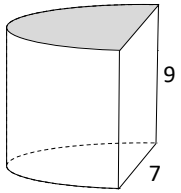
9)



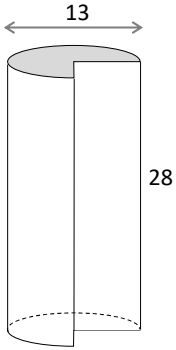
10)



11) A half cylinder

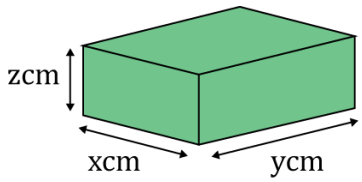


12) A three-quarter cylinder

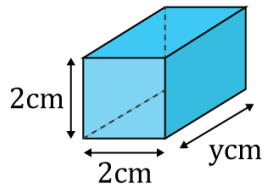


Each prism has the same volume.

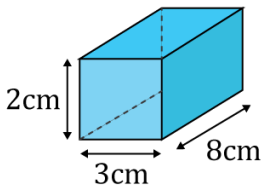
Prism A



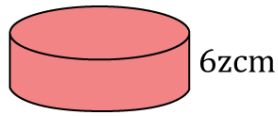
Prism B



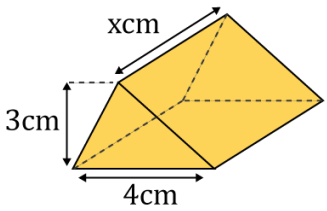
Prism C



Prism D



Prism E



5 Area and Volume Unit Conversions

Convert:

1) $90000\ cm^2\ to\ m^2$

2) $900\ cm^2\ to\ m^2$

3) $90000\ mm^2\ to\ m^2$

4) $90\ m^2\ to\ cm^2$

5) $9\ m^2\ to\ cm^2$

6) $9\ cm^2 to\ m^2$

7) $0.9\ m^2 to\ cm^2$

8) $0.04\ m^2 to\ cm^2$

9) $0.04\ m^2 to\ mm^2$

10) $36\ km^2 to\ m^2$

11) $3.6\ km^2 to\ m^2$

12) $0.1 km^2 to\ m^2$

13) $0.1\ m^2 to\ km^2$

Question 1: Shown is a rectangle with length 3m and width 2m

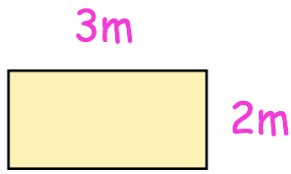
(a) Find the area of the rectangle in m^2

(b) What is the length of the rectangle in cm?

(c) What is the width of the rectangle in cm?

(d) Find the area of the rectangle in cm^2

(e) Fill in the missing number using your answers to (a) and (d)



$1m^2 = \square\ cm^2$

Question 2: Convert the following areas into cm^2

(a) $5m^2$ (b) $9m^2$ (c) $25m^2$ (d) $104m^2$

(e) $0.7m^2$ (f) $4.3m^2$ (g) $0.09m^2$ (h) $60.2m^2$

Question 3: Convert the following areas into m^2

(a) $40{,}000cm^2$ (b) $70{,}000cm^2$ (c) $180{,}000cm^2$

(d) $600{,}000cm^2$ (e) $3{,}830{,}000cm^2$ (f) $2{,}500cm^2$

(g) $900cm^2$ (h) $4{,}421cm^2$ (i) $12cm^2$

Question 4: Shown is a rectangle with length 5cm and width 3cm

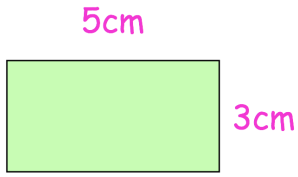
(a) Find the area of the rectangle in cm^2

(b) What is the length of the rectangle in mm?

(c) What is the width of the rectangle in mm?

(d) Find the area of the rectangle in mm^2

(e) Fill in the missing number using your answers to (a) and (d)



$1cm^2 = \square\ mm^2$

Question 5: Convert the following areas into mm^2

(a) $2cm^2$ (b) $8cm^2$ (c) $35cm^2$ (d) $730cm^2$

(e) $0.6cm^2$ (f) $1.4cm^2$ (g) $0.03cm^2$ (h) $0.057cm^2$

Question 6: Convert the following areas into cm^2

(a) $500mm^2$ (b) $400mm^2$ (c) $2{,}200mm^2$

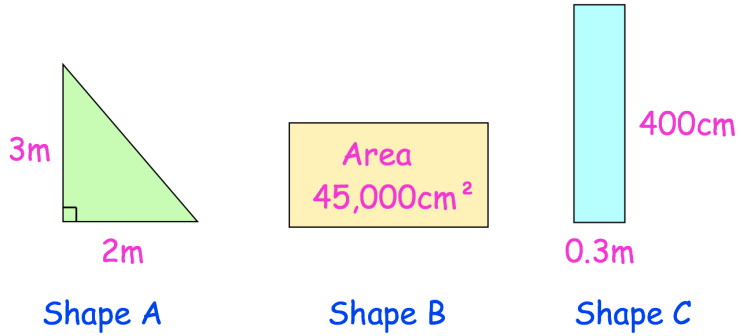
(d) $8{,}000mm^2$ (e) $91{,}000mm^2$ (f) $20mm^2$

(g) $17mm^2$ (h) $5mm^2$ (i) $0.3mm^2$

Question 7: Convert $6m^2$ to mm^2

Purposeful Practice

Question 1: Shown below are three shapes (not drawn accurately).



List the shapes in order of area, from smallest to greatest.

Question 2: Tommy has been asked to changed $800cm^2$ into m^2
He says:

"since there are 100 centimetres in 1 metres, the answer is $8m^2$"

Explain why Tommy is incorrect.

Question 3: Rebecca is tiling her kitchen floor.
The floor is a rectangle, measuring 8m by 6m.
Each tile is a square measuring 20cm by 20cm.
The tiles are sold in boxes of 10 and each box costs £8.50

Work out the total cost of the tiles needed for the kitchen floor.

Purposeful Practice

Calculate the following, giving **all** your answers in standard form.

1) a) Convert $0.4\ \text{mm}^2$ into km^2.
   b) Convert $8000\ \text{m}^2$ into km^2.
   c) How many tiles of area $0.4\ \text{mm}^2$ would it take to fill an area of $8000\ \text{m}^2$?

2) a) Calculate how many square centimetres there are in $2\ \text{km}^2$
   b) Calculate many square centimetres there are in $90\ 000\ \text{m}^2$.
   c) A farmer has farms measuring $2\ \text{km}^2$ and $90\ 000\ \text{m}^2$. Find the total area of her land in cm^2.

3) a) Convert $3\times10^{12}\ \text{mm}^2$ into square metres.
   b) Convert $4\times10^{-2}\ \text{km}^2$ into square metres.

   A small island has an area of $3\times10^{12}\ \text{mm}^2$. Each year, erosion reduces its area by $4\times10^{-2}\ \text{km}^2$.
   c) What will the area of the island be one year from now in square metres?
   d) How many years will it take for the island disappear entirely?

4) The Moon has a surface area of $1.44\times10^{7}\ \text{km}^2$. The sole of my shoe has an area of roughly $2.4\times10^{4}\ \text{mm}^2$.
   By converting both areas to m^2, approximate how many steps it would take to walk on the Moon's entire surface.

Convert:

1) $2\ cm^3\ to\ mm^3$

2) $2\ mm^3\ to\ cm^3$

3) $2\ m^3\ to\ cm^3$

4) $2\ km^3\ to\ m^3$

5) $0.002\ km^3\ to\ m^3$

6) $0.00002\ cm^3 to\ mm^3$

7) $0.4\ m^3 to\ cm^3$

8) $0.04\ m^3 to\ cm^3$

9) $0.04\ m^3 to\ mm^3$

10) $0.0016\ km^3 to\ m^3$

11) $0.00016\ km^3 to\ m^3$

12) $0.1 km^3 to\ m^3$

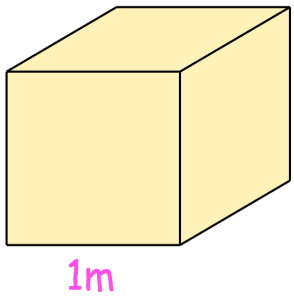
13) $0.1\ m^3 to\ km^3$

Fluency Practice

1) Convert 1900 litres to m ^{3}
2) Convert 4000 litres to m ^{3}
3) Convert 85.4 litres to cm ^{3}
4) Convert 3100 litres to m ^{3}
5) Convert 3900 litres to m ^{3}
6) Convert 3400 litres to m ^{3}
7) Convert 9000 litres to m ^{3}
8) Convert 9.3 litres to cm ^{3}
9) Convert 16.8 litres to cm ^{3}
10) Convert 3500 litres to m ^{3}

1) Convert 18300 cm ^{3} to litres
2) Convert 987000 cm ^{3} to litres
3) Convert 71500 cm ^{3} to litres
4) Convert 9.3 m ^{3} to litres
5) Convert 9.7 m ^{3} to litres
6) Convert 7.9 m ^{3} to litres
7) Convert 697000 cm ^{3} to litres
8) Convert 7.5 m ^{3} to litres
9) Convert 478000 cm ^{3} to litres
10) Convert 4.8 m ^{3} to litres

Question 1: Shown is a cube with side length 1m



(a) Find the volume of the cube in m^3

(b) What is the side length of the cube in cm?

(c) Find the volume of the cube in cm^3

(d) Fill in the missing number using your answers to (a) and (c)

$1m^3 = \square\ cm^3$

Question 2: Convert the following volumes into cm^3

(a) $3m^3$ (b) $11m^3$ (c) $80m^3$ (d) $205m^3$

(e) $0.5m^3$ (f) $0.17m^3$ (g) $0.006m^3$ (h) $4{,}000m^3$

Question 3: Convert the following volumes into m^3

(a) $7{,}000{,}000cm^3$ (b) $33{,}000{,}000cm^3$ (c) $190{,}000{,}000cm^3$

(d) $200{,}000cm^3$ (e) $45{,}000cm^3$ (f) $1{,}000{,}000{,}000cm^3$

Question 4: Shown is a cube with side length 1cm

(a) Find the volume of the cube in cm^3

(b) What is the side length of the cube in mm?

(c) Find the volume of the cube in mm^3

(d) Fill in the missing number using your answers to (a) and (c)

$1cm^3 = \square\ mm^3$

Question 5: Convert the following volumes into mm^3

(a) $6cm^3$ (b) $75cm^3$ (c) $300cm^3$ (d) $0.9cm^3$

(e) $0.01cm^3$ (f) $0.008cm^3$ (g) $27.52cm^3$

Question 6: Convert the following volumes into cm^3

(a) $4{,}000mm^3$ (b) $88{,}000mm^3$ (c) $500{,}000mm^3$ (d) $300mm^3$

(e) $2mm^3$ (f) $100.5mm^3$ (g) $60{,}000{,}000mm^3$

Question 7: Convert $2m^3$ to mm^3

Question 8: Given 1 litre = $1000cm^3$
Convert each of the following into cm^3

(a) 2 litres (b) 9 litres (c) 30 litres (d) 18 litres

(e) 0.4 litres (f) 500ml (g) 7,500 litres (h) 330ml

(i) 15ml (j) 7.5ml (k) 1ml

Question 9: Convert each of the following into litres

(a) $5{,}000cm^3$ (b) $2{,}400cm^3$ (c) $20{,}000cm^3$ (d) $400cm^3$

Purposeful Practice

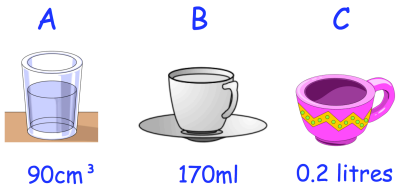
Question 1: Tommy has been asked to changed $2m^3$ into cm^3
He says:

"since there are 100 centimetres in 1 metres, the answer is $200m^3$"

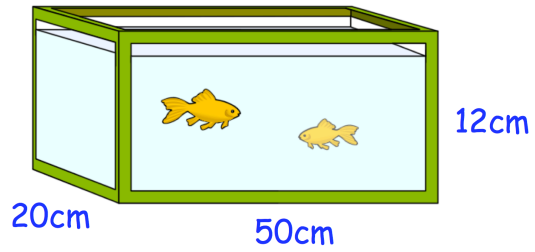
Explain why Tommy is incorrect.

Question 2: Shown below are three containers of water.
The amount of water in each is shown.

List the containers in order, from greatest to least.



Question 3: Shown below is a fish tank.



The fish tank is emptied and then filled with clean water.
The water is poured in at a rate of 25ml every second.
How long will it take to fill the fish tank?

Question 4: A cube has a volume of $0.008m^3$
Work out the surface area of the cube.
Give your answer in cm^2

Convert the following units of area.

(a) 5 cm^2 into mm^2

(b) 8 cm^2 into mm^2

(c) 6.5 cm^2 into mm^2

(d) 200 mm^2 into cm^2

(e) 1300 mm^2 into cm^2

(f) 750 mm^2 into cm^2

Convert the following units of area.

(a) 7 m^2 into cm^2

(b) 3 m^2 into cm^2

(c) 0.9 m^2 into cm^2

(d) 30000 cm^2 into m^2

(e) 67000 cm^2 into m^2

(f) 8000 cm^2 into m^2

Convert the following units of volume.

(a) 6 cm^3 into mm^3

(b) 2.5 cm^3 into mm^3

(c) 41 cm^3 into mm^3

(d) 800 mm^3 into cm^3

(e) 1200 mm^3 into cm^3

(f) 90 mm^3 into cm^3

Convert the following units of volume.

(a) 6 m^3 into cm^3

(b) 2.5 m^3 into cm^3

(c) 41 m^3 into cm^3

(d) 8000000 cm^3 into m^3

(e) 3000000 cm^3 into m^3

(f) 900000 cm^3 into m^3

Convert the following units of capacity.

(a) 5000 cm^3 in ml

(b) 5000 cm^3 in litres

(c) 2500 cm^3 in litres

(d) 250 cm^3 in litres

(e) 25 cm^3 in litres

Fluency Practice

A1 Convert 15 metres into cm	**A2** Convert 23 cm into mm	**A3** Convert 29 metres into km	**A4** Convert 71 mm into metres
B1 Convert 2 m^2 into cm^2	**B2** Convert 54 cm^2 into mm^2	**B3** Convert 900 cm^2 into m^2	**B4** Convert 8 km^2 into m^2
C1 Convert 15 cm^3 into mm^3	**C2** Convert 12 m^3 into cm^3	**C3** Convert 4 km^3 into m^3	**C4** Convert 40 mm^3 into cm^3
D1 Convert 18 mm^2 into cm^2	**D2** Convert 6 km into cm	**D3** Convert 250 cm^3 into m^3	**D4** Convert 14 m^2 into mm^2
E1 Convert 380 m^2 into km^2	**E2** Convert 4.5 cm^3 into mm^3	**E3** Convert 940 mm into km	**E4** Convert 3 km^2 into cm^2

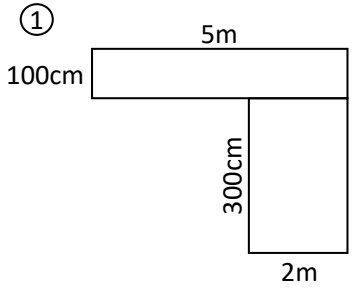
Purposeful Practice

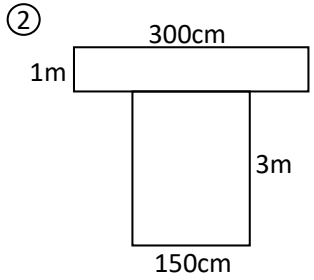
Converting Units of Area and Volume		
(a)	**(b)**	**(c)**
Which is the greater area? $5000\ mm^2$ or $5\ cm^2$	A rectangle measures $6\ cm$ by $5\ cm$. Find the area of the rectangle: (i) in cm^2 (ii) in mm^2	Which is the greater volume? $0.08\ m^3$ or $8000\ cm^3$
(d)	**(e)**	**(f)**
A fish tank has dimensions $80\ cm$ by $60\ cm$ by $35\ cm$. It is filled with water. How many litres of water does it contain?	A cube has side length $6\ cm$. Find the volume of the cube: (i) in cm^3 (ii) in m^3	A kitchen floor has an area of $9\ m^2$. Charles wants to varnish the floor. It costs $£2.45$ for a tin of varnish which covers $1500\ cm^2$ of floor. How much will it cost to varnish the floor?
(g)	**(h)**	**(i)**
Coco has $0.005\ m^3$ of orange juice. She wants to fill as many glasses as possible with juice. Each glass holds $210\ cm^3$. How many glasses can Coco completely fill?	A standard bin holds 240 litres of rubbish. A refuse lorry can hold $26\ m^3$ of waste. How many full bins could be emptied into the lorry before it is full?	Which has the greatest volume? A cuboid with a capacity of 0.6 litres, a prism with a cross section of $5000\ mm^2$ and length of $6\ cm$, or a cube with side length $0.08\ m$.

Purposeful Practice

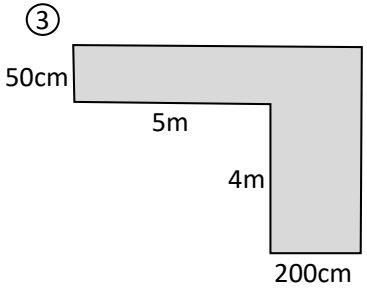
Converting Areas & Volumes

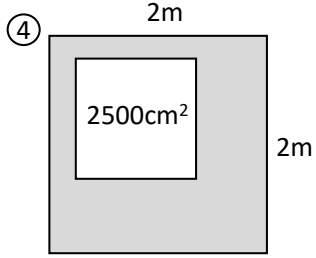
Find the perimeter and area of these shapes **in cm**.

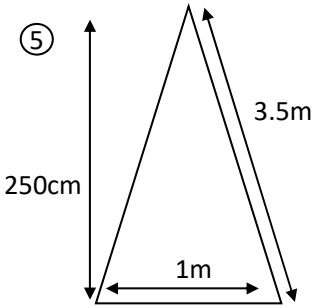
① 

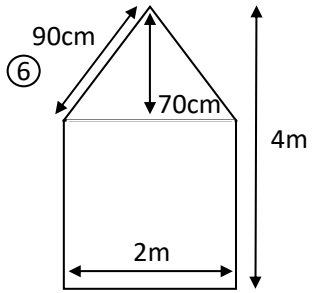
② 

Find the area of these shapes in both cm^2 and m^2

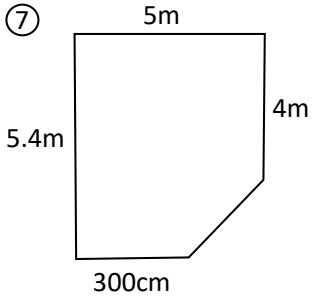
③ 

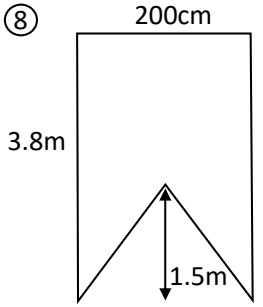
④ 

⑤ 

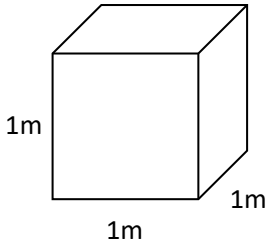
⑥ 

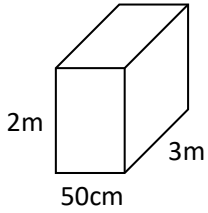
Find the area of each shape in both cm^2 and m^2.

⑦ 

⑧ 

What is the volume of these objects in cm^3?

⑨ 

10 

11

John wants to carpet 2 rectangular rooms. One room measures 1.7m by 3m. The second room is 680cm by 4 ½ m. How many square meters of carpet will he need?

1 square meter of carpet costs £5.
How much will he need to spend?

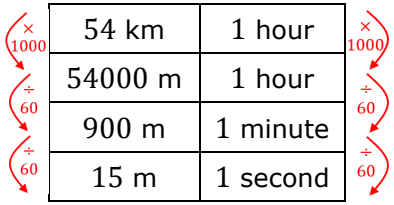
6 Compound Measures

Fluency Practice

Converting Metric Units of Speed

(a)

Convert 54 km/h to m/s



54 km	1 hour
54000 m	1 hour
900 m	1 minute
15 m	1 second

(b)

Convert 90 km/h to m/s

90 km	1 hour
90000 m	1 hour
	1 minute
	1 second

(c)

Convert 45 km/h to m/s

45 km	1 hour
	1 hour
	1 minute
	1 second

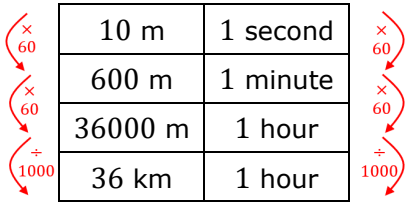
(d)

Convert 126 km/h to m/s

126 km	1 hour

(e)

Convert 10 m/s to km/h



10 m	1 second
600 m	1 minute
36000 m	1 hour
36 km	1 hour

(f)

Convert 2.5 m/s to km/h

2.5 m	1 second
150 m	1 minute
	1 hour
	1 hour

(g)

Convert 30 m/s to km/h

30 m	1 second
	1 minute
	1 hour
	1 hour

(h)

Convert 7.5 m/s to km/h

7.5 m	1 second

(i)

A car is travelling at 14 m/s. The speed limit is 50 km/h. Is the car breaking the speed limit? You must show your working.

(j)

A lorry travels at x km/h. Find an expression for the speed of the motorbike in metres per second.

Convert the following units of distance:

(a) 700 cm to m (b) 850 cm to m

(c) 925 cm to m (d) 75 cm to m

(e) 3000 m to km (f) 4700 m to km

(g) 6550 m to km (h) 400 m to km

(i) 6 km to m (j) 6.5 km to m

(k) 7.25km to m (l) 0.6 km to m

Convert the following units of time:

(a) 120 minutes into hours

(b) 90 minutes into hours

(c) 15 minutes into hours

(d) 225 minutes into hours

(e) 5 minutes into seconds

(f) 7 minutes into seconds

(g) 2.5 minutes into seconds

Calculate the speed in the units given for each distance and time shown:

	Distance	Time	Units
(a)	100 km	2 hours	km/h
(b)	175 km	5 hours	km/h
(c)	45 m	9 seconds	m/s
(d)	155 m	10 seconds	m/s

Calculate the speed in the units given for each distance and time shown:

(a)	200 km	120 minutes	km/h
(b)	75 km	90 minutes	km/h
(c)	500 cm	20 seconds	m/s
(d)	6 m	1 minute	m/s
(e)	8400 m	150 minutes	km/h
(f)	480 cm	2 minutes	m/s

speed - handling time intervals and conversions

Work out the missing values in each row.

	Minutes	Hours & Minutes	Hours (decimal)	Hours (mixed number)	Hours (improper fraction)	Start Time	End Time
A	80	1h 20m	$1.\dot{3}$	$1\frac{1}{3}$	$\frac{4}{3}$	11:45am	1:05pm
B	135					2:20pm	
C		1h 12m					10:35am
D			2.4			8:40pm	
E				$1\frac{5}{12}$			3:15pm
F					$\frac{23}{10}$	10:55am	
G						8:25am	11:13am
H			$1.1\dot{6}$			5:55pm	

speed - altering variables

1. Amy and John travel the same distance.
   Amy travels for a longer time.
   Who has the higher average speed?

2. Ivy and Olivia travel for the same time.
   Ivy travels further than Olivia.
   Who has the higher average speed?

3. Sam and Noah travel the same distance.
   Sam has a higher average speed.
   Who takes the most time?

4. **Average speed = Distance ÷ Time taken**
   If the time is under-estimated,
   is the speed an under- or over-estimate?

5. **Journey time = Distance ÷ Average Speed**
   If the average speed is under-estimated,
   is the time an under- or over-estimate?

6. If the distance travelled is doubled
   and the time taken is halved,
   What happens to the average speed?

7. If the distance travelled is doubled
   and the time taken is doubled,
   What happens to the average speed?

8. If the distance travelled is divided by 2
   and the time taken is multiplied by 3,
   What happens to the average speed?

matching activity - speed, distance & time

Match the missing value for each situation to the jumbled answers below.
Pay careful attention to the units.

A Kim cycles 17km in 85 minutes.

Average speed =

_____ km/h

B A train travels at a speed of 75km/h for 24 minutes.

Distance travelled =

_____ km

C A boat departs at 11:30am and travels 187km at a speed of 66km/h.

Arrival time =

_____

D A forklift truck is driven at 0.6m/s for 25 seconds.

Distance travelled =

_____ m

E A plane takes off at 1:10pm and flies 1276km at an average speed of 880km/h.

Arrival time =

_____

F An athlete runs 400m in 50 seconds.

Average speed =

_____ m/s

G A rambler walks 6 miles in 1 hour and 12 minutes.

Average speed =

_____ mph

H A coach travels 221 miles at an average speed of 52mph, arriving at its destination at 6:05pm.

Departure time =

_____

I A satellite travels at 20,000km/h.

Time to travel 100km =

_____ s

J Rebecca leaves at 1:30pm, drives for 70km and arrives at 2:45pm.

Average speed =

_____ km/h

K Ameera jogs 2.4km at an average speed of 2.5m/s.

Time spent jogging =

_____ minutes

L A van travels from 2:50pm to 5:10pm at an average speed of 54mph.

Distance travelled =

_____ miles

jumbled answers

18 | 30 | 2:37pm | 15 | 5 | 2:20pm | 126 | 12 | 56 | 8 | 1:50pm | 16

(a) A car travels at 40 km/h for 3 hours. How far has it travelled?

(b) A runner travels at 8 m/s for 12 seconds. How far have they run?

(c) The train from Manchester to London travels at 120 km/h for 2 hours 30 minutes. How far does the train travel?

(d) An insect crawls at a speed of 0.05 m/s for 2 minutes. How far has it travelled?

(a) A plane makes a journey of 2250 km at a speed of 750 km/h. How long does the journey take?

(b) An arrow travels at 70 m/s over a distance of 245 metres. How many seconds does it take?

(c) The bus from Preston to Leeds travels 105 km at an average speed of 70 km/h. How long does the journey take?

(a) A hiker sets off at 10.30 am and walks for 8.1 km at a speed of 3.6 km/h. At what time do they finish their walk?

(b) A delivery van travels at 64 km/h for 3 hours 18 minutes. How far has it travelled?

(c) Kristian rides his bike at a speed of 42 km/h from home to work, a distance of 28 km. How long, in minutes, does it take him?

(a) Aisha travels at 44 km/h for 45 minutes, then at 50 km/h for 24 minutes. How far does she travel in total?

(b) The bus sets off from school at 4 pm. It travels 12 km to Edenfield at a speed of 30 km/h. It then travels from Edenfield to Bacup, a distance of 15 km, at a speed of 50 km/h. What time does the bus arrive in Bacup?

(a) A man walking takes 2 hours to walk 10 miles. What was his speed?

(b) A policeman took 2½ hours to travel 100 miles. What speed was he travelling at?

(c) A girl ran 105 metres in 15 seconds. What was her speed?

(d) A cyclist took 1 hours 24 minutes to travel 28 km. What speed was the cyclist travelling at?

(a) What distance would a car travel after 4½ hours travelling at 60mph?

(b) Find the distance travelled by a train travelling at 140 km/h for 6 hours.

(c) If a person runs at 5 m/s, how long will it take that person to run 300 metres?

(d) A horse travels at 12 km/hour. How long will it take to travel 18km?

Convert:

(a) 60 km/h into m/s

(b) 75 km/h into m/s

(c) 126 km/h into m/s

(d) 18 m/s into km/h

(e) 50 m/s into km/h

(f) 42 m/s into km/h

(a) The speed limit on a road is 50 mph. A car travels 19 miles in 22 minutes. Is the car breaking the speed limit?

(b) Lee completes a journey in three stages. In stage 1, he drives at 30 km/h for 45 minutes. In stage 2, he drives at 50 km/h for 2 hours 48 minutes. Altogether, over all three stages, he drives 200 km in 4 hours. What is Lee's average speed in stage 3 of his journey?

(c) Given that 1 mile = 1.6 km, which is faster - 35 mph or 57 km/h?

(a) Billie walks from home to school and then to the shops. The distance from home to school is 6 km and from school to the shops is 2 km. Billie walks at a speed of 4 km/h for the first part of the journey, and the whole journey takes her 2 hours 45 minutes. Find Billie's speed as she walks from school to the shops.

	Home to School	School to Shops	Whole Journey
Speed	4 km/h		
Distance	6 km	2 km	
Time			2.75 hours

(b) Tim drove 63 km from Leeds to Manchester, then 56 km from Manchester to Liverpool. His average speed from Leeds to Manchester was 84 km/h. The time taken from Manchester to Liverpool was 75 minutes. Find the average speed for the whole journey from Leeds to Liverpool and the total time taken.

(c) Ishaq travels from Stockport to Preston at an average speed of 66 mph. Henry travels the same route at an average speed of 48 mph. Given that the journey takes Ishaq 72 minutes, how long does it take Henry to travel from Stockport to Preston? Give your answer in minutes.

(d) Zala travels for 50 miles at a speed of 40 mph, then another 50 miles at a speed of 50 mph. Work out Zala's average speed across her whole journey.

(e) Hassan sets off on his delivery route at 9 am. He travels 90 miles from home to Penrith at a speed of 60 mph. He then travels from Penrith to Lancaster in 45 minutes, at a speed of 68 mph. Finally, he travels from Lancaster to home, travelling 45 miles and arriving home at 12.05 pm. Calculate (i) Hassan's average speed across the whole journey to 1 decimal place and (ii) his speed when travelling from Lancaster to home.

Purposeful Practice

Harder Speed Calculations		
(a)	**(b)**	**(c)**
A tractor travels at 12 mph for 10 minutes and then at 20 mph for 15 minutes. Calculate the average speed of the tractor across the whole journey.	A train travels 320 km from Manchester to London in 2 hours 5 minutes. Initially, the train travels at 180 km/h for 50 minutes. It then travels at a constant speed s for the rest of the journey. Find s in km/h.	Riya walks from home to school in 24 minutes at a speed of 4 km/h. She then jogs back home and is 9 minutes quicker than when she walked. What is Riya's average speed jogging home?
(d)	**(e)**	**(f)**
Liverpool is 120 km from Leeds. A car sets off from Liverpool travelling at 80 km/h. A lorry sets off from Leeds travelling at 70 km/h. How far from Liverpool are the two vehicles when they pass each other?	Ayesha goes for the same run every morning. She normally runs at 7.5 km/h but finds that when she increases her speed to 8 km/h, she completes the run 2 minutes quicker. How far does Ayesha run?	Train A leaves the station at 9.24 am travelling at 126 km/h. Train B leaves the same station at 9.32 am, travelling along the same line at 140 km/h. At what time will train B catch up to train A?
(g)	**(h)**	**(i)**
Theo travels from home to work at a constant speed of 50 km/h. At the end of the day, he travels from work to home at a constant speed of 30 km/h. Calculate his average speed across both journeys.	A taxi travels at x km/h for 15 minutes, then at $3x$ km/h for 10 minutes and finally at $2x$ km/h for 5 minutes. Find the average speed of the taxi across the whole journey in terms of x.	Yusuf runs a 400 m race. He sets off at x m/s and runs at this speed for 50 seconds before increasing his speed by 25% to run for the remaining 30 seconds. Find the value of x.

Question 1: Convert the times from hours/minutes into hours, without a calculator.
e.g. 1 45 minutes = 0.75 hours
e.g. 2 1 hour 30 minutes = 1.5 hours

(a) 15 minutes (b) 30 minutes (c) 45 minutes
(d) 20 minutes (e) 40 minutes (f) 2 hours 30 minutes
(g) 1 hour 15 minutes (h) 3 hours 45 minutes (i) 2 hours 40 minutes
(j) 5 hours 30 minutes (k) 7 hours 20 minutes (l) 4 hours 15 minutes

Question 2: Convert the times from hours/minutes into hours.
You may use a calculator if needed.

(a) 18 minutes (b) 54 minutes (c) 1 hour 3 minutes
(d) 1 hour 36 minutes (e) 2 hours 48 minutes (f) 2 hours 33 minutes
(g) 8 hours 51 minutes (h) 3 hours 21 minutes (i) 27 minutes

Question 3: Convert the times from hours/minutes into hours.
Give each answer to 3 decimal places.

(a) 44 minutes (b) 8 minutes (c) 1 hour 50 minutes
(d) 2 hours 10 minutes (e) 4 hours 26 minutes (f) 3 hours 29 minutes
(g) 5 hours 2 minutes (h) 2 hours 55 minutes (i) 59 minutes

Question 4: Convert the times from hours into hours/minutes, without a calculator.

(a) 0.75 hours (b) 1.25 hours (c) 5.5 hours
(d) 1.3333... hours (e) 2.6666... hours (f) 10.75 hours
(g) 3.25 hours (h) 0.5 hours (i) 22.3333... hours

Question 5: Convert the times from hours into hours/minutes.
You may use a calculator if needed.

(a) 0.7 hours (b) 0.1 hours (c) 0.9 hours
(d) 1.3 hours (e) 3.6 hours (f) 6.7 hours
(g) 0.85 hours (h) 1.15 hours (i) 3.45 hours

Question 6: Convert the times from hours into hours/minutes.

(a) 0.93333... hours (b) 0.48333... hours (c) 1.06666... hours
(d) 2.73333... hours (e) 3.68333... hours (f) 2.18333... hours
(g) 8.01666... hours (h) 4.46666... hours (i) 1.76666... hours

Question 1: Calculate the average speeds for each of the following, without using a calculator.

(a) A car travels 60 miles in 2 hours
(b) A lorry travels 120 miles in 3 hours
(c) A cyclist travels 45 miles in 5 hours
(d) A jogger travels 30km in 4 hours
(e) A runner runs 100 metres in 10 seconds
(f) A car travels 195 miles in 3 hours
(g) A helicopter travels 425 miles in 5 hours
(h) A helicopter flies 840 miles in 7 hours
(i) A dog runs 216 metres in 12 seconds
(j) An airplane travels 984 miles in 6 hours
(k) A bird flies 19 miles in 2 hours
(l) A car travels 600km in 8 hours

Question 2: Calculate the average speeds for each of the following, without using a calculator.

(a) A car travels 20 miles in 30 minutes
(b) A lorry travels 32 miles in 30 minutes
(c) A bird flies 17 kilometres in 30 minutes
(d) A man jogs 2 kilometres in 15 minutes.
(e) A helicopter flies 18 miles in 15 minutes
(f) An F1 car travels 32 miles in 15 minutes.
(g) A dog runs 3 kilometres in 10 minutes
(h) A jet travels 23 miles in 6 minutes.
(i) A car travels 12 miles in 20 minutes
(j) A car travels 9 miles in 12 minutes
(k) A motorcycle travels 36 miles in 40 minutes
(l) A car travels 27 kilometres in 45 minutes.

Question 3: Calculate the average speeds for each of the following.

(a) A car travels 63 miles in 1 hour 30 minutes
(b) A man runs 15 miles in 2 hours 30 minutes
(c) A helicopter flies 238 miles in 3 hours 30 minutes
(d) A car travels 85.5 miles 2 hours 15 minutes
(e) An airplane flies 315 kilometres in 1 hour 45 minutes
(f) A lorry travels 351 miles in 6 hours 45 minutes
(g) A car drives 154 miles in 2 hours 20 minutes
(h) A helicopter flies 160 kilometres in 1 hour 40 minutes

Question 4: Calculate the average speeds for each of the following.

(a) A man jogs 6 miles in 1 hour 12 minutes
(b) A motorcycle drives 130 miles in 2 hours 36 minutes
(c) A helicopter flies 152 miles in 1 hour 54 minutes
(d) A plane travels 1272 kilometres in 5 hours 18 minutes
(e) A car travels 98 miles in 2 hours 27 minutes
(f) A rocket travels 750 miles in 3 minutes
(g) A car travels 6.4 miles in 7 minutes. Give your answer to 2 decimal places.
(h) A ship sails 105 miles in 4 hours 28 minutes. Give your answer to 2 decimal places.
(i) A plane travels 400 miles in 1 hour 55 minutes. Give your answer to 2 decimal places.
(j) A car drives 500 kilometres in 7 hours 13 minutes. Give your answer to 2 decimal places.

Question 5: Calculate how far each of the following travels.

(a) A car travels at a speed of 50mph for 3 hours.
(b) A plane flies at a speed of 230 kilometres per hour for 2 hours.
(c) A lorry drives for 4 hours at a speed of 45 miles per hour.
(d) A man runs at a speed of 8 metres per second for 15 seconds.
(e) A helicopter flies for 8 hours at a speed of 80 miles per hour.
(f) A dog runs at a speed of 15 m/s for 20 seconds.
(g) A car travels at a speed of 48 mph for 3 hours.
(h) A truck travels at a speed of 29 mph for 5 hours.

Question 6: Calculate the distance travelled by each of the following.

(a) A car drives at a speed of 60mph for 30 minutes.
(b) A taxi travels for 30 minutes at a speed of 28 mph.
(c) A car travels at a speed of 44mph for 15 minutes.
(d) A lorry drives at a speed of 51mph for 20 minutes.
(e) An airplane travels at a speed of 441mph for 20 minutes.
(f) A car drives at a speed of 48mph for 45 minutes.
(g) A helicopter flies at a speed of 72miles per hour for 10 minutes
(h) A bird flies for 40 minutes at a speed of 60 kilometres per hour.

Question 7: Work out the distance travelled by each of the following.

(a) A car drives at a speed of 40mph for 1 hour 30 minutes
(b) A bird flies at a speed of 32 kilometres per hour for 1 hour 30 minutes
(c) A lorry travels for 2 hours 30 minutes at a speed of 52 mph
(d) A F1 race car drives for 1 hour 15 minutes at a speed of 124 mph
(e) A helicopter flies at a speed of 104 mph for 1 hour 45 minutes
(f) A car drives at a speed of 58 mph for 3 hours 15 minutes
(g) A man runs at 6 mph for 1 hour 24 minutes
(h) A car drives for 2 hours 54 minutes at a speed of 50 mph
(i) A plane flies at a speed of 306 kilometres per hour for 3 hours 20 minutes
(j) A hot air balloon flies at a speed of 18 mph for 1 hour 40 minutes
(k) A bird flies for 4 hours 36 minutes at a speed of 40 kilometres per hour.
(l) A helicopter travels at 98mph for 5 hours 6 minutes.
(m) A car travels at 40 mph for 1 hour 7 minutes. Give your answer to 2 decimal places.
(n) A lorry drives at 65 mph for 2 hours 19 minutes. Give your answer to 2 decimal places.
(o) A car drives at 70 mph for 44 minutes. Give your answer to 2 decimal places.
(p) A car drives at 32 mph for 1 minute. Give your answer to 2 decimal places.

Question 8: Work out the distance travelled by each of the following.

(a) A runner runs at a speed of 8m/s for 2 minutes
(b) A jog runs at a speed of 4m/s for 10 minutes.
(c) A car drives at 60mph for 90 seconds.
(d) A lorry drives at 30 mph for 150 seconds.

Question 9: Work out how long each of the journeys take.

(a) A car drives 120 miles at a speed of 40 mph.
(b) A lorry drives 250 miles at a speed of 50 mph.
(c) A bird flies 330 kilometres at a speed of 55 kilometres per hour.
(d) An object travels 48 miles at speed of 16 mph.
(e) A man runs 240 metres at a speed of 6m/s
(f) A dog runs 168 metres at a speed of 12m/s
(g) A lorry travels 240 miles at a speed of 60mph.
(h) A helicopter travels 345 miles at a speed of 115 mph.
(i) A plane travels at a speed of 250 mph and covers a distance of 2250 miles.

Question 10: Calculate how long each journey lasts.
Give each answer in hours and minutes.

(a) A car travels 100 miles at a speed of 40mph.
(b) A lorry travels 90 miles at a speed of 60 mph.
(c) A bus drives at a speed of 48mph and covers a distance of 60 miles.
(d) A helicopter flies 105 kilometres at a speed of 140 km/h
(e) A bird covers a distance of 95 miles at a speed of 20 miles per hour.
(f) A car travels at 50 mph and covers a distance of 110 miles.
(g) A lorry drives a distance of 452.4 kilometres at a speed of 52 km/h.
(h) A bird flies 80 miles at a speed of 15 miles per hour
(i) A ship sails 208 miles a speed of 24 miles per hour
(j) A jet flies at a speed of 480km/h and covers a distance of 2088 kilometres
(k) A racing car drives 256 miles at a speed of 120 mph
(l) A helicopter flies 764 kilometres at a speed of 80 km/h

Question 11: Change the following speeds into metres per second.

(a) 360km/h	(b) 18km/h	(c) 36km/h	(d) 72km/h
(e) 10 km/h	(f) 40km/h	(g) 2 km/h	(h) 4.5km/h

Question 12: Change the following speeds into kilometres per hour.

(a) 45m/s	(b) 15m/s	(c) 20m/s	(d) 4m/s
(e) 1m/s	(f) 0.5m/s	(g) 0.2m/s	(h) 300m/s

Question 13: Change these speed into kilometres per hour

(a) 10mph	(b) 40mph	(c) 25 mph	(d) 200mph
(e) 8mph	(f) 2mph	(g) 10.5mph	(h) 24.6mph

Question 14: Change these speed into miles per hour

(a) 32km/h	(b) 48km/h	(c) 24km/h	(d) 800km/h
(e) 16km/h	(f) 0.64km/h	(g) 16000km/h	(h) 2400000km/h

Apply

1. A bus travels 222 miles in 6 hours.
   What was the average speed of the bus?

2. Thomas drives 130 miles at an average speed of 40 mph.
   How long does the journey take Thomas?

3. A jumbo jet flies at 484 mph for 4 hours 30 minutes.
   How far does the jet travel?

4. Greg and Kevin both travel between two towns that are 90 miles apart.
   Greg drives and it takes him 1 hour 30 minutes.
   Kevin cycles and it takes him 7 hours 30 minutes.
   Work out the difference between their average speeds?

5. Harry catches the train from Belfast to Dublin at 4pm.
   The average speed of the train is 70mph and the distance from Belfast to Dublin is 105 miles.
   What time does Harry arrive in Dublin?

6. The distance from Sunderland to Wigan is 150 miles.
   Mollie leaves Sunderland in her car at 07:50.
   Her average speed on the journey is 60mph.
   What time does she arrive in Wigan?

7. Jenny drives from Paris to Rochefort, a distance of 483 km
   Her average speed on the journey is 84 km/h.
   She leaves at 9:50pm.
   What time does she arrive in Rochefort?

8. Philip runs at an average speed of 4 m/s.
   How long will it take Philip to complete a 10 kilometre race?
   Give your answer in minutes and seconds.

9. A car travels for 4 hours at an average speed of 45 mph and then 6 hours at an average speed of 35 mph.
   (a) Work out the total distance travelled.
   (b) Work out the average speed for the entire journey.

10. David cycles at 20mph for 1¼ hours, then at 16mph for 2 hours and then 12mph for 45 minutes.
   (a) Work out the total distance travelled.
   (b) Work out the average speed for the entire journey.

11. Mr Jenkins catches the 11:45am bus from London to Glasgow.
The distance between the two cities is 407 miles.
The bus travels at an average speed of 55mph.
What time should he arrive in Glasgow?

12. Michael drives 143 miles from town A to town B in 2 hours 36 minutes.
He then drives from town B to town C at the same speed and it takes 21 minutes.

(a) Work out Michael's average speed from town A to town B.
(b) How far did Michael travel, in total, from town A to town C?

13. The distance from Junction 19 to Junction 20 on a motorway is 14 miles.
Bethany drove the distance in 15 minutes.
Max drove the distance at a speed of 52mph.
Who was faster?

14. The distance from Swindon to a village is 40 miles.
Vicky drives from the village to Swindon at 60 mph.
Charlie drives from the village to Swindon at 50mph.
Work out how much longer the journey takes Charlie.
Give your answer in minutes.

15. Miss Black completes a journey in 3 stages.
In stage 1, she drives at a speed of 40km/h for 45 minutes.
In stage 2, she drives at 60 km/h for 2 hours 9 minutes.
Altogether, over the 3 stages, Miss Black drives 171.6km in 3 hours 15 minutes
What is her average speed, in km/h, in stage 3?

16. The speed limit on a road is 40mph.
A scooter drives 9 miles in 13 minutes.
Is the scooter breaking the speed limit?

Fluency Practice

speed 1

(1) A Peregrine Falcon flies 14 miles horizontally in 15 minutes.
What is the average speed in miles per hour?

(2) When it is diving the Peregrine Falcon goes much faster, at 4.5 miles in 1 minute.
How fast is this in miles per hour?

(3) A Cheetah runs at an average speed of 72 mph for 20 minutes.
How far did it travel?

(4) A Mako Shark takes 10 minutes to travel 10 miles.
What is the average speed?

(5) A Sea Horse travels at 0.01 mph.
How long (in days and hours) will it take to travel a mile?

(6) A Sailfish, the fastest fish, travels 22.73 miles in 20 minutes.
How fast does it travel in mph?

(7) A snail works hard to travel 0.01 miles in 1 minute.
How fast does it go in mph?

(8) Sound travels at nearly 1200 mph.
How far does it travel in 5 minutes?

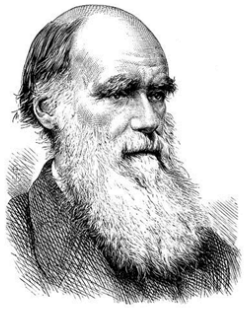
(9) A jet aircraft travels 36.5 miles every minute.
How fast is this in mph?

(10) A car runs at an average speed of 42 mph on a fairly built up motorway.
How far will it go at this speed in 1 hour 10 minutes?

Fluency Practice

speed 2

Shrewsbury in Shropshire



(1) How far is Stoke on Trent away if an escaped horse, travelling at an average speed of 13 mph takes 3 hours to get there?
(2) How far is it to London if it takes 3 hours at an average speed of 54 mph?
(3) A runner goes to Chester, 40 miles away, at an average speed of 8 mph. How long does it take them?
(4) How long does it take a cyclist riding at an average speed of 12mph to travel to Aberystwyth, 72 miles away?
(5) How long does it take to travel to Telford, 15 miles away at an average speed of 45 mph?
(6) How long does it take to get to Hereford, 54 miles away at an average speed of 36 mph?
(7) How long does it take to get to Wolverhampton, 32 miles away, travelling at an average speed of 48 miles per hour?
(8) What is the average speed of a truck that goes to Birmingham, 48 miles away, in 1hr 30 mins?
(9) What is the average speed of a lorry which travels to Gloucester, 80 miles away, in 2.5 hours?
(10) A very old car takes 3hours 18 mins to get to Liverpool, 66 miles away. What is the average speed of the car? How long would it take at this speed to get to Manchester, 74 miles away?

Fluency Practice

speed 3

speed = distance ÷ time

1.6 km/h = 1 mph
1 km/h = 0.62 mph
1 km/min = 37.2 mph
50 km/h = 31 mph

m/sec × 60 = m/min
m/min × 60 = m/hr
m/hr ÷ 1000 = km/hr
km/hr × 0.62 = mph

use a calculator to work out the speeds, in mph, of the world records for:

(1) Women's 2000m of 325.36 seconds.
(2) Men's 100m of 9.58 seconds.
(3) Men's 100 metres freestyle swimming competition of 46.91 seconds.
(4) Women's 100 metre Breaststroke competition of 64.45 seconds.
(5) Men's 20,000m walk of 4645.6 seconds.
(6) Women's 100 metres hurdles of 12.21 seconds.
(7) Men's 200 metres butterfly of 111.51 seconds.
(8) Men's 10,000 metres of 26 minutes and 17.53 seconds.
(9) Men's 50km walk of 3 hours, 34 mins and 14 seconds.
(10) Women's 20km walk of 1 hour, 2 mins and 36 seconds.

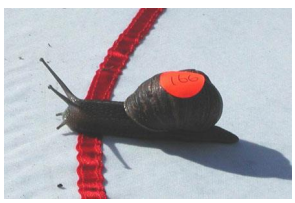
Use the formula $speed = \frac{distance}{time}$ to work out the speed of each object.

You may use a calculator

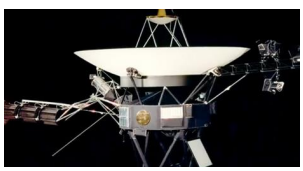
Felix Baumgartner recently set a number of records by jumping out of a balloon 39km above the ground. At one point he was travelling faster than the speed of sound. Altogether he took about 10 minutes to reach the ground.
What was his average speed, in km per minute?

Bloodhound SSC plans to set a new land-speed record. It is a rocket- and jet-powered vehicle which expects to cover the length of the 1 mile test track in around 3.5 seconds. **How fast is this, in miles per second?**

According to the 1998 Guinness Book of World Records, the winner of the 1995 world snail racing championships was a garden snail named Archie which completed the 33cm racecourse in exactly 2 minutes.
What was the speed of the snail, in cm per minute?



Voyager 1 is a space probe which is currently the fastest thing ever built. Launched in 1977, its primary function was to take pictures of the outer planets, but, having passed Jupiter in 1979, a total of 546 days after take-off, it is now heading out into deep space, and will leave the solar system in the near future. The distance it had to travel between the Earth and Jupiter was roughly 630 million kilometres.
What was its average speed, in kilometres per day?



The earth is hurtling through space in its orbit around the sun. Since we're all travelling with it at the same speed (relative to the sun) we don't notice the effect, but every year (around 365 days) we accompany our planet on a 940 million km journey around the sun.
What speed is this, in kilometres per day?

Can you put these 5 things in order, from slowest to fastest? Take care converting speeds with different units.

Fluency Practice

Density, Mass and Volume		
(a)	**(b)**	**(c)**
A metal cube with side length $3\ cm$ has a mass of $62.1\ g$. Find the density of the metal in g/cm^3.	A solid cylinder has a radius of $5\ cm$ and a height of $8\ cm$. The density of the cylinder is $1.25\ g/cm^3$. Calculate the mass of the cylinder in grams to 3 significant figures.	A spherical boulder has a radius of $1.2\ m$. If the boulder has a mass of $15000\ kg$, find its density in kg/m^3. Give your answer to 3 significant figures.
(d)	**(e)**	**(f)**
A prism has a mass of $2.6\ kg$ and a density of $1.3\ kg/m^3$. If the prism has a cross sectional area of $0.8\ m^2$, calculate the length of the prism.	A wooden cuboid has dimensions $8\ cm$ by $4\ cm$ by $x\ cm$. The cuboid has density $1.1\ g/cm^3$ and mass $228.8\ g$. Find the value of x.	A cube of side length $6\ cm$ and mass $561.6\ g$ has the same density as a cylinder of mass $1176\ g$. If the radius of the cylinder is $3\ cm$, find its height.
(g)	**(h)**	**(i)**
$120\ g$ of aluminium and $380\ g$ of copper are melted down and mixed together to form an alloy. Aluminium has density $2.7\ g/cm^3$ and copper has density $8.9\ g/cm^3$. Find the density of the alloy.	Melted chocolate has a density of $0.71\ g/cm^3$ and milk has a density of $1.03\ g/cm^3$. $50\ ml$ of melted chocolate is mixed with $200\ ml$ of warm milk to make a drink. Find the density of the drink in g/cm^3.	A toy is made of a metal hemisphere with a wooden cone on top. The hemisphere has a radius of $4\ cm$. The cone also has a radius $4\ cm$, a height of $10\ cm$ and density $1.5\ g/cm^3$. If the average density of the toy is $6.1\ g/cm^3$, find the density of the metal.

Question 1: Work out the density of each of the following.
State the units of each answer.

(a) A piece of wood has a mass of 7g and a volume of $10cm^3$

(b) A rod of aluminium has a mass of 575.4g and a volume of $210cm^3$

(c) A piece of nickel has a mass of 3.48kg and a volume of $400cm^3$

(d) An iron statue with volume of $0.05m^3$ and a mass of 394kg

(e) $2.1m^3$ of oil with a mass of 1775kg

Question 2: Work out the mass of each of the following.
State the units of each answer.

(a) A statue with a volume of $120cm^3$ made from ceramic which has a density of $2g/cm^3$.

(b) A rod with a volume of $50cm^3$ made from copper which has a density of $8.9g/cm^3$.

(c) A block with a volume of $1.8m^3$ made from silver which has a density of $10490kg/m^3$

(d) A statue with a volume of $3m^3$ made from zinc which as a density of $7.14g/cm^3$

(e) $2800cm^3$ of butter which has a density of $911kg/m^3$

Question 3: Work out the volume of each of the following.
State the units of each answer.

(a) A 50g piece of wood which has a density of $0.4g/cm^3$

(b) A 770g block made of brass which has a density of $8.67g/cm^3$

(c) A 4kg sheet of glass which has a density of $2.42g/cm^3$

(d) 80kg of rye which has a density of $720kg/m^3$

(e) 5 tonnes of gold which has a density of $19300kg/m^3$

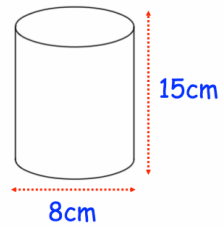
Apply

Question 1: A cube of ice has side length of 5cm.
The mass of the cube of ice is 114.5g.

Find the density of ice.
Give your answer in g/cm^3

Question 2: Shown is a solid cylinder made from carbon.
The density of carbon is $1.95g/cm^3$

Find the mass of the cylinder.



Question 3: The mass of $4m^3$ of silver is 41960kg.
The density of gold is $19300kg/m^3$.

Calculate the difference in mass between $5m^3$ of silver and $5m^3$ of gold.

Question 4: Beverley is building a toy boat.
If wood has a density under $1g/cm^3$, it will float.
She has a choice of three different pieces of wood.

Piece 1: volume = $400cm^3$ and mass = 450g.

Piece 2: volume = $0.02m^3$ and mass = 8kg

Piece 3: volume = $1000cm^3$ and mass = 1.03kg

Which piece of wood is the most suitable?

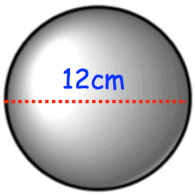
Question 5: Material A has a density of $4.5g/cm^3$.
Material B has a density of $14g/cm^3$.

5kg of Material A and 200g of Material B form Material C.

Work out the density of Material C.

Question 6: A solid sphere has a diameter of 12cm.
The sphere is made from glass.
The density of the glass is $3.02g/cm^3$

Find the mass of the glass sphere.

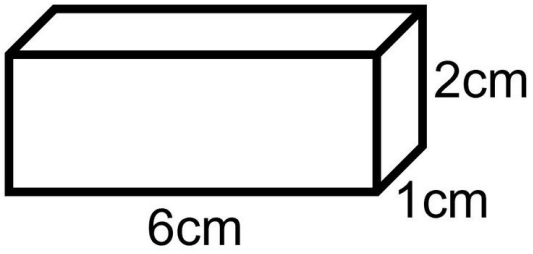


Purposeful Practice

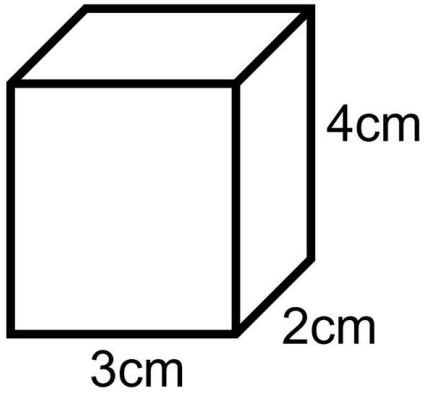
Question 7: An object has a mass of 420kg, correct to two significant figures.
The density of the material it is made from is 5.4g/cm^3, correct to one decimal place.

Work out the smallest possible volume of the object.
Give your answer to three significant figures.

Could these two cuboids be made of the same material?

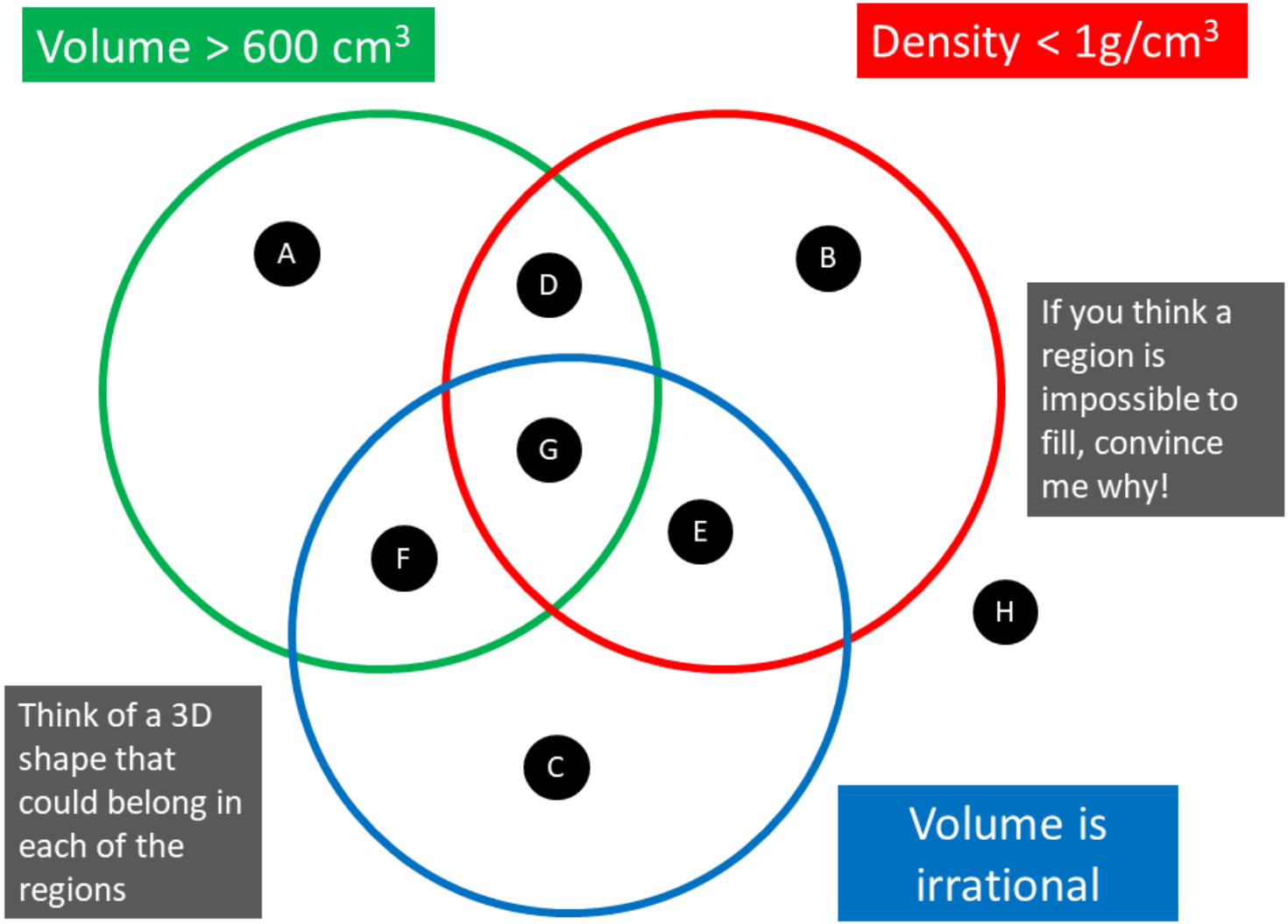


Mass = 60 g



Mass = 120 g

Problem Solving



Question 1: Work out the pressure for each of the following.
Give suitable units for each answer.

(a) A box is placed on a table and exerts a force of 250N on an area of $20cm^2$

(b) An object is placed on the ground and exerts a force of 3000N on an area of $4m^2$

(c) An object is placed on the ground and exerts a force of 54N on an area of $0.5cm^2$

(d) A box is placed on a table and exerts a force of 124 newtons on an area of $10.5cm^2$

(e) An object is placed on the ground and exerts a force of 25958N on an area of $1.4m^2$

Question 2: Work out the force for each of the following.
In each case a box has been placed on the floor.

(a) The area of contact is $16cm^2$ and the pressure exerted is $10N/cm^2$

(b) The area of contact is $1.5m^2$ and the pressure exerted is $5000N/m^2$

(c) The area of contact is $660cm^2$ and the pressure exerted is $8.2N/cm^2$

(d) The area of contact is $0.2m^2$ and the pressure exerted is $1.2N/cm^2$

(e) The area of contact is $500cm^2$ and the pressure exerted is $450000N/m^2$

Question 3: Work out the area of contact for each of the following.
In each case an object has been placed on the floor.
Give suitable units for each answer.

(a) The object exerts a force of 420N on the floor and the pressure on the floor is $20N/cm^2$

(b) The object exerts a force of 8590N on the floor and the pressure on the floor is $900N/m^2$

(c) The object exerts a force of 30N on the floor and the pressure on the floor is $600N/m^2$

(d) The object exerts a force of 3945N on the floor and the pressure on the floor is $200N/cm^2$

Question 1: Find the pressure exerted by a force of 180 newtons on an area of $50cm^2$.
Give your answer in newtons/m^2

Question 2: A cylinder is placed on a table.
The cylinder has a weight of 400N and has a diameter of 10cm.

Work out the pressure on the table in newtons/cm^2

Question 3: Two cubes are placed on a table.
One cube has a side length of 4cm and the other cube has a cube length of 10cm.

The weight of the smaller cube is 50N and the weight of the large cube is 250N

Which cube exerts a greater pressure on the table?

Question 4: A microwave is placed on a worktop.

The area of the microwave in contact with the table is $600cm^2$.
The pressure of the microwave is 2450 Newtons/m^2.

Work out the force exerted by the microwave on the worktop.

Question 5: The pressure of a tyre is 32 pounds per square inch.

Given 1 pound = 0.4536 kilograms
1 inch = 2.54 centimetres

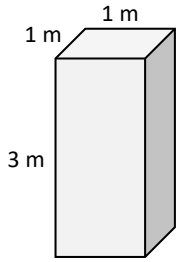
Work out the pressure in grams per square centimetre.

Purposeful Practice

An object with a mass of m kg exerts a downward force of mg newtons.
g = the acceleration of gravity = 9.81 m/s^2
For these questions, assume g = 10 m/s^2

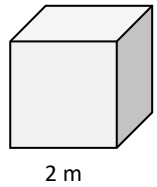
A **column** of stone (density = 1500 kg/m^3).

Calculate the pressure this column exerts on its lowest surface.



A **cube** of concrete (density = 2000 kg/m^3).

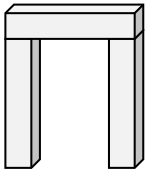
Calculate the pressure this cube exerts on the floor.



Mini-Stonehenge: 3 congruent sandstone cuboids (density = 2.6 t/m^3)

Dimensions of one cuboid = 50 cm × 50 cm × 2.5 m

Calculate the pressure this trilithon exerts on its lowest surfaces.



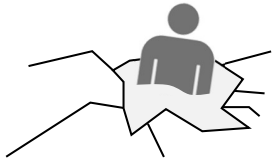
Tom has fallen through the ice!

With its thickness, the ice can only resist a pressure of 14,500 N/m^2.

Humans have a density of 950 kg/m^3.

Tom wears size 10 shoes with a contact area of 200 cm^2 each.

Estimate the volume of Tom's body.



Fluency Practice

Q		Answers
1	An object travels $20\ m$ in 5 seconds. Work out the average speed.	
2	An object travels at $20\ m/s$ for 5 seconds. Work out the distance travelled.	
3	An object travels $20\ m$ at a speed of $5\ m/s$. Work out the time taken.	
4	An object exerts a force of $20\ N$ on an area of $5\ m^2$. Work out the pressure applied.	
5	An object applies a pressure of $20\ N/m^2$ on an area of $5\ m^2$. Work out the force exerted.	
6	An object exerts a force of $20\ N$ by applying a pressure of $5\ N/m^2$. Work out the area the force is applied to.	
7	An object has a mass of $20\ kg$ and a volume of $5\ m^3$. Work out the density.	
8	An object has a density of $20\ kg/m^3$ and a volume of $5\ m^3$. Work out the mass.	
9	An object has a mass of $20\ kg$ and a density of $5\ kg/m^3$. Work out the volume.	

Fluency Practice

(a)	(b)	(c)	(d)
Convert $725\ cm$ into metres.	Convert $1.3\ litres$ into ml.	Change $13\ m^2$ into cm^2.	Change $540\ 000\ cm^3$ into m^3.
(e)	**(f)**	**(g)**	**(h)**
A pressure of $60\ N/m^2$ is exerted on a surface of area $1.5\ m^2$. Calculate the force on the surface.	The density of a metal with a mass of $56.84\ g$ is $2.8\ g/cm^3$. Find the volume of the metal.	Tia sets off on a drive at 9.30am. She drives for 114 km and arrives at her destination at 11am. Find her average speed.	A plane travels for 5 hours 45 minutes at an average speed of $625\ km/h$. Find the distance travelled to the nearest km.
(i)		**(j)**	**(k)**
The Eurostar train travels $492\ km$ from London to Paris at a speed of $220\ km/h$. Find the time taken for the journey, in hours and minutes, to the nearest minute.		Convert $18\ m/s$ to a speed in km/h.	Convert $660\ km/h$ to a speed in m/s.
(l)		**(m)**	
Zeeshan sets off at 10.30am and drives from A to B at a speed of $57\ km/h$. The distance from A to B is $38\ km$. He then travels from B to C, a distance of $108\ km$. At what speed must Zeeshan travel from B to C in order to reach C at 12.30pm?		A metal cylinder has a height of $15\ cm$ and a mass of $768\ g$. The density of the cylinder is $3.2\ g/cm^3$. Find the radius of the cylinder, to 3 significant figures.	

(a) The mass of 3 m^3 of zinc is 21420 kg. Find the density of zinc in kg/m^3.
(b) Find the density of a piece of wood with a mass of 135 g and a volume of 150 cm^3.
(c) The density of gold is 19.5 g/cm^3. Find the mass of 18 cm^3 of gold in grams.
(d) A brick of mass 3000 g has a density of 7.5 g/cm^3. Calculate the volume of the brick in cm^3.

(a) A force of 80N acts over an area of 10 m^2. What is the pressure?
(b) A pressure of 8 Pa acts on an area of 0.25 m^2. What force is exerted?
(c) A crate weighs 200 N and exerts a pressure of 40 Pa on the ground. What is the area of the base of the crate?

(a) A classroom is 7 m long by 5 m wide by 3 m high. If the density of air in room temperature is about 1.3 kg/m^3, how many kg of air does this room contain?
(b) A force of 70 N acts on an area of 20 cm^2. The force is increased by 10 N and the area is increased by 10 cm^2. Does this increase or decrease the pressure?
(c) Why do camels have large, wide feet?

(a) Two pieces of scrap metal are melted down to make a single piece of metal. The first piece has a mass of 1500 kg and a density of 7000 kg/m^3. The second piece has a mass of 1000 kg and a density of 8000 kg/m^3. Work out the total volume of the new metal.
(b) Liquid A has a density of 0.7 g/cm^3 and liquid B has a density of 1.6 g/cm^3. 140 g of liquid A and 128 g of liquid B are mixed to make liquid C. Find the density of liquid C.