KING EDWARD VI
HANDSWORTH GRAMMAR
SCHOOL FOR BOYS

KING EDWARD VI
ACADEMY TRUST
BIRMINGHAM

Year 9

2023 Mathematics 2024

Unit 13 Booklet – Part 1

HGS Maths

Tasks

Dr Frost Course

Name: _____

Class: _____

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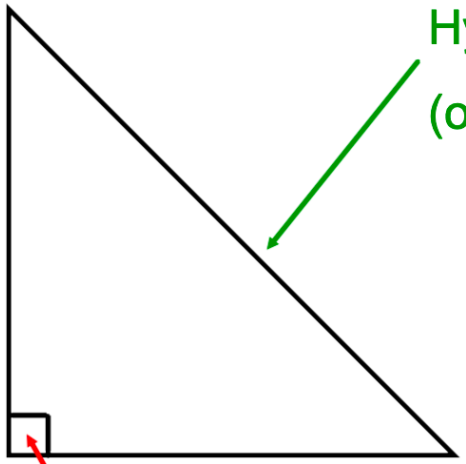
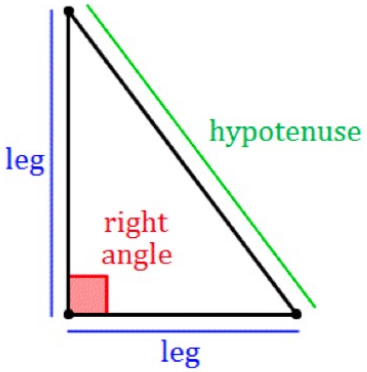
Contents Page

1 2D Pythagoras' Theorem

Hypotenuse

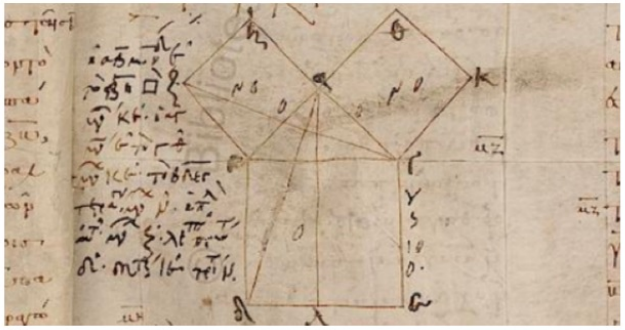


From the Greek derived *hypo* meaning 'under' and *teinein* meaning 'to stretch'.



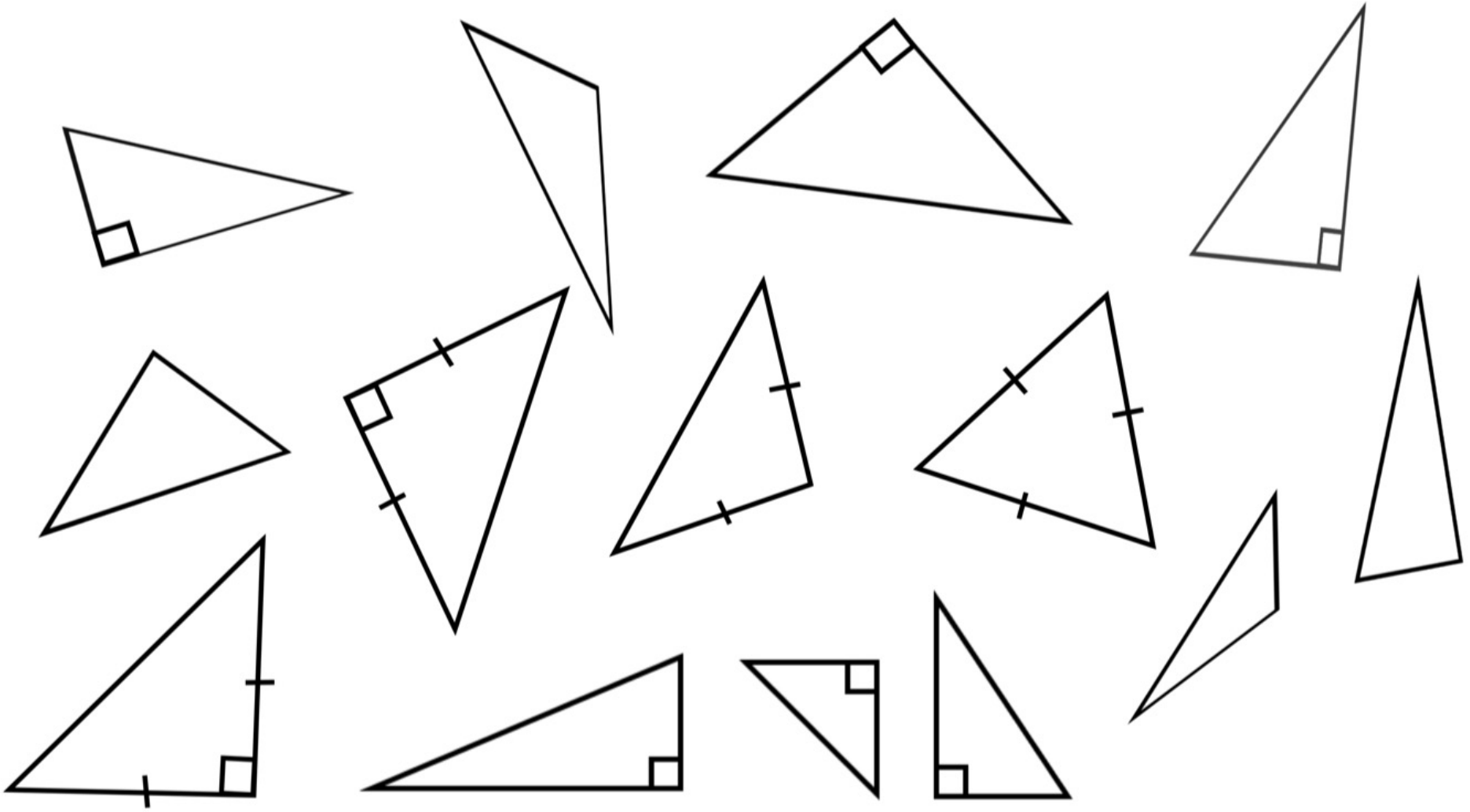
The two sides that aren't the hypotenuse are known as legs.

The hypotenuse is the side that stretches from one leg to another.



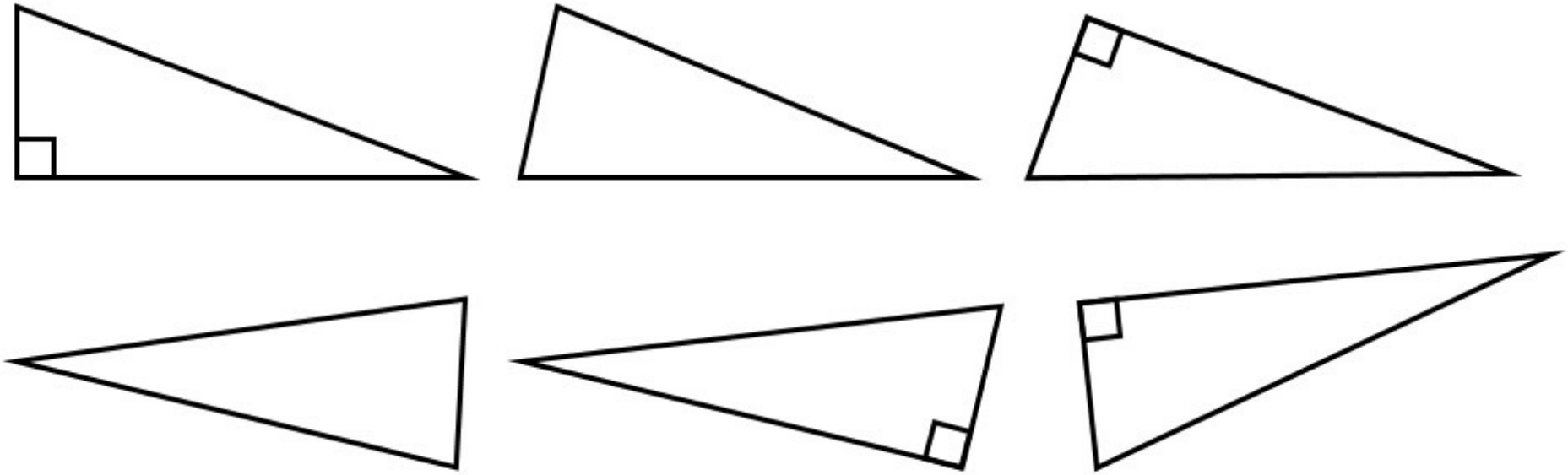
Fluency Practice

In each triangle that has a hypotenuse, label the hypotenuse with a letter C

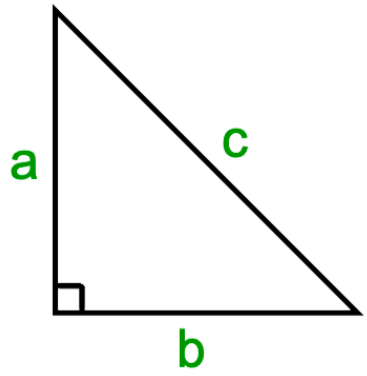


Fluency Practice

a) Cross out all shapes which Pythagoras' Theorem won't apply to.
b) In each remaining shape, label the hypotenuse c and the legs a and b.



Pythagoras' Theorem

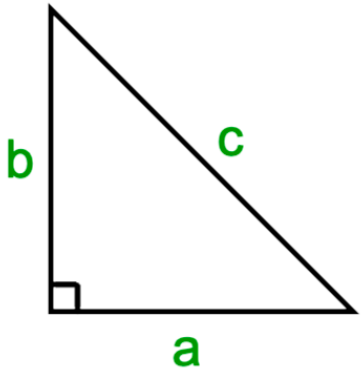


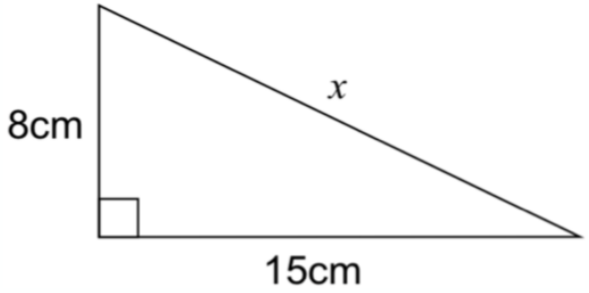
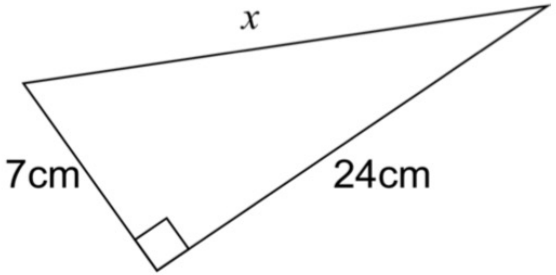
In any *right angled triangle*, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

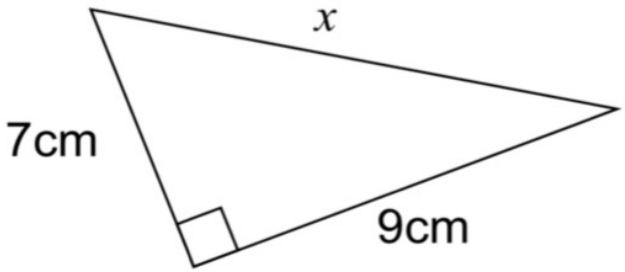
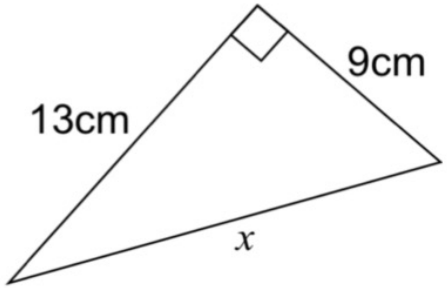
In other words:

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

Note: a and b can be labelled in any order but c has to be the hypotenuse i.e the triangle could be labelled like this:



Worked Example	Your Turn
Calculate the unknown side in this triangle.  	Find the sum of interior angles of this polygon. 

Worked Example	Your Turn
Calculate the unknown side in this triangle. Give your answer to 2 decimal places.  	Calculate the unknown side in this triangle. Give your answer to 2 decimal places. 

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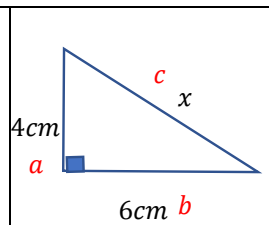
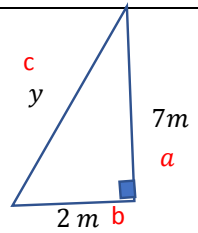
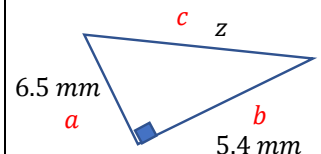
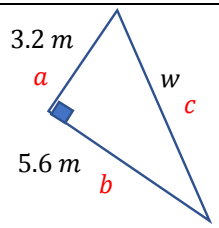
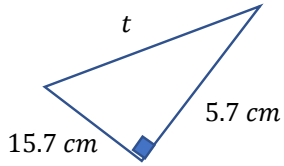
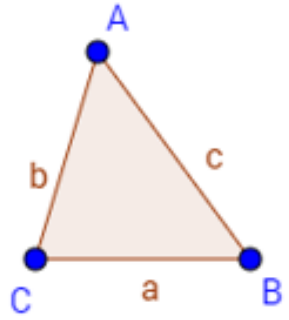
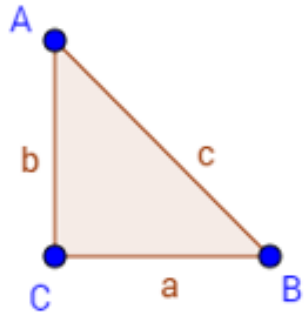
Finding Missing Lengths Part 1. Complete the examples in the table by finding the value of the hypotenuse. Round your answers to 1 decimal place.

Question Label diagram					
Write down Pythagoras' Theorem	$c^2 = a^2 + b^2$	$c^2 = a^2 + b^2$	$c^2 = a^2 + b^2$	$c^2 = a^2 + b^2$	
Substitute in the values	$x^2 = 4^2 + 6^2$	$y^2 = 7^2 + 2^2$	$z^2 = 6.5^2 + 5.4^2$		
Evaluate the squares and add together	$x^2 = 16 + 36$ $x^2 = 52$	$y^2 = 49 + 4$ $y^2 = 53$	$z^2 = 42.25 + 29.16$ $z^2 = 71.41$		
Square root to solve the equation	$x = \sqrt{52}$	$y = \sqrt{53}$			
Round your answer (where appropriate) and give units	$x = 7.2\ cm\ (1dp)$				

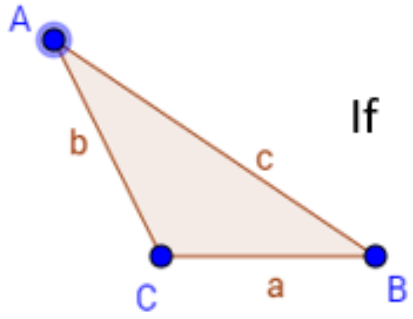
Converse of Pythagoras' Theorem



If $c^2 < a^2 + b^2$ then ABC is an acute triangle



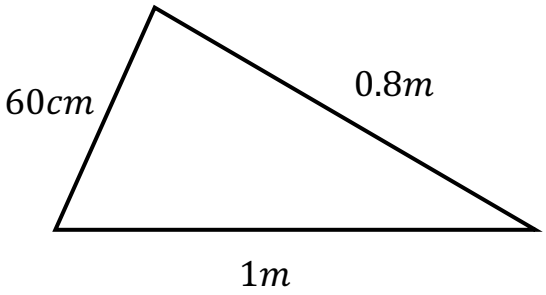
If $c^2 = a^2 + b^2$ then ABC is right triangle

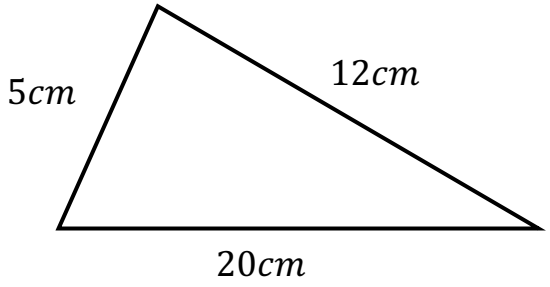


If $c^2 > a^2 + b^2$ then ABC is an obtuse triangle

Worked Example

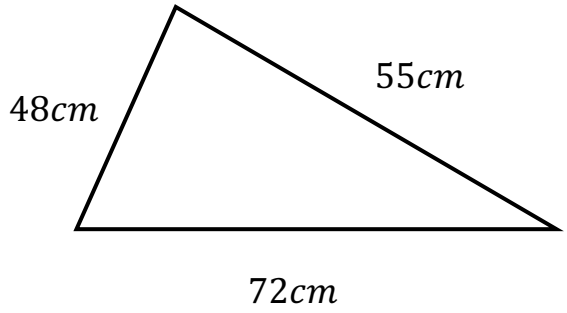
Are the triangles below right-angled?

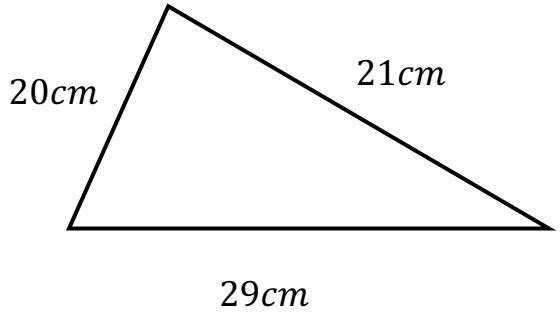


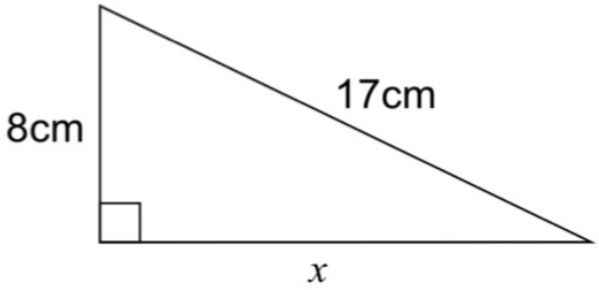
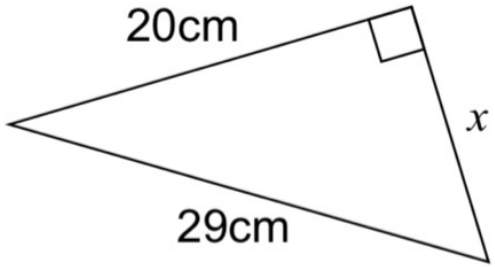


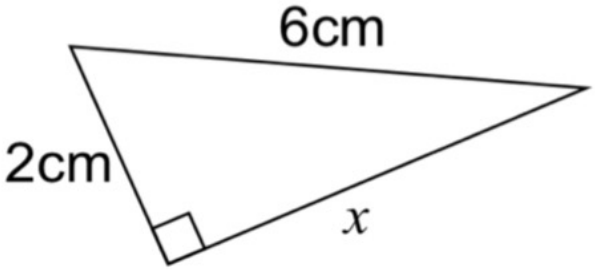
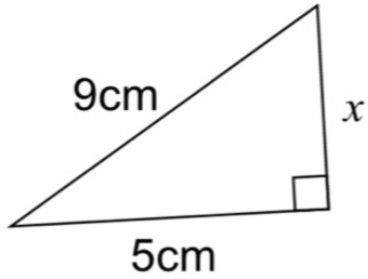
Your Turn

Are the triangles below right-angled?





Worked Example	Your Turn
Calculate the unknown side in this triangle.  	Calculate the unknown side in this triangle. 

Worked Example	Your Turn
Calculate the unknown side in this triangle. Give your answer to 2 decimal places.  	Calculate the unknown side in this triangle. Give your answer to 2 decimal places. 

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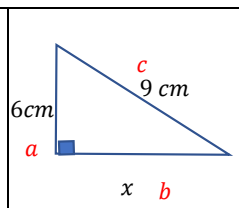
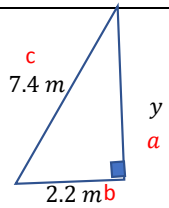
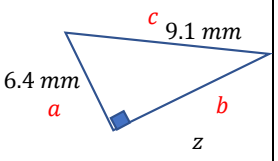
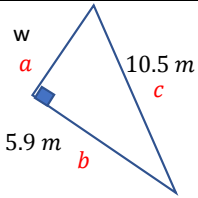
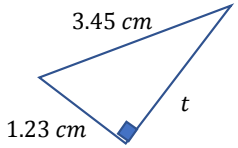
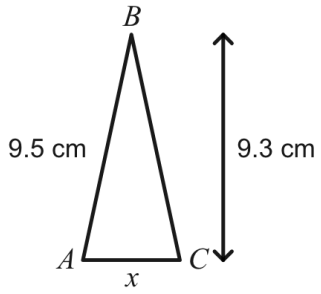
Finding Missing Lengths Part 2. Complete the examples in the table by finding the value of the leg. Round your answers to 1 decimal place.

Question Label diagram					
Write down Pythagoras' Theorem	$c^2 = a^2 + b^2$	$c^2 = a^2 + b^2$	$c^2 = a^2 + b^2$	$c^2 = a^2 + b^2$	
Substitute in the values	$9^2 = 6^2 + x^2$	$7.4^2 = y^2 + 2.2^2$	$9.1^2 = 6.4^2 + z^2$		
Evaluate the squares and rearrange the equation to get the unknown square on its own.	$81 = 36 + x^2$ -36 -36 $45 = x^2$ $x^2 = 45$	$54.76 = y^2 + 4.84$ -4.84 -4.84 $49.92 = y^2$ $y^2 = 49.92$	$82.81 = 40.96 + z^2$ -40.96 -40.96 $41.85 = z^2$ $z^2 = 41.85$		
Square root to solve the equation	$x = \sqrt{45}$	$y = \sqrt{49.92}$			
Round your answer (where appropriate) and give units	$x = 6.7\ cm\ (1dp)$				

Worked Example	Your Turn
Find the length of the line segments between the given points. Give your answers as simplified surds: a) $(1, 2)$ and $(4, 6)$ b) $(-1, 13)$ and $(4, 1)$ c) $(1, 2)$ and $(3, 5)$	Find the length of the line segments between the given points. Give your answers as simplified surds: a) $(1, 2)$ and $(5, 5)$ b) $(-5, 10)$ and $(-13, 4)$ c) $(1, 2)$ and $(-1, 5)$

Worked Example

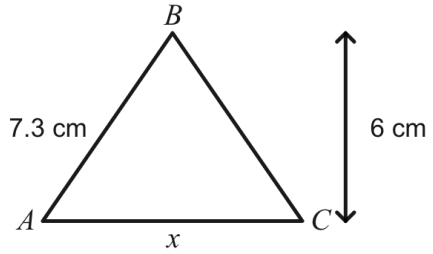
ABC is an isosceles triangle where $AB = BC$.



Find the length marked x on the diagram.
Give your answer correct to 1 decimal place.

Your Turn

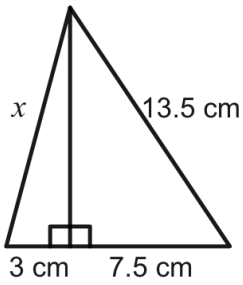
ABC is an isosceles triangle where $AB = BC$.



Calculate the length marked x on the diagram.
Give your answer correct to 1 decimal place.

Worked Example

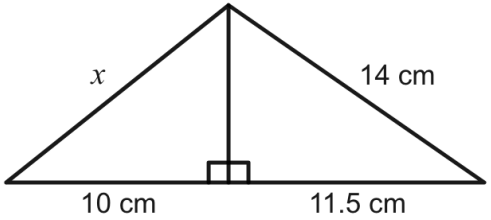
Work out the value of x.



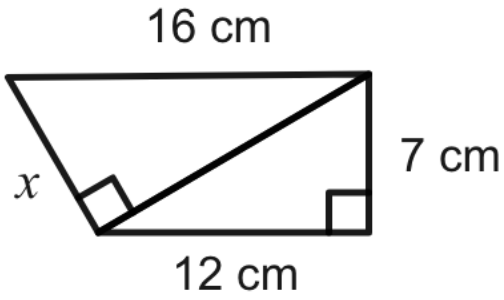
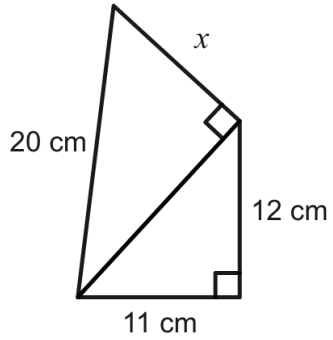
Give your answer correct to 1 decimal place.

Your Turn

Work out the value of x.

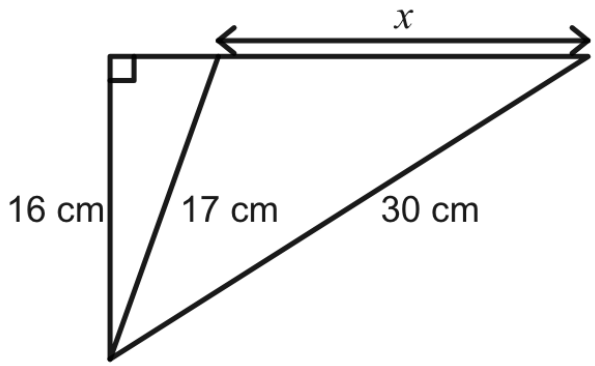


Give your answer correct to 1 decimal place.

Worked Example	Your Turn
Find the value of x.  Give your answer correct to 1 decimal place.	Determine the value of x.  Give your answer correct to 1 decimal place.

Worked Example

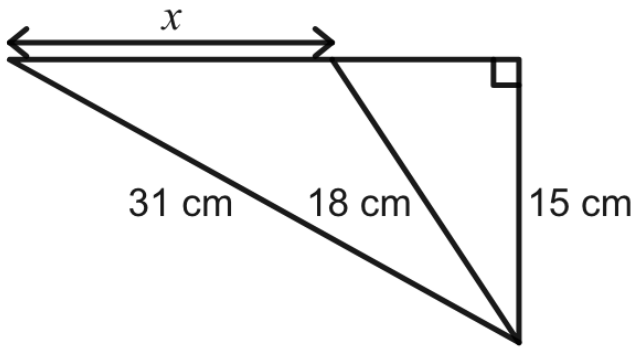
Find the value of x.



Give your answer correct to 1 decimal place.

Your Turn

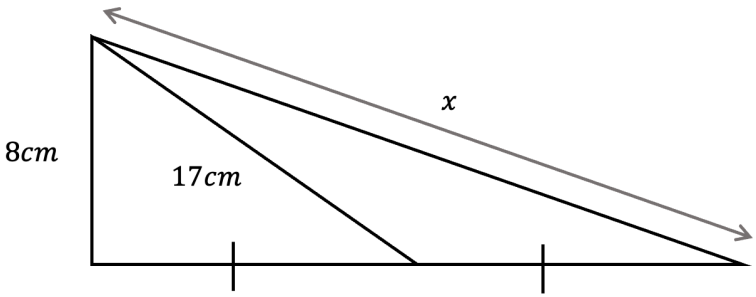
Find the value of x.



Give your answer correct to 1 decimal place.

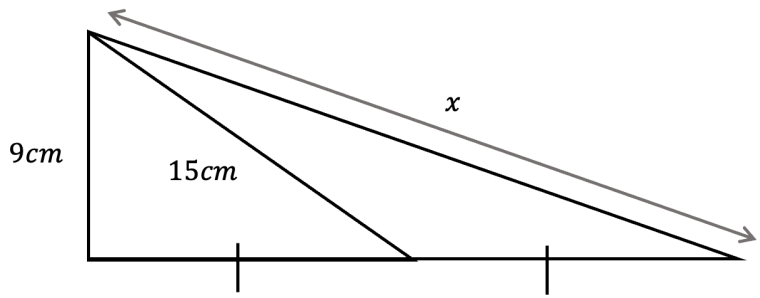
Worked Example

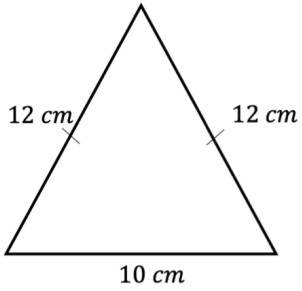
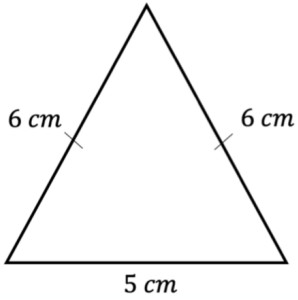
Find the value of x to 2dp.



Your Turn

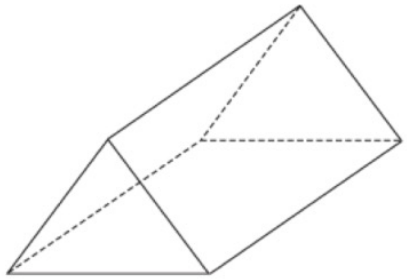
Find the value of x to 2dp.



Worked Example	Your Turn
Find the area of this triangle.  	Find the area of this triangle. 

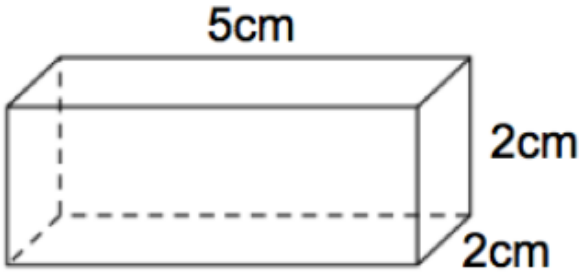
Extra Notes

2 Properties of 3D Shapes

Worked Example	Your Turn
For the cuboid, write down the:  Number of faces (F) The number of edges (E) The number of vertices (V) Calculate $V - E + F$	For the triangular prism, write down the:  Number of faces (F) The number of edges (E) The number of vertices (V) Calculate $V - E + F$

Worked Example

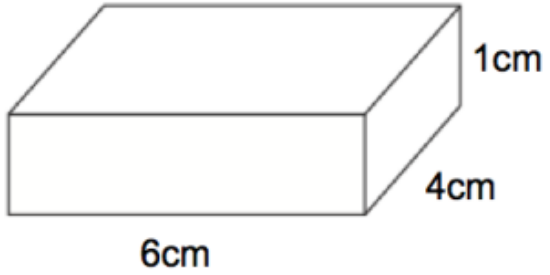
Draw a net for the cuboid.



Each square represents 1 cm^2

Your Turn

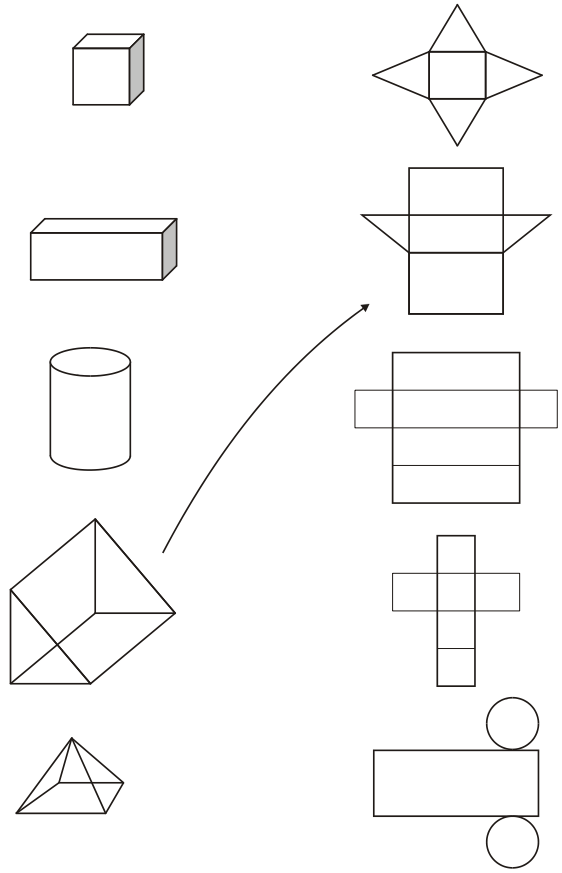
Draw a net for the cuboid.



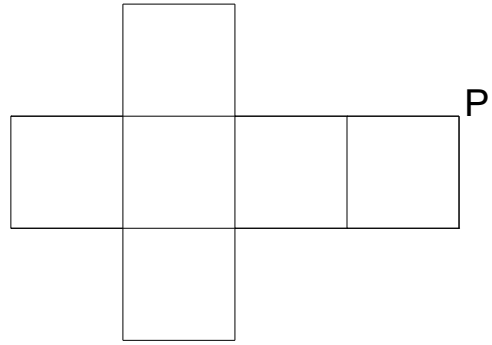
Each square represents 1 cm^2

Fluency Practice

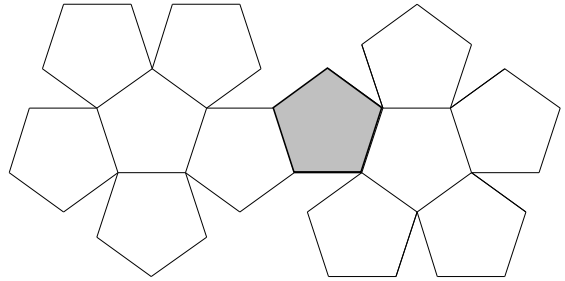
1. Match the 3D solids with their net



2. The net is folded to make a cube.
Two other vertices meet at *P.*
Mark each of these vertices with the letter *P*.

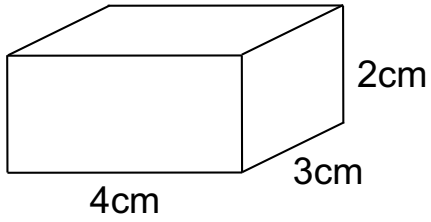


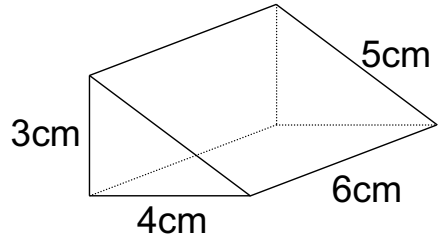
3. The net shown is folded to make a dodecahedron. Label the face which is opposite the shaded one



Fluency Practice

4. Using the grid provided with 1 square = 1 cm, draw an accurate net of these solids

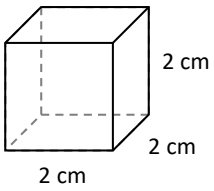




Fluency Practice

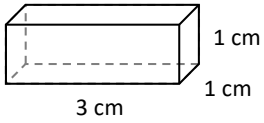
On the scale grid draw the **NET** for each cuboid.

a)

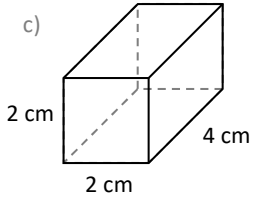


3 cm

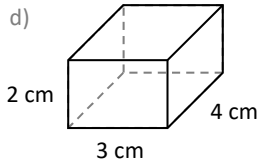
b)



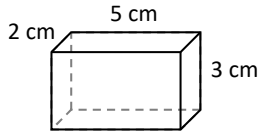
c)



d)



e)



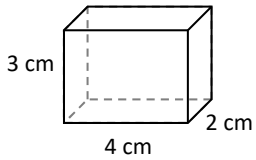
①

Fluency Practice

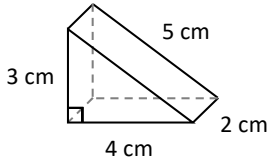
On the scale grid draw the **NET** for each 3D shape.

2 cm

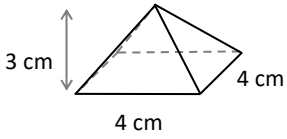
a) cuboid



b) triangular prism

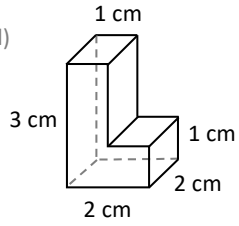


c) regular pyramid



rectilinear prism

d)



②

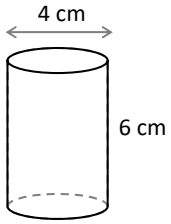
Fluency Practice

On the scale grid draw the **NET** for each type of cylinder.

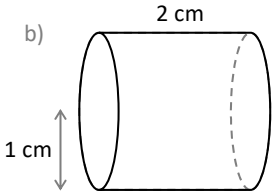
Label the lengths of each rectangle.

3 cm

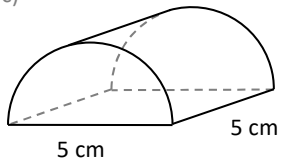
a)



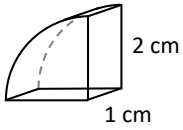
b)



c) half cylinder



d) quarter cylinder



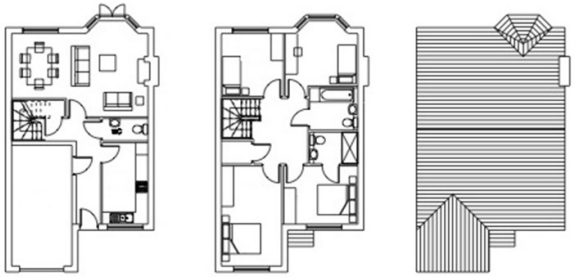
Extra Notes

3 Plans and Elevations

The **plan** is the view from the top of a 3D solid.

Elevations are horizontal views of a 3D object:

- **Front elevation**: The view from the front of an object.
- **Back elevation**: The view from behind the object.
- **Side elevation**: The view from the side of an object.



plans

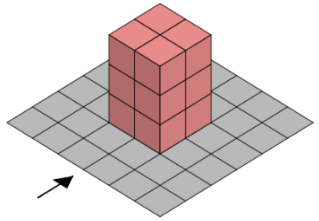
front elevation

side elevation

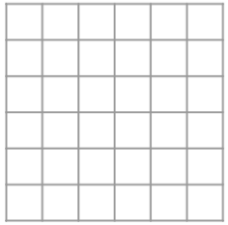
back elevation

side elevation

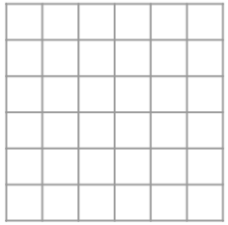
Worked Example



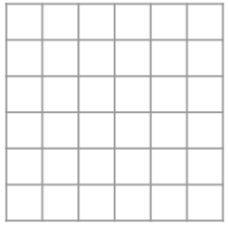
Plan:



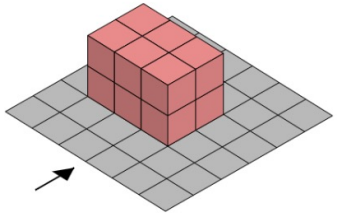
Front (with arrow):



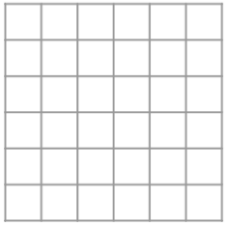
Side (from right):



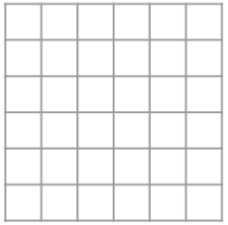
Your Turn



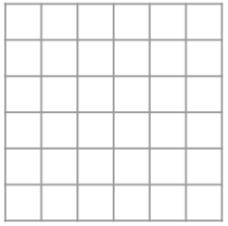
Plan:



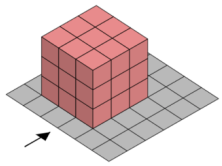
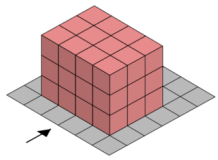
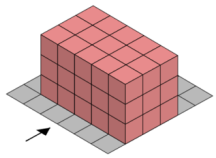
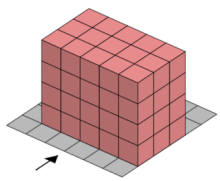
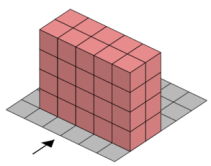
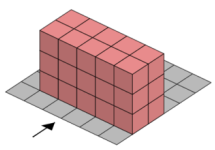
Front (with arrow):



Side (from right):

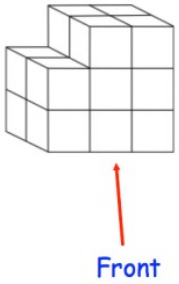


1 For each of the shapes below, draw the plan view, front view (shown with the arrow) and side view (from the right).

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

Worked Example

A shape is made of centimetre cubes. On the centimetre square grid, draw the elevations:



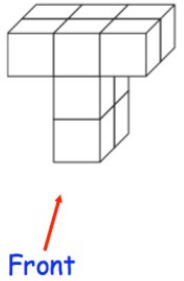
Front:

Left Side:

Plan:

Your Turn

A shape is made of centimetre cubes. On the centimetre square grid, draw the elevations:

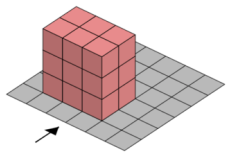
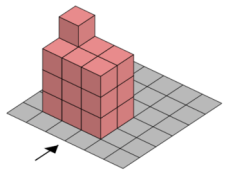
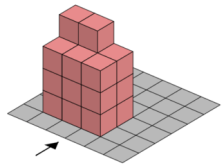
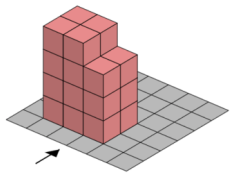
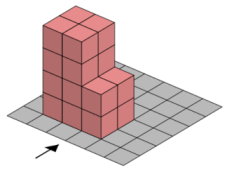
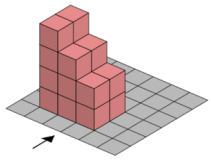


Front:

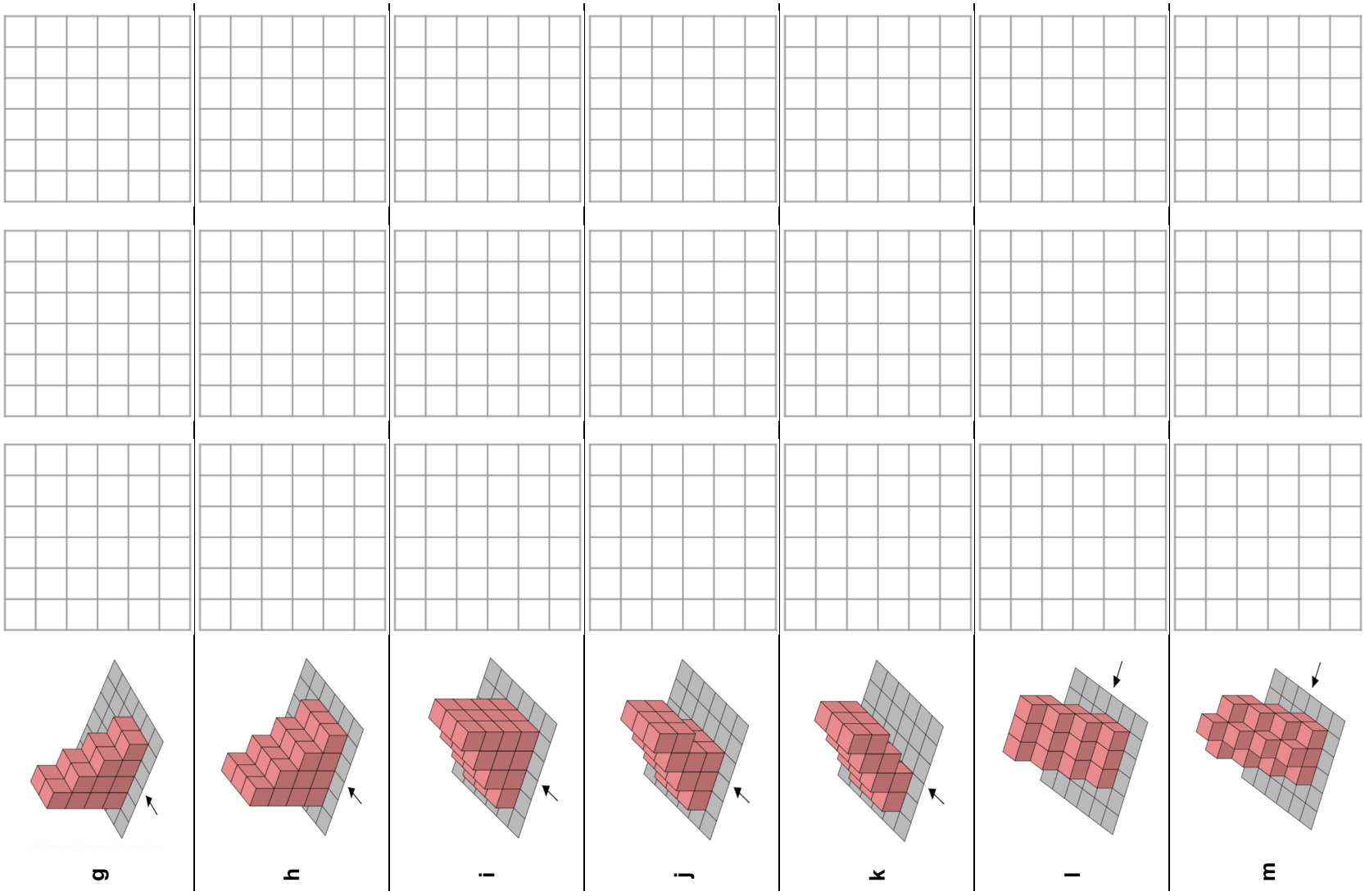
Left Side:

Plan:

1 For each of the shapes below, draw the plan view, front view (shown with the arrow) and side view (from the right).

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

Fluency Practice

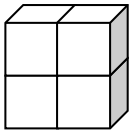


4 Cubes

4 cubes can be arranged in 8 different ways.

Draw the plan, the front elevation and the side elevation for each arrangement.

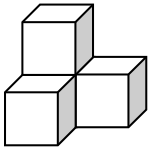
Why are there only 8 arrangements?



Plan

Front Elevation

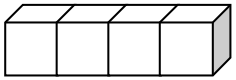
Side Elevation



Plan

Front Elevation

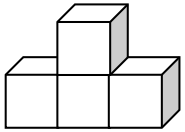
Side Elevation



Plan

Front Elevation

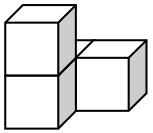
Side Elevation



Plan

Front Elevation

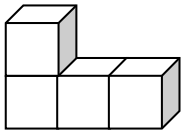
Side Elevation



Plan

Front Elevation

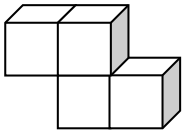
Side Elevation



Plan

Front Elevation

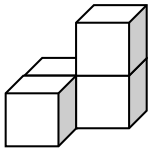
Side Elevation



Plan

Front Elevation

Side Elevation



Plan

Front Elevation

Side Elevation

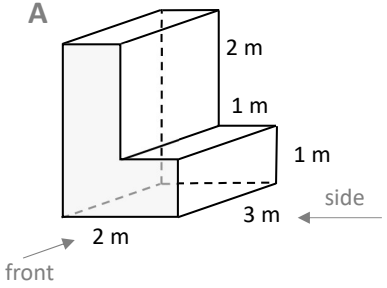
Fluency Practice

not to scale

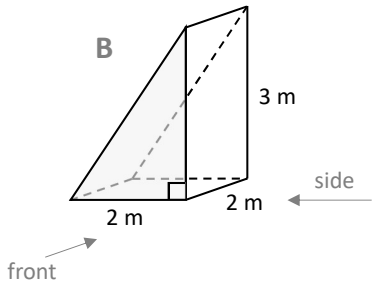
Plans & Elevations

On the scale grid draw the
front & **side elevations**, and the **plan**, for these prisms.

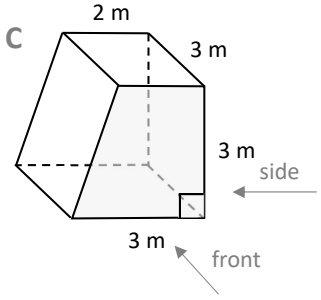
A



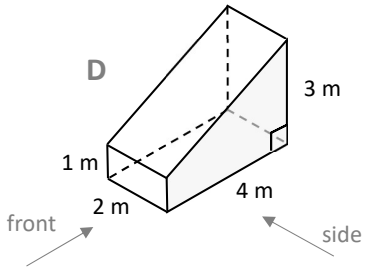
B



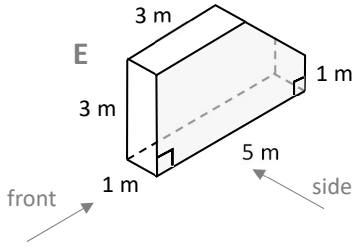
C

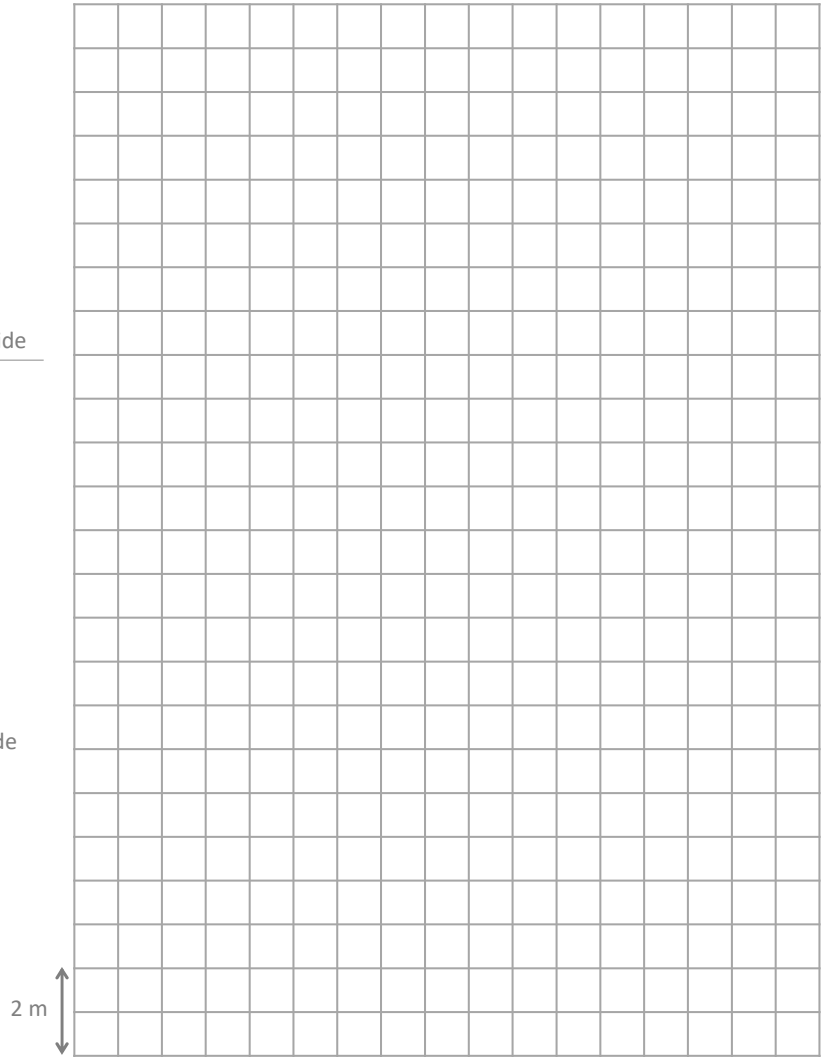


D



E





Fluency Practice

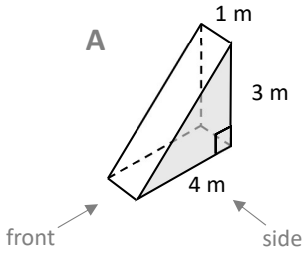
Pythag & Plans & Elevations

not to scale

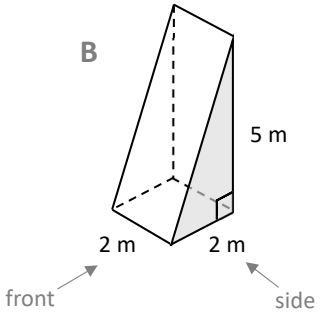
On the scale grid draw the **front** & **side elevations**, and the **plan**, for these **prisms**.

Label lengths that are not on the diagrams below.

A



B



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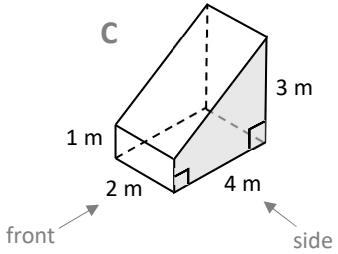

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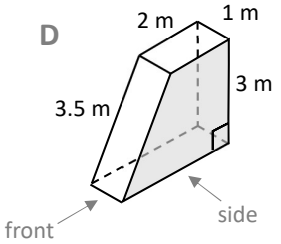

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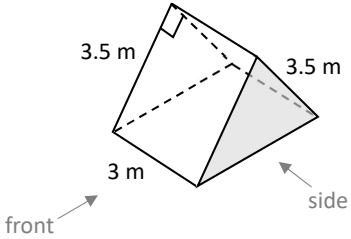
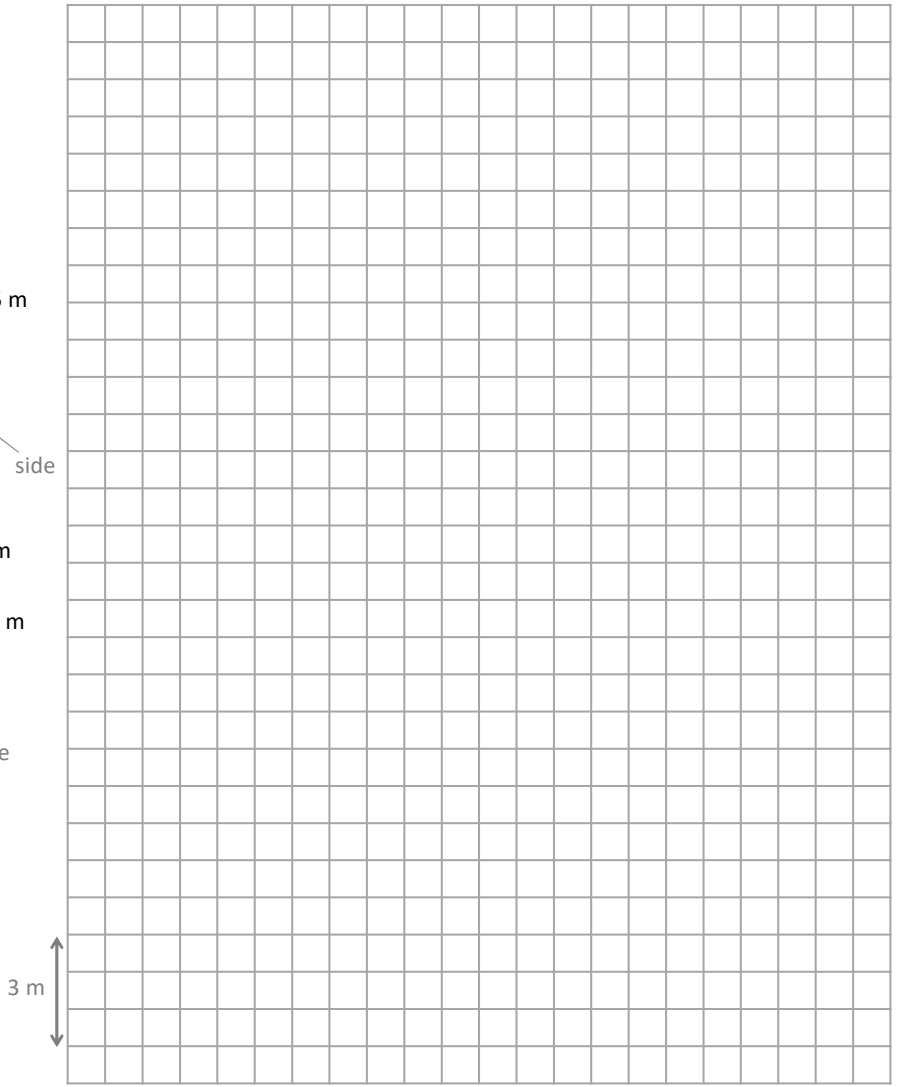
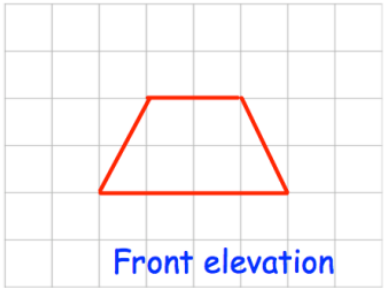
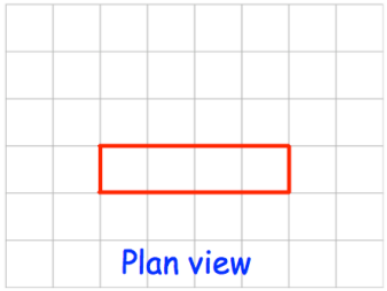




Worked Example

Given the elevations



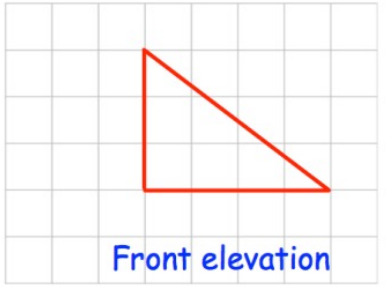


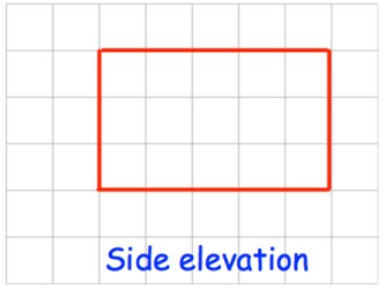
Draw the side elevation

Sketch the solid shape

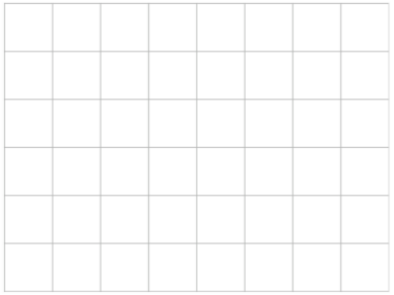
Your Turn

Given the elevations





Draw the plan view



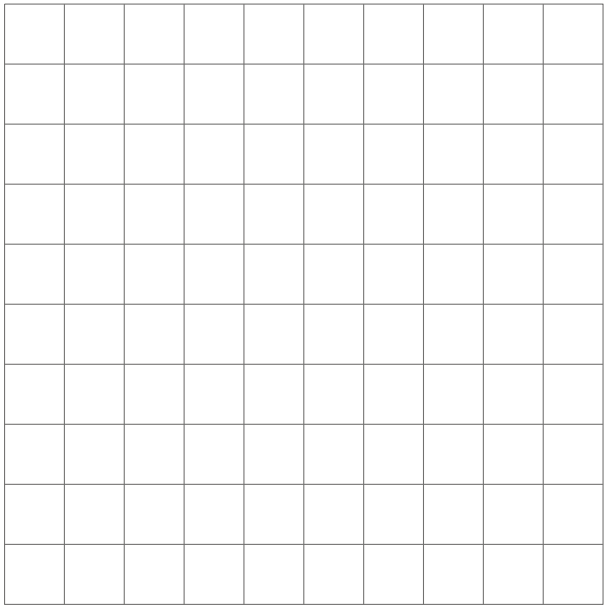
Sketch the solid shape

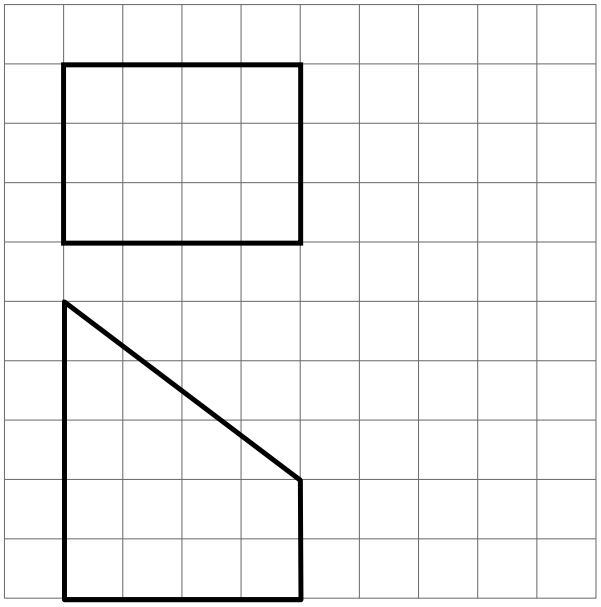
Fluency Practice

1. Here is the plan and side elevation of a prism.

The side elevation shows the cross section of the prism.

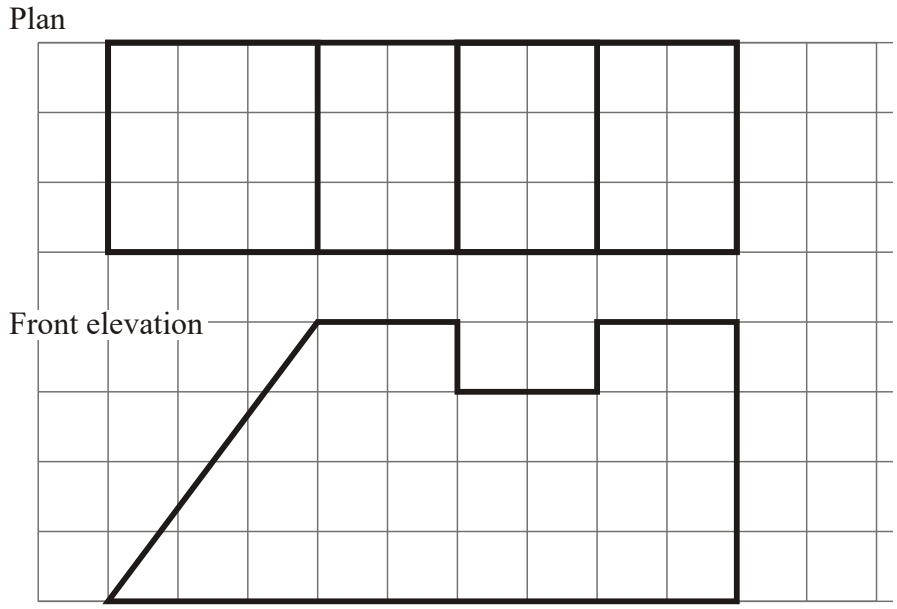
On the grid below, draw the front elevation of the prism.



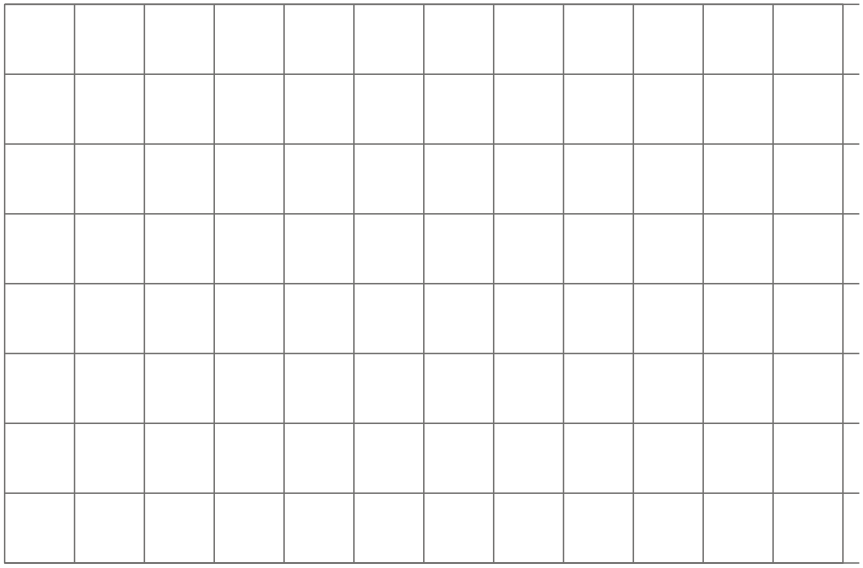


(b) In the space below, draw a 3-D sketch of the prism.

2. Here are the plan and front elevation of a prism.
The front elevation shows the cross section of the prism.

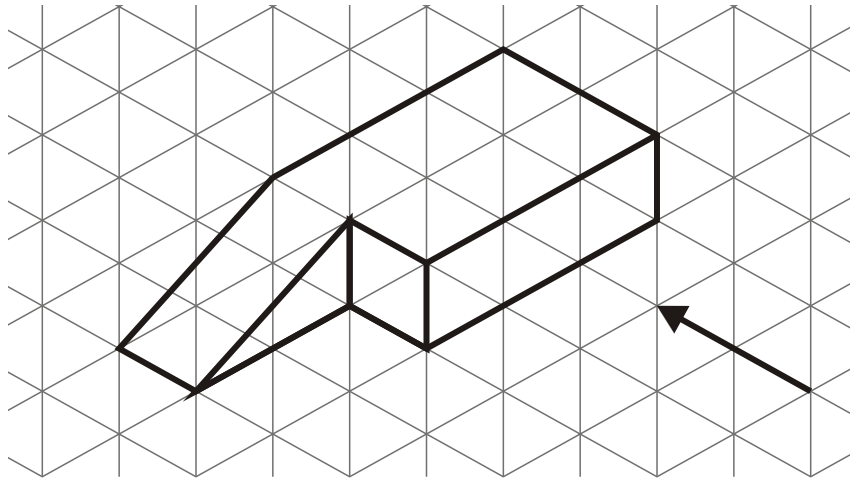


(a) On the grid below, draw a side elevation of the prism.



(b) In the space below, draw a 3-D sketch of the prism.

3. The diagram shows a solid object.



(a) In the space below, sketch the front elevation from the direction marked with an arrow.

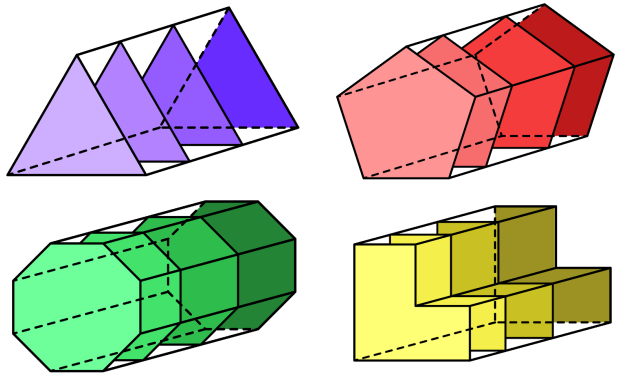
(b) In the space below, sketch the plan of the solid object.

Extra Notes

4 Volume and Surface Area of Prisms

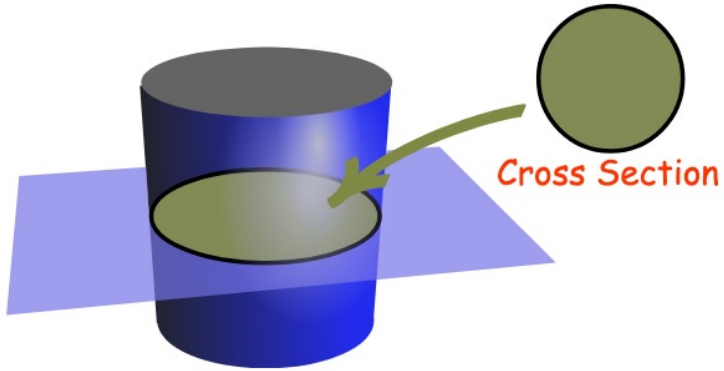
Prisms

A **prism** is a 3D shape which has the same *cross-section* along its length.

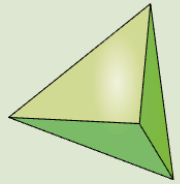
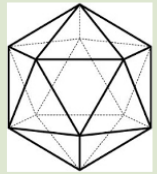
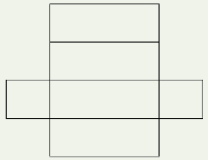
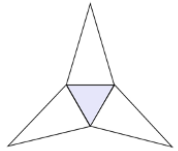


Cross-Section

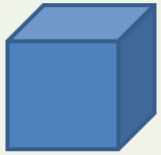
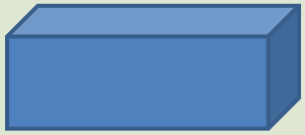
It is the shape made when a solid is cut through parallel to the base.

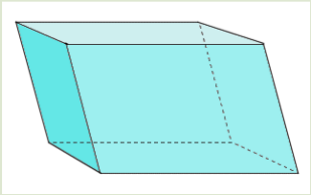
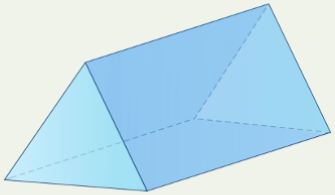
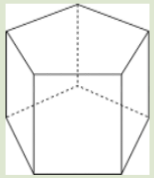
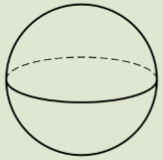


What is a Prism?

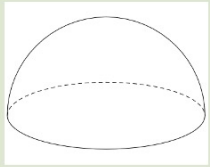
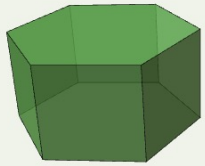
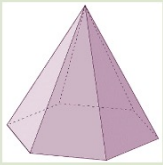
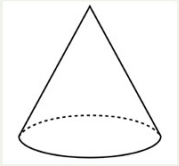
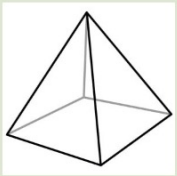
Shape	Prism?
	
	
	
Net 	
Net 	

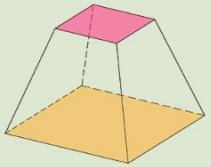
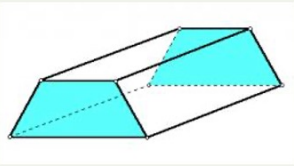
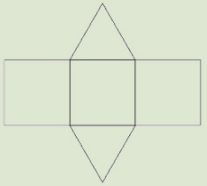
Fluency Practice

Shape	Prism?
	
	
	
	
	

Shape	Prism?
	
	
	
	
	

Fluency Practice

Shape	Prism?
	
	
	
	
	

Shape	Prism?
	
	
Net 	
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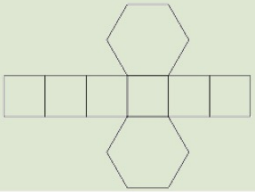
Net 	

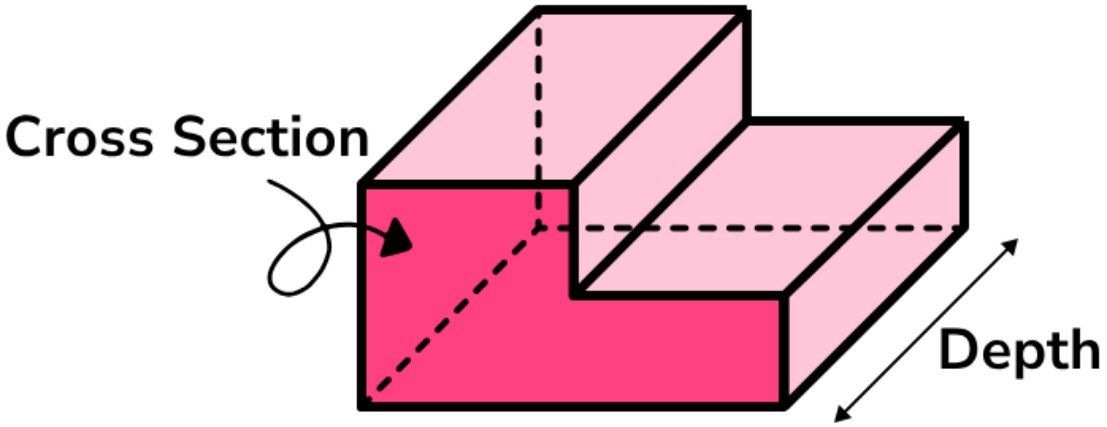
Frayer Model – Prism

Definition	**Characteristics**
Examples	**Non-Examples**

Volume of Prisms

Volume of Prism = Area of Cross Section × Depth

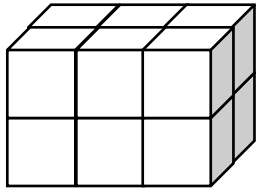
Volume of Prism = A × D



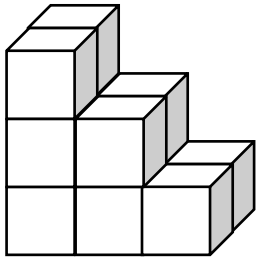
Worked Example

Write down the volume of the shape:

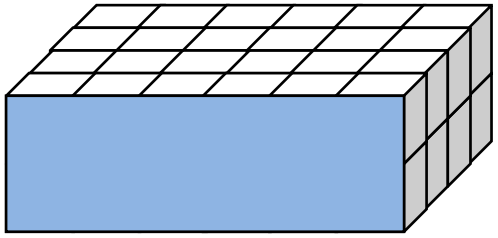
a)



b)



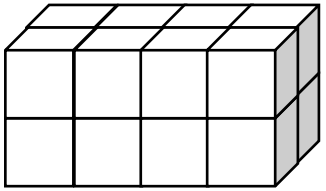
c)



Your Turn

Write down the volume of the shape:

a)



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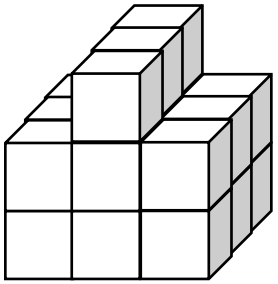

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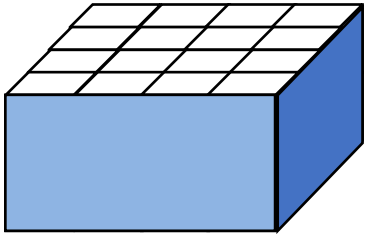
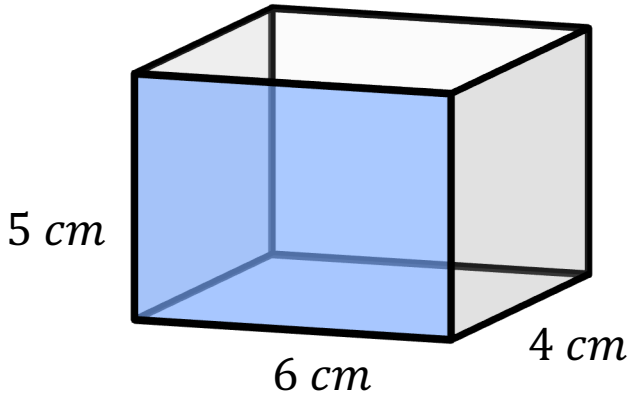
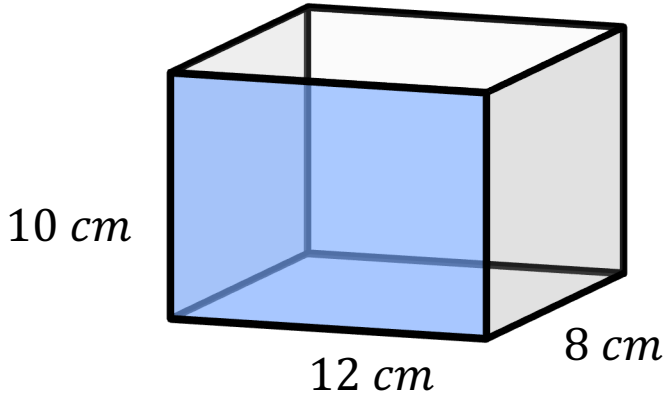
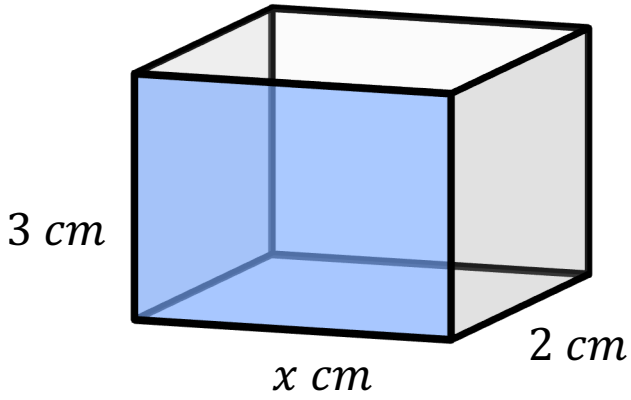


Worked Example	Your Turn
Calculate the volume of the cuboid:  	Calculate the volume of the cuboid: 

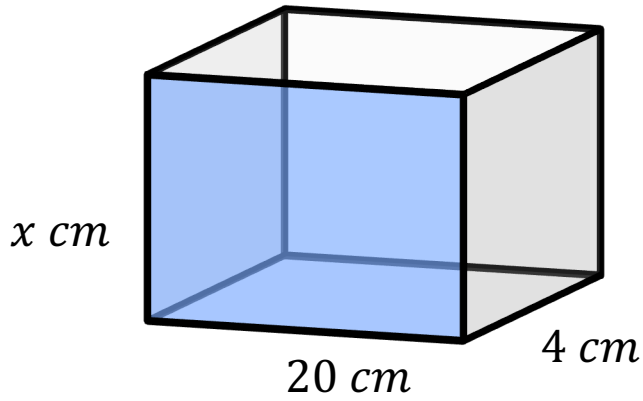
Worked Example

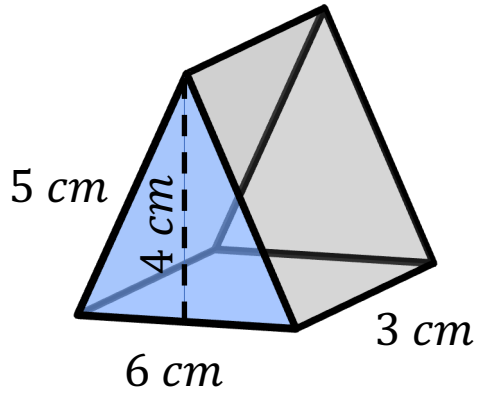
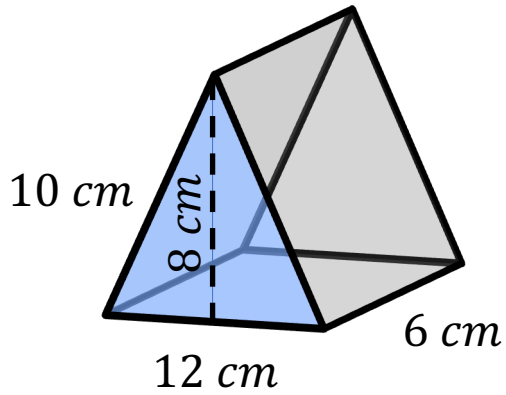
Find x, given that the volume of the cuboid is $60\ cm^3$

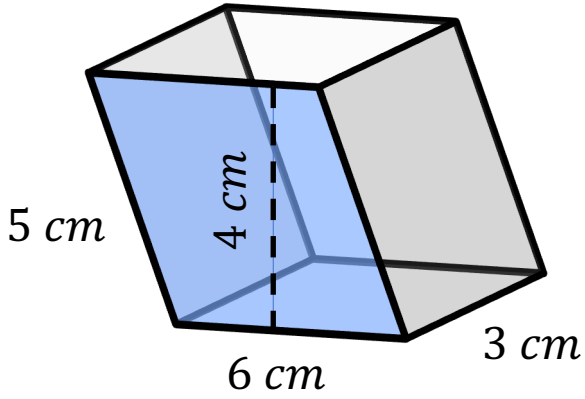
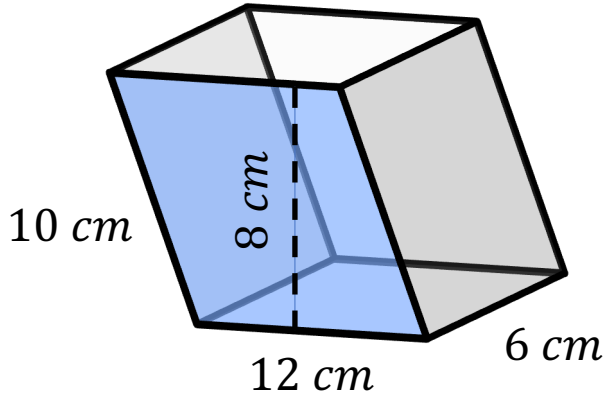


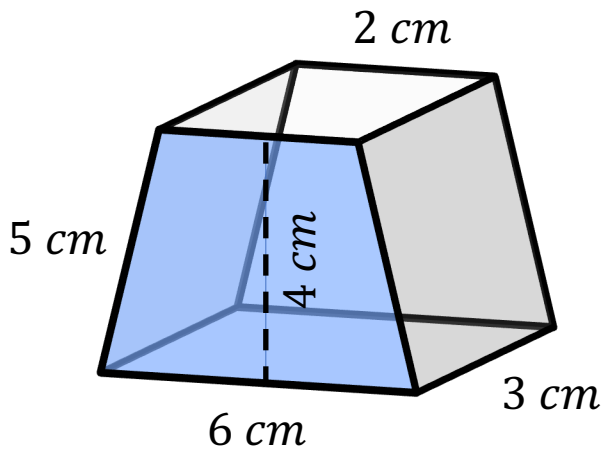
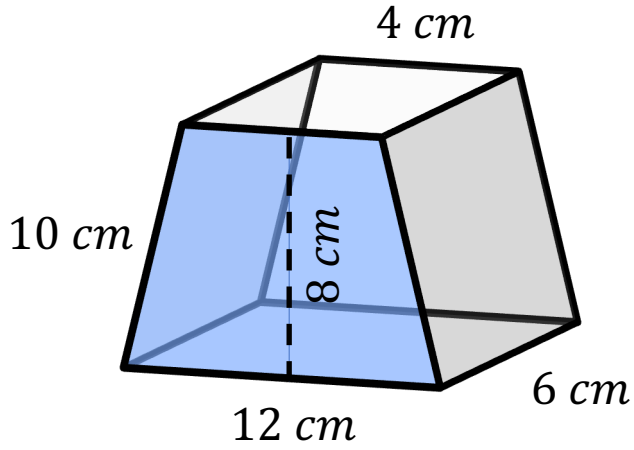
Your Turn

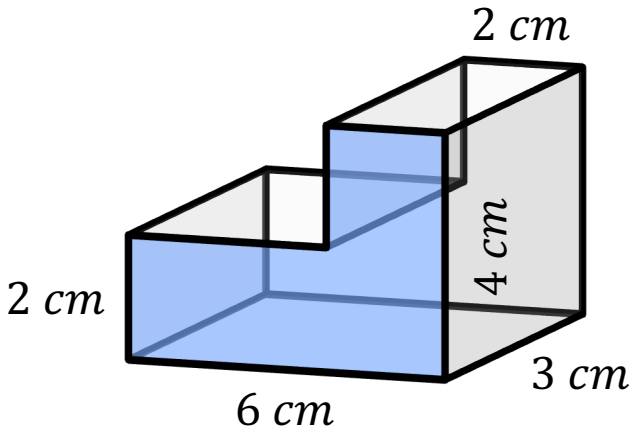
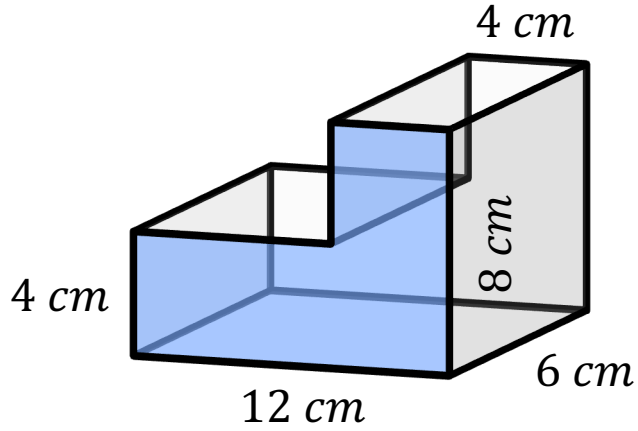
Find x, given that the volume of the cuboid is $480\ cm^3$



Worked Example	Your Turn
Calculate the volume of the triangular prism:  	Calculate the volume of the triangular prism: 

Worked Example	Your Turn
Calculate the volume of the parallelepiped:  	Calculate the volume of the parallelepiped: 

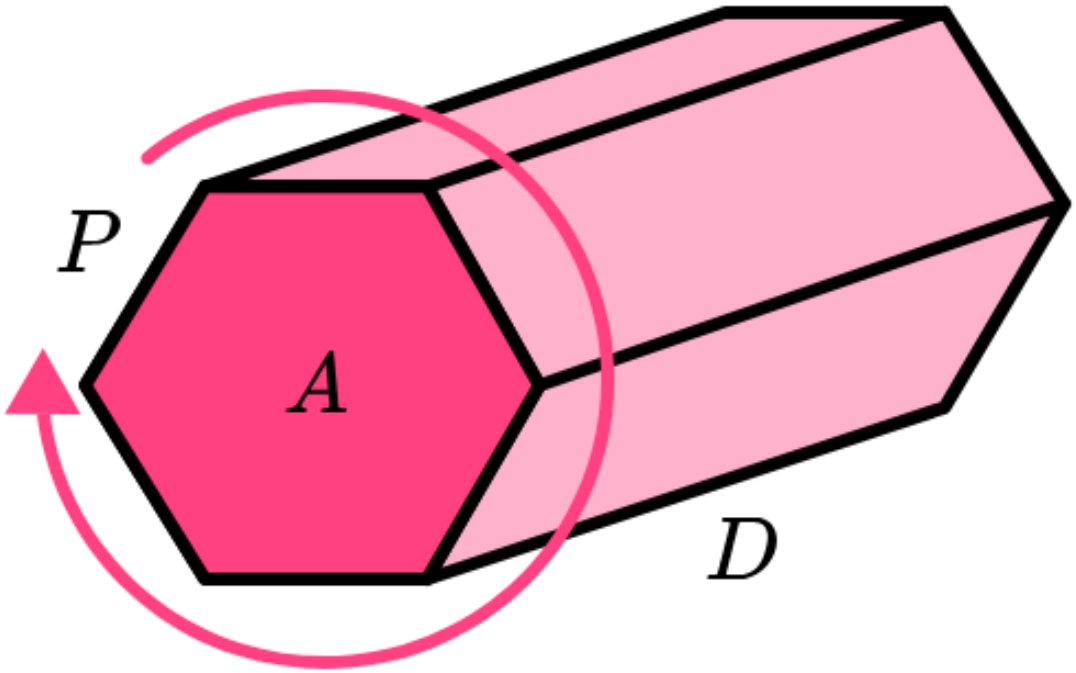
Worked Example	Your Turn
Calculate the volume of the trapezium prism:  	Calculate the volume of the trapezium prism: 

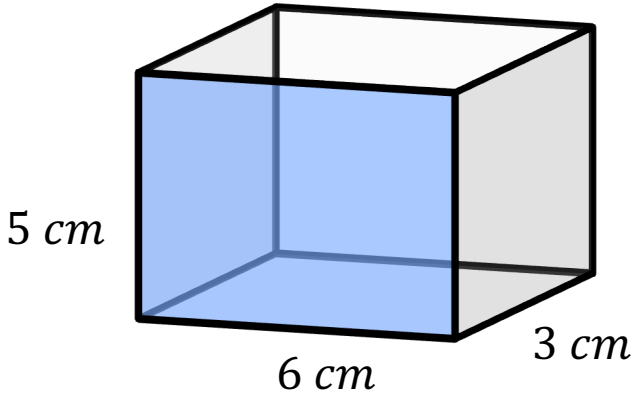
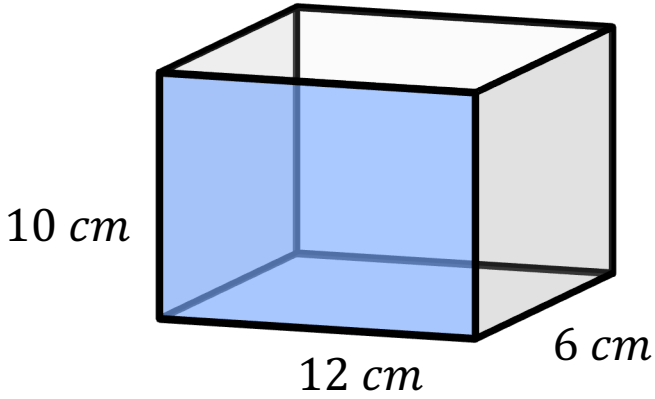
Worked Example	Your Turn
Calculate the volume of the L-shaped prism:  	Calculate the volume of the L-shaped prism: 

Surface Area of Prisms

Surface Area of Prism = 2 × Area of Cross Section + Perimeter of Cross Section × Depth of Prism

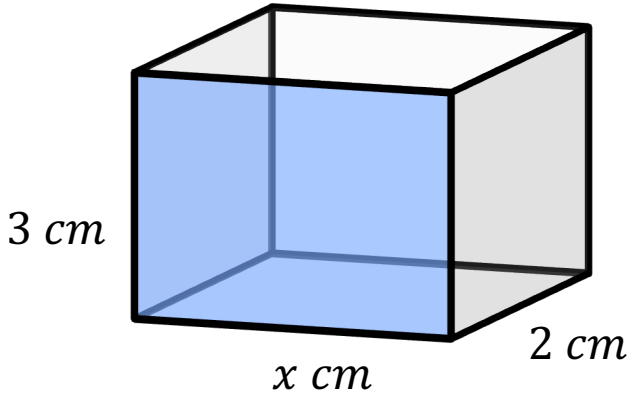
Surface Area of Prism = 2A + PD



Worked Example	Your Turn
Calculate the surface area of the cuboid:  	Calculate the surface area of the cuboid: 

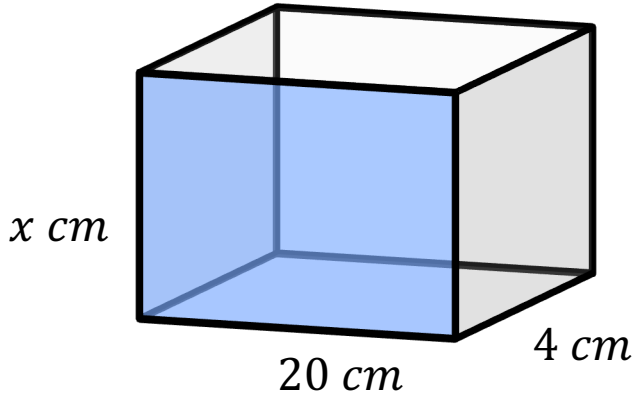
Worked Example

Find x, given that the total surface area is $112\ cm^2$



Your Turn

Find x, given that the total surface area is $448\ cm^2$



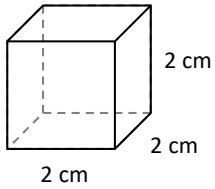
Fluency Practice

On the scale grid draw the **NET** for each cuboid.

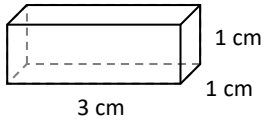
Use the net to find the **total surface area** of each shape.

3 cm

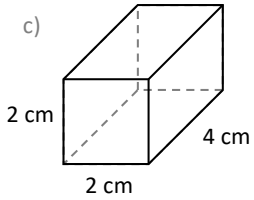
a)



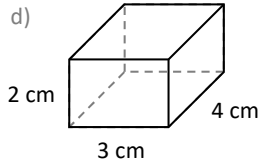
b)



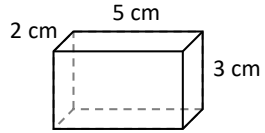
c)

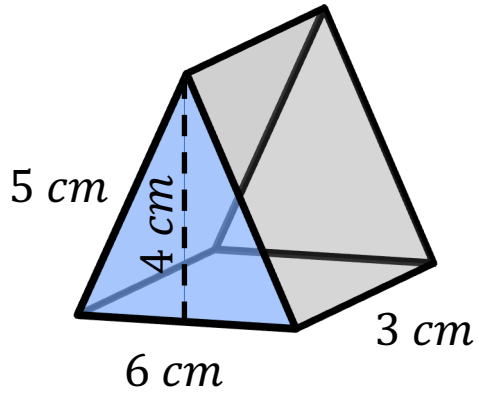
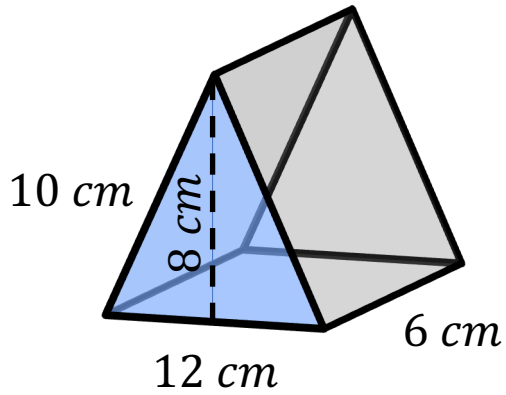


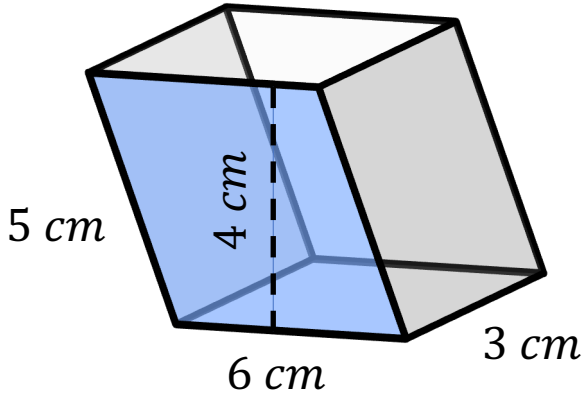
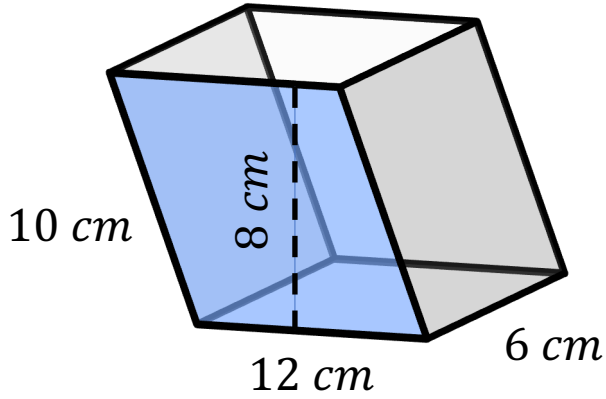
d)

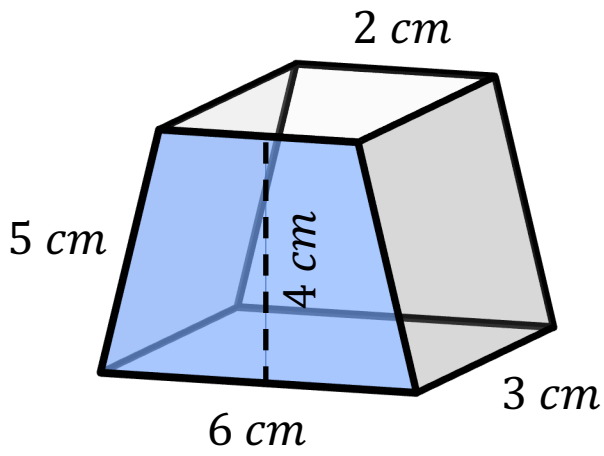
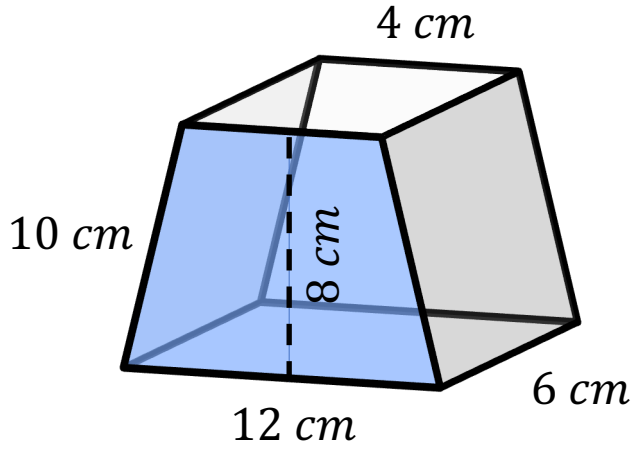


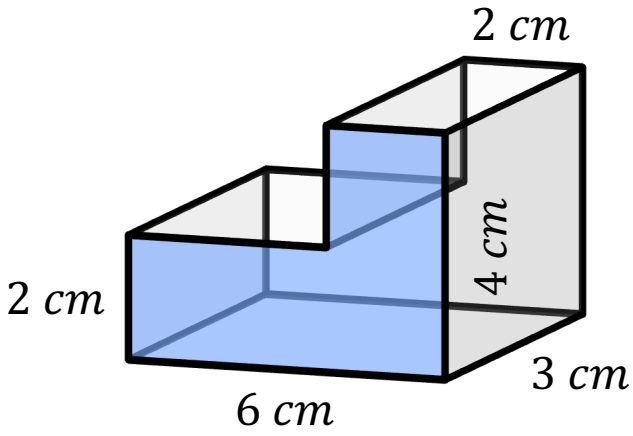
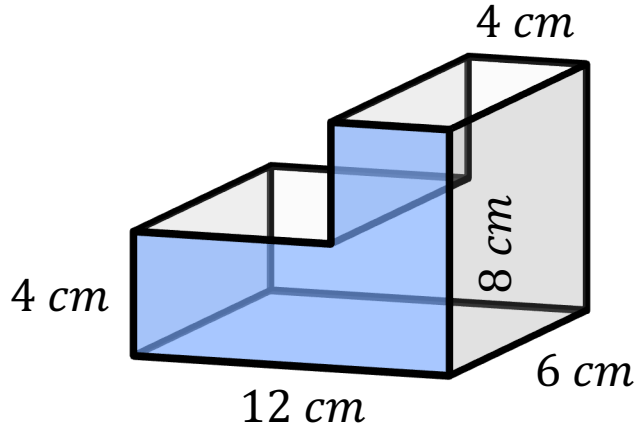
e)



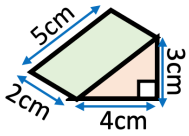
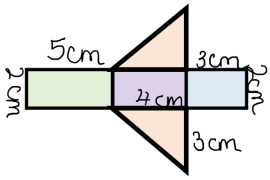
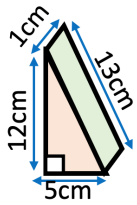
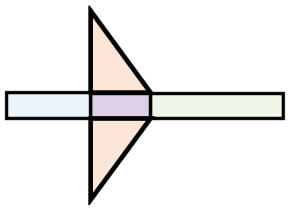
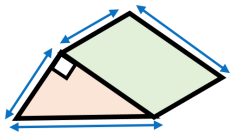
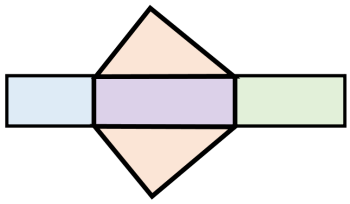
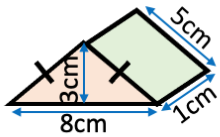
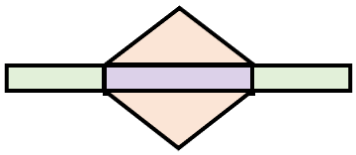
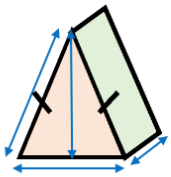
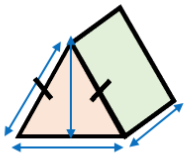
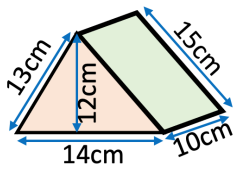
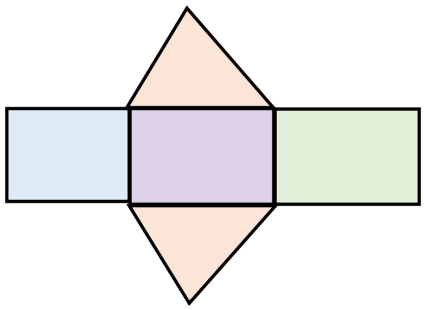
Worked Example	Your Turn
Calculate the surface area of the triangular prism:  	Calculate the surface area of the triangular prism: 

Worked Example	Your Turn
Calculate the surface area of the parallelepiped:  	Calculate the surface area of the parallelepiped: 

Worked Example	Your Turn
Calculate the surface area of the trapezium prism:  	Calculate the surface area of the trapezium prism: 

Worked Example	Your Turn
Calculate the surface area of the L-shaped prism:  	Calculate the surface area of the L-shaped prism: 

Fill In the table with labels, nets and surface area of each triangular prism

Triangular Prism	Net	Surface Area	Surface Area
			
			
		$2 \times \frac{8 \times 6}{2}$ $+8 \times 7$ $+6 \times 7$ $+10 \times 7$	
			
		$2 \times \frac{10 \times 12}{2}$ $+13 \times 1$ $+13 \times 1$ $+10 \times 1$	
		$2 \times \frac{12 \times 8}{2}$ $+10 \times ?$ $+10 \times ?$ $+12 \times ?$	$224cm^2$
			

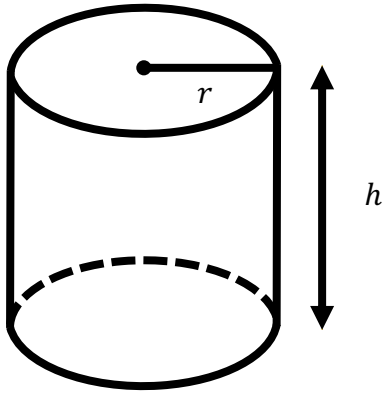
Fill in the Gaps

Cube or Cuboid	Length	Width	Height	Volume	Surface Area
Cuboid	10 *cm*	5 *cm*	3 *cm*		190 cm^2
Cube	4 *cm*			64 cm^3	
Cuboid	12 *cm*	8 *cm*	2 *cm*		
Cuboid	30 *mm*	25 *mm*	15 *mm*		
Cube		1.8 *m*			
Cuboid	10 *cm*	7 *cm*		350 cm^3	
Cube				729 cm^3	
Cuboid		3.6 *cm*	20 *cm*	259.2 cm^3	
Cuboid	45 *mm*	20 *mm*		22500 mm^3	
Cube					294 cm^2
Cuboid	4 *cm*		6 *cm*		228 cm^2
Cuboid	20 *mm*	12 *mm*			1568 mm^2
Cuboid		11 *cm*		528 cm^3	404 cm^2
Cuboid	2 *mm*			720 mm^3	876 mm^2

Volume of Cylinders

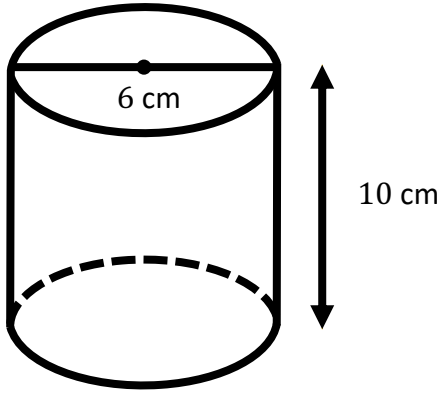
Volume of Cylinder = Area of circle × height
Volume of Cylinder = π × radius² × height

Volume of Cylinder = $\pi r^2 h$



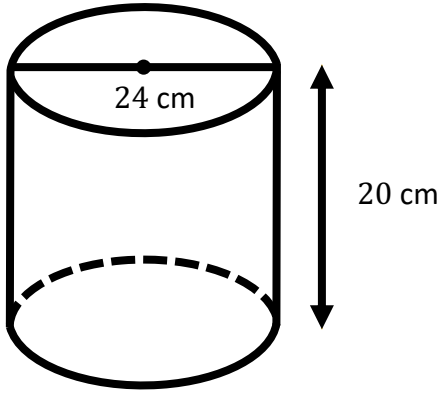
Worked Example

Calculate the volume of the following cylinder. Give your answer in terms of π and to 1 decimal place.



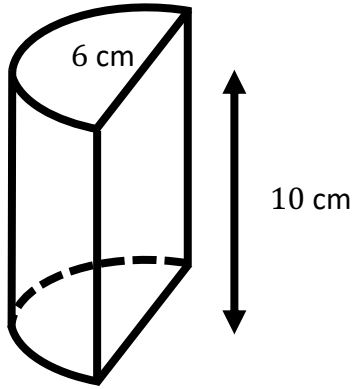
Your Turn

Calculate the volume of the following cylinder. Give your answer in terms of π and to 1 decimal place.



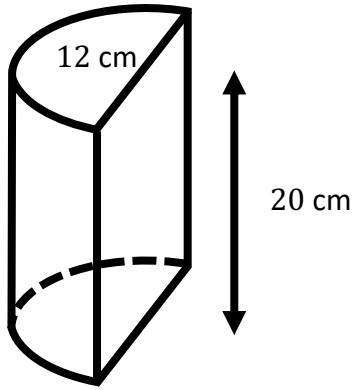
Worked Example

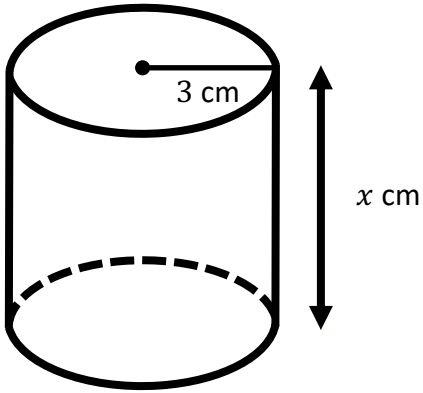
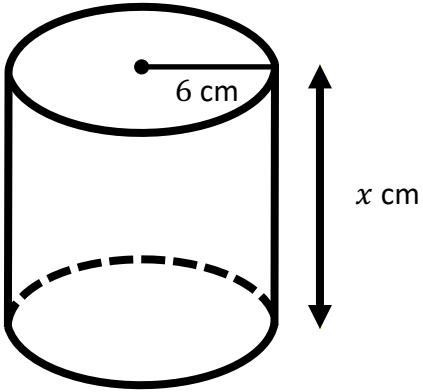
Calculate the volume of the following half cylinder. Give your answer in terms of π and to 1 decimal place.

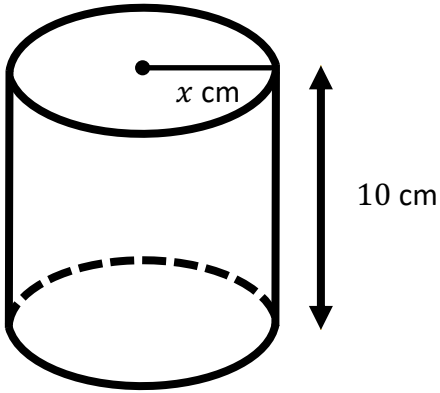
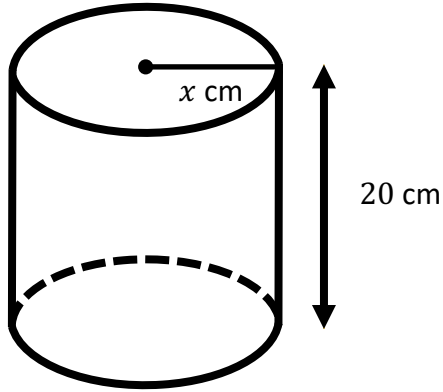


Your Turn

Calculate the volume of the following half cylinder. Give your answer in terms of π and to 1 decimal place.

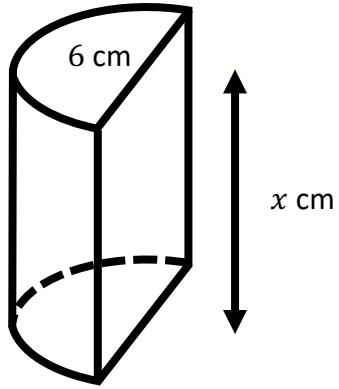


Worked Example	Your Turn
Find the height, x, given that the volume of the following cylinder is $282.7\ cm^3$. Give your answer to 1 decimal place. 	Find the height, x, given that the volume of the following cylinder is $2261.9\ cm^3$. Give your answer to 1 decimal place. 

Worked Example	Your Turn
Find the radius, x, given that the volume of the following cylinder is $282.7\ cm^3$. Give your answer to 1 decimal place.  	Find the radius, x, given that the volume of the following cylinder is $2261.9\ cm^3$. Give your answer to 1 decimal place. 

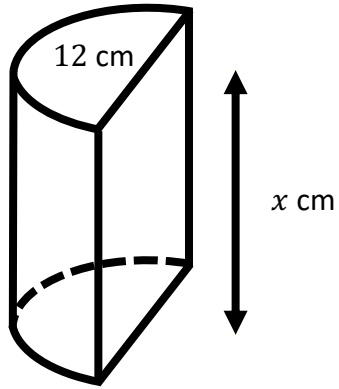
Worked Example

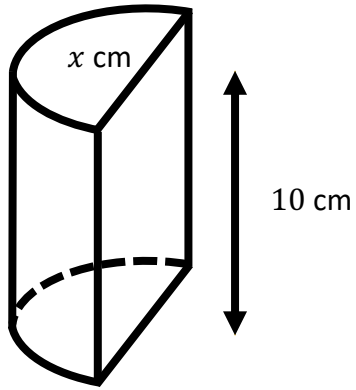
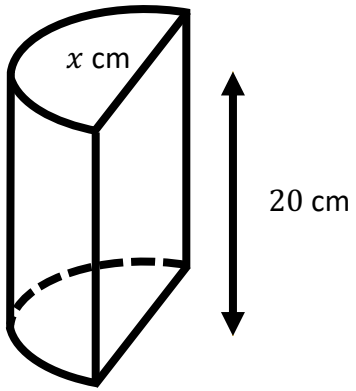
Find the height, x, given that the volume of the following half cylinder is $141.4\ cm^3$. Give your answer to 1 decimal place.



Your Turn

Find the height, x, given that the volume of the following half cylinder is $1131.0\ cm^3$. Give your answer to 1 decimal place.

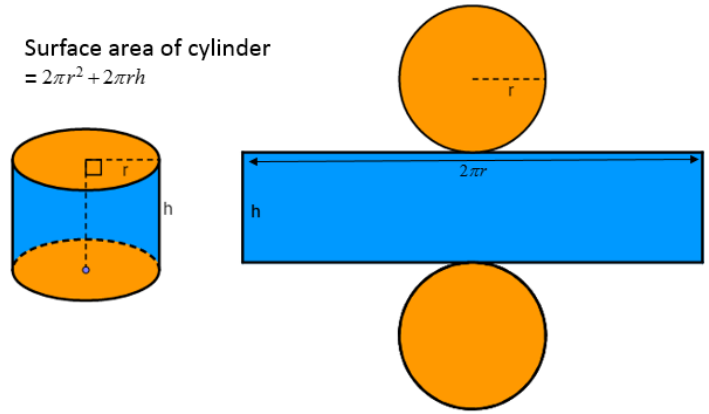


Worked Example	Your Turn
Find the diameter, x, given that the volume of the following half cylinder is $141.4\ cm^3$. Give your answer to 1 decimal place. 	Find the diameter, x, given that the volume of the following half cylinder is $1131.0\ cm^3$. Give your answer to 1 decimal place. 

Surface Area of Cylinders

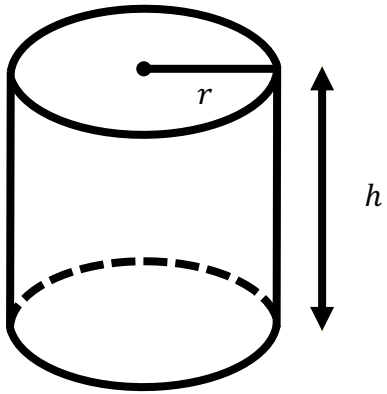
Curved Surface Area of Cylinder = 2 × π × radius × height

Curved Surface Area of Cylinder = 2πrh



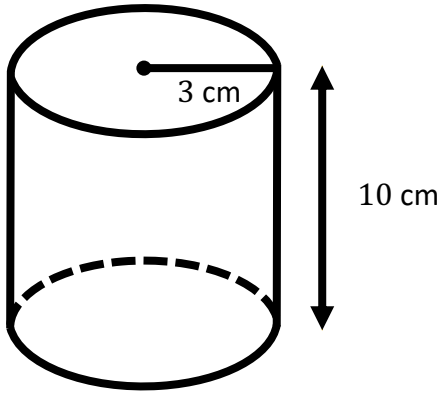
Total Surface Area of Cylinder = 2 × π × radius × height + 2 × π × radius²

Total Surface Area of Cylinder = $2\pi rh + 2\pi r^2$



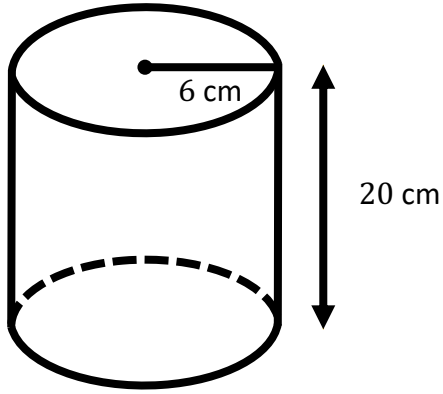
Worked Example

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



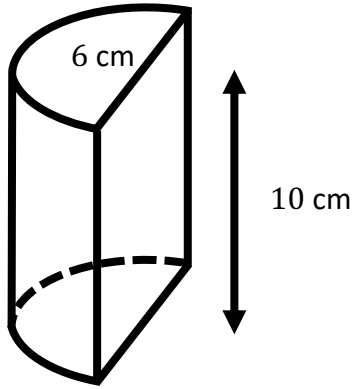
Your Turn

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



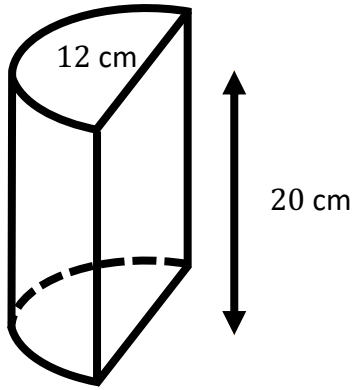
Worked Example

Calculate the total surface area of the following half cylinder.
Give your answer in terms of π and to 1 decimal place.



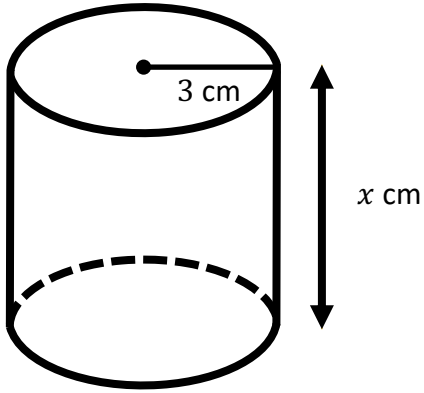
Your Turn

Calculate the total surface area of the following half cylinder.
Give your answer in terms of π and to 1 decimal place.



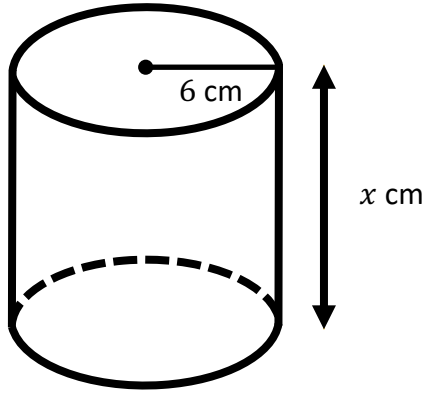
Worked Example

Find the height, x, given that the total surface area of the following cylinder is $245.0\ cm^2$. Give your answer to 1 decimal place.



Your Turn

Find the height, x, given that the total surface area of the following cylinder is $980.2\ cm^2$. Give your answer to 1 decimal place.

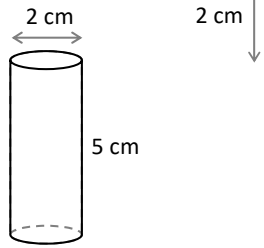


Fluency Practice

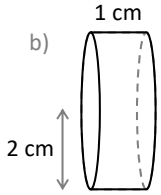
On the scale grid draw the **NET** for each type of cylinder.

Use your diagram to calculate the **surface area** of each shape.

a)

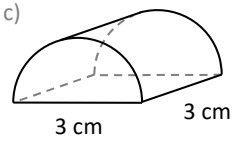


b)



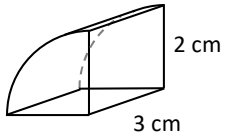
half cylinder

c)



quarter cylinder

d)



Fill in the Gaps

Radius	Height	Volume in terms of π	Volume to 3 s.f.	Curved Surface Area in terms of π	Total Surface Area in terms of π	Total Surface Area to 3 s.f.
$5\ cm$	$10\ cm$	$250\pi\ cm^3$		$100\pi\ cm^2$	$150\pi\ cm^2$	
$7\ cm$	$15\ cm$			$210\pi\ cm^2$		
$16\ mm$	$20\ mm$					
$0.6\ m$	$2.4\ m$					
$10\ cm$		$500\pi\ cm^3$				
	$12\ cm$			$192\pi\ cm^2$		
$1.5\ m$					$\frac{39}{2}\pi\ m^2$	
	$20\ mm$				$312\pi\ mm^2$	

Extra Notes

5 Area and Volume Unit Conversions

Worked Example	Your Turn
Convert: a) $7\ cm^2\ to\ mm^2$ b) $2500\ cm^2\ to\ m^2$	Convert: a) $7\ km^2\ to\ m^2$ b) $2500\ mm^2\ to\ cm^2$

Fill in the Gaps

Shape	Area in m²	Area in cm²	Area in mm²
 $2m$ $7m$			
 $3m$ $6m$			
 $3m$ $5m$			
 $?\,m$ $5m$		$200\ 000\ cm^2$	
 $3m$ $?\,m$			$21\ 000\ 000\ mm^2$
 $?\,m$ $?\,m$	$22\ m^2$		

Worked Example	Your Turn
Convert: a) $7\ cm^3\ to\ mm^3$ b) $5\ mm^3\ to\ cm^3$	Convert: a) $7\ m^3\ to\ cm^3$ b) $5\ cm^3\ to\ m^3$

Worked Example	Your Turn
Convert: a) 241 litres to cm^3 b) 83400 cm^3 to litres	Convert: a) 4500 litres to cm^3 b) $813\ 000$ cm^3 to litres

Fill in the Gaps

Area		
mm^2	cm^2	m^2
	10000	
		2
500000		
		0.07
	92000	
13000000		
	62	
		7.81
42900		
		0.363

Volume			
mm^3	cm^3	m^3	$litres$
	1000		1
7000000			
			20
		0.6	
3400000			
	28000		
		1.7	
			0.45
	379000		
8520000			

Extra Notes

6 Compound Measures

Compound measures are measures that rely on other measures:

- Speed
- Density
- Pressure

Worked Example	Your Turn
Convert 3600 metres per second to a speed in kilometres per hour	Convert 7200 metres per second to a speed in kilometres per hour

Worked Example	Your Turn
Convert 250 kilometres per hour to a speed in metres per second	Convert 750 kilometres per hour to a speed in metres per second

Speed

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Worked Example	Your Turn
A car travels 50 miles in 2 hours. What speed does it travel at?	A car travels 60 miles in 2 hours. What speed does it travel at?
A car travels at $50mph$ (miles per hour) for 2 hours. How far does it travel?	A car travels at $60mph$ (miles per hour) for 2 hours. How far does it travel?
A car travels 50 miles at $25mph$ (miles per hour). How long does it take?	A car travels 30 miles at $60mph$ (miles per hour). How long does it take?

Fill in the Gaps

Distance	Time	Speed	Units of Speed
120 km	4 $hours$		km/h
55 m	5 $seconds$		m/s
8000 m	2 $hours$		km/h
450 km	180 $minutes$		km/h
	20 $seconds$	10	m/s
	3 $hours$	25	km/h
900 cm	3 $seconds$		m/s
132 m		12	m/s
640 km		80	km/h
	120 $minutes$	65	km/h
30 m	1 $minute$		m/s
1750 cm		2.5	m/s
	150 $minutes$	88	km/h
	1.5 $minutes$	8.5	m/s
20000 m	30 $minutes$	40	

Fill in the Gaps

Distance	Time	Speed	Units of Speed
135 km	$4\frac{1}{2}$ $hours$		km/h
57.2m	5.2 $seconds$		m/s
8000 m	2 $hours$		km/h
450 km	180 $minutes$		km/h
	20 $seconds$	10.5	m/s
	3 $hours$	27.5	km/h
900 cm	3 $seconds$		m/s
170.4 m		12	m/s
348.5 km		82	km/h
	150 $minutes$	65	km/h
30 m	1 $minute$		m/s
1750 cm		2.5	m/s
	2 $hours$ 20 $minutes$	87	km/h
	1 $minute$ 18 $seconds$	8.5	m/s
358.4 $miles$	192 $minutes$		mph
20000 m	30 $minutes$	40	

Fill in the Gaps

Speed Distance Time

not simplified ⇨ *denominator of 1*

	Distance	Time	$\frac{distance}{time}$		$\frac{distance}{time}$	Speed	Compound Units
	60 kilometres	2 hours	$\frac{60}{2}$	=	$\frac{}{1}$		km/h
	80 kilometres	4	$\frac{}{4}$	=	$\frac{}{1}$		
	90 miles	6 hours		=			mph
		12 hours	$\frac{60}{}$	=	$\frac{}{1}$		kmph
	50	30 minutes	$\frac{}{0.5}$	=	$\frac{}{1}$		km/h
	7 miles	30 minutes		=	$\frac{}{1}$		mph
	20 kilometres	15 minutes		=	$\frac{}{1}$		kmph
	60		$\frac{}{1.5}$	=			km/h
	75	2 hours 30 minutes		=	$\frac{}{1}$		kph
	36 miles	4 hours 30 minutes		=	$\frac{}{1}$		
		45 minutes	$\frac{9}{}$	=			km/h
			$\frac{36}{0.75}$	=			kmph
	12 miles	minutes	$\frac{}{0.1}$	=	$\frac{}{1}$		mph
	32	24 minutes		=	$\frac{}{1}$		km/h
	392	2 hours 48 minutes		=			kph

Fill in the Gaps

Sporting Speeds				
Sport	**Distance**	**Time**	**Speed (km/h)**	**Speed (m/s)**
Adam Peaty Swimming 	$100\ m$	$56.88\ seconds$	$6.33\ km/h$	
Battaash Horse Racing 	$1\ km$	$50.9\ seconds$		
Mark Cavendish Cycling 	$200\ m$			$21.7\ m/s$
Rafael Nadal's Tennis Ball 		$0.47\ seconds$		$50\ m/s$
Usain Bolt 100 m Sprint 	$100\ m$	$9.58\ seconds$		
Max Verstappen Formula 1 		$1\ minute$ $14\ seconds$	$157.8\ km/h$	
Lionel Messi's Football 	$23.4\ m$		$130\ km/h$	
Mo Farah Marathon 	$42.24\ km$	$2\ hours\ 10\ min$ $28\ seconds$		

Worked Example	Your Turn
John travels 94 miles at a speed of 47 mph. John then travels 115 miles at a speed of 46 mph. Work out John's overall speed for the entire journey. Give your answer correct to 1 decimal place.	Fred travels 105 km at a speed of 35 km/h. Fred then travels 126 km at a speed of 60 km/h. Work out Fred's overall speed for the entire journey. Give your answer correct to 1 decimal place.

Density

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Worked Example	Your Turn
The mass of an object is $50\ g$. The volume is $10\ cm^3$. What is the density of the object?	The mass of an object is $100\ g$. The volume is $25\ cm^3$. What is the density of the object?
The density of an object is $10\ g/cm^3$. The volume is $5\ cm^3$. What is the mass?	The density of an object is $10\ g/cm^3$. The volume is $25\ cm^3$. What is the mass?
The density of an object is $10\ g/cm^3$. The mass is $50\ g$. What is the volume?	The density of an object is $10\ g/cm^3$. The mass is $25\ g$. What is the volume?

Worked Example	Your Turn
Liquid A has a density of 1.15 g/cm^3. Liquid B has a density of 1.23 g/cm^3. 76 cm^3 of liquid A and 116 cm^3 of liquid B are mixed to make liquid C. Work out the density of liquid C. Give your answer correct to 2 decimal places.	Liquid A has a density of 1.11 g/cm^3. Liquid B has a density of 1.3 g/cm^3. 41 cm^3 of liquid A and 143 cm^3 of liquid B are mixed to make liquid C. Work out the density of liquid C. Give your answer correct to 2 decimal places.

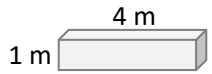
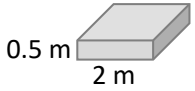
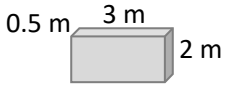
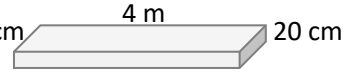
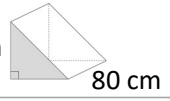
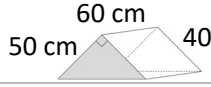
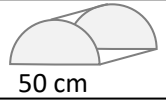
Pressure

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

Worked Example	Your Turn
The force exerted by an object on a surface is $50N$. The surface area in contact with the object is $10cm^2$. What is the pressure exerted by the object?	The force exerted by an object on a surface is $100N$. The surface area in contact with the object is $25cm^2$. What is the pressure exerted by the object?
The pressure exerted on a surface by an object is $50N/cm^2$. The surface area in contact with the object is $10cm^2$. What is the force exerted?	The pressure exerted on a surface by an object is $100N/cm^2$. The surface area in contact with the object is $25cm^2$. What is the force exerted?
The pressure exerted on a surface by an object is $50N/cm^2$. The force exerted on the surface is $10N$. What is the surface area in contact with the object?	The pressure exerted on a surface by an object is $100N/cm^2$. The force exerted on the surface is $25N$. What is the surface area in contact with the object?

Fill in the Gaps

Cuboid Compound Measures The objects are resting on Earth (Gravitational acceleration = 10 m/s^2). Answer to 3 sf.

	Object	Mass	Volume	Density	Force (Weight)	Contact Area	Pressure
1	square-based 	400 kg					
2	cube 	1,000 kg	8 m^3				
3	cube 50 cm 	3 kg					
4	square-based 		12 m^3		500 N		
5		20 kg				6 m^2	
6		20 kg					
7					1,500 N		
8	isosceles 	4 kg					
9		3.5 kg					
10					8 N		40 N/m^2

Fill in the Gaps

Mass	Volume	Density	
$500\ g$	$200\ cm^3$		g/cm^3
$6.2\ kg$	$0.004\ m^3$		kg/m^3
$1.6\ kg$		2000	kg/m^3
	$2.25\ cm^3$	1.6	g/cm^3
	$0.2\ m^3$	750	kg/m^3
$264\ g$		0.88	g/cm^3
$0.24\ kg$	$400\ cm^3$		g/cm^3
$56000\ g$		800	kg/m^3
	$400000\ cm^3$	2180	kg/m^3
$8000\ g$	$0.0025\ m^3$		g/cm^3
$13.8\ kg$	$0.015\ m^3$		g/cm^3

Force	Area	Pressure	
$7\ N$	$0.4\ m^2$		N/m^2
$60\ N$	$2.4\ m^2$		N/m^2
	$0.06\ m^2$	70	N/m^2
$56\ N$		32	N/m^2
	$0.001\ m^2$	3800	N/m^2
$99\ N$		450	N/m^2
$85\ N$	$20000\ cm^2$		N/m^2
	$80000\ cm^2$	12.75	N/m^2
$174\ N$	$725\ cm^2$		N/m^2
$135\ N$	$5000000\ mm^2$		N/m^2
	$3600\ mm^2$	1850	N/m^2

Extra Notes