Year 9
Mathematics
CATCH UP

Name: _____

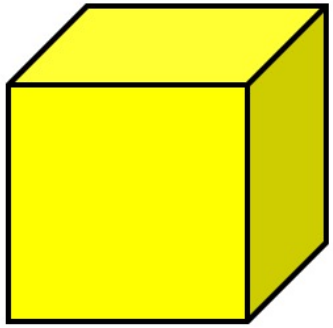
Class: _____

Contents Page

Please see catch up course on drfrostmaths.com

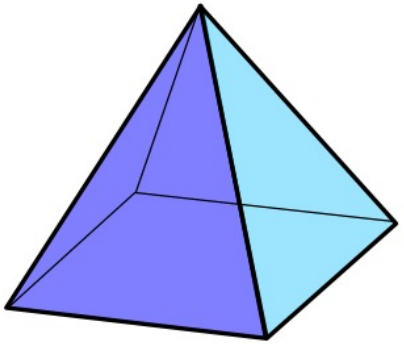
1 Properties of 3D Shapes

Cube

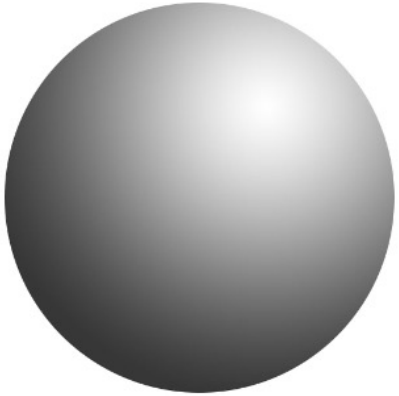


Cuboid

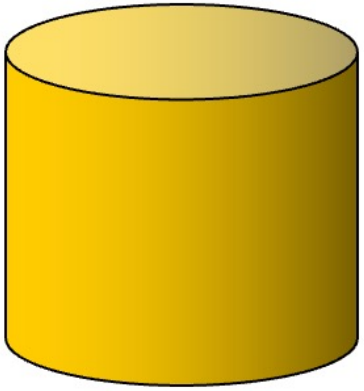
Square-based pyramid



Sphere



Cylinder



Cone

Edges, Faces and Vertices

Faces

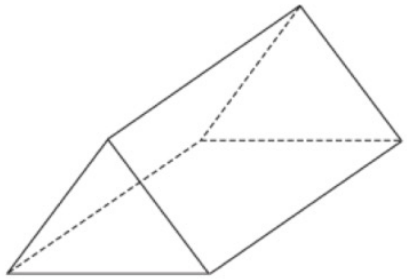
A face is a flat or curved surface on a 3D shape.

Edges

An edge is where two faces meet.

Vertices

A vertex is a corner where edges meet. The plural is vertices.

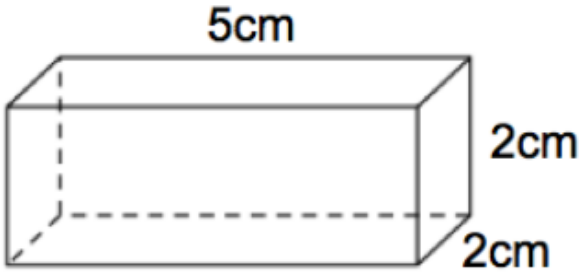
Worked Example	Your Turn
For the cuboid, write down the:  Number of faces (F) The number of edges (E) The number of vertices (V) Calculate $V - E + F$	For the triangular prism, write down the:  Number of faces (F) The number of edges (E) The number of vertices (V) Calculate $V - E + F$

Nets

A net shows what a 3D solid could look like if ‘unfolded’ and laid out flat

Worked Example

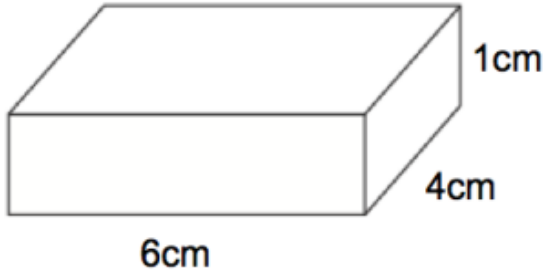
Draw a net for the cuboid.



Each square represents 1 cm^2

Your Turn

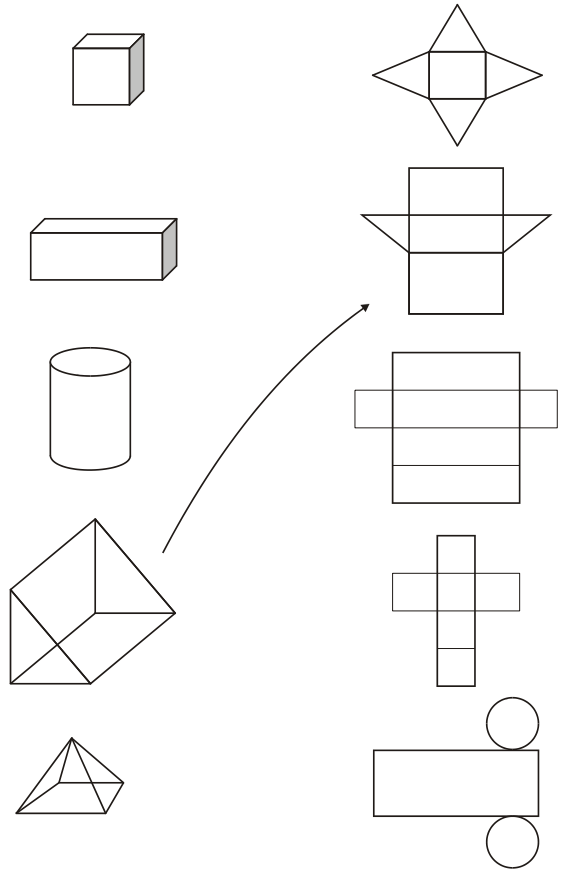
Draw a net for the cuboid.



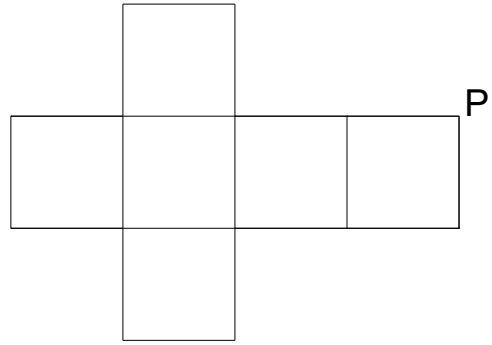
Each square represents 1 cm^2

Fluency Practice

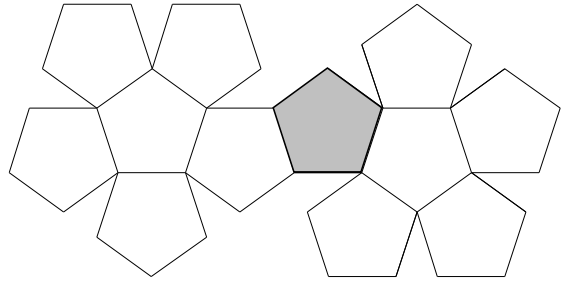
1. Match the 3D solids with their net



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

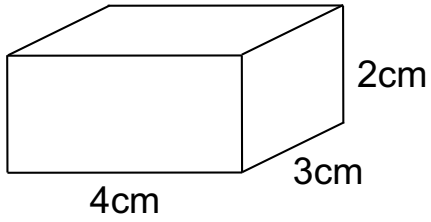


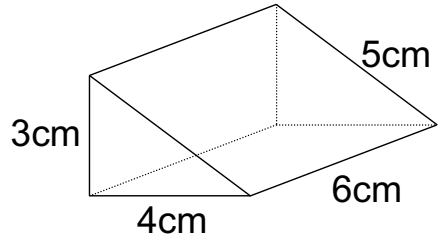
3. The net shown is folded to make a dodecahedron. Label the face which is opposite the shaded one



Fluency Practice

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



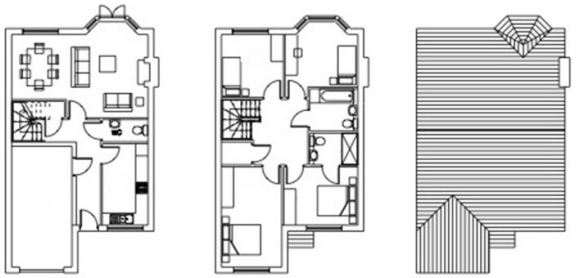


2 Plans and Elevations

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

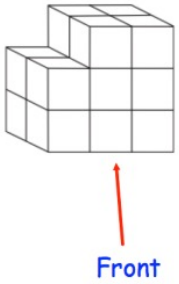
side elevation

back elevation

side elevation

Worked Example

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



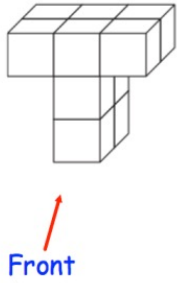
Front:

Side:

Plan:

Your Turn

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



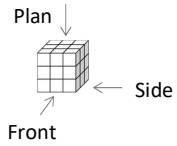
Front:

Side:

Plan:

Fluency Practice

Cutting Cubes 3 × 3 × 3



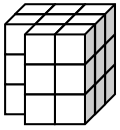
Draw the plan and elevations for each cube.

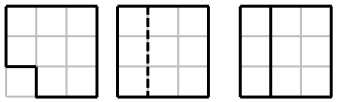
Solid line = a visible edge
Dashed line = a hidden edge

If we can see where all the missing cubes have been removed, we assume…?

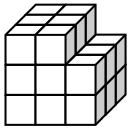
①

Ex.)



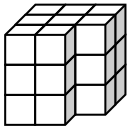


a)



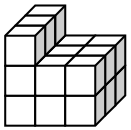
Plan | Side Elevation | Front Elevation

b)



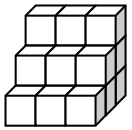
Plan | Side Elevation | Front Elevation

c)



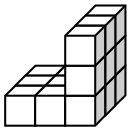
Plan | Side Elevation | Front Elevation

d)



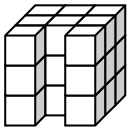
Plan | Side Elevation | Front Elevation

e)



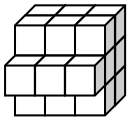
Plan | Side Elevation | Front Elevation

f)



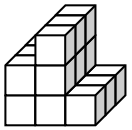
Plan | Side Elevation | Front Elevation

g)



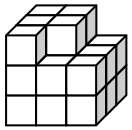
Plan | Side Elevation | Front Elevation

h)



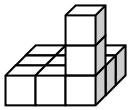
Plan | Side Elevation | Front Elevation

i)



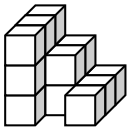
Plan | Side Elevation | Front Elevation

j)



Plan | Side Elevation | Front Elevation

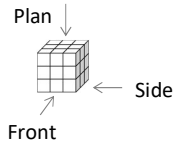
k)



Plan | Side Elevation | Front Elevation

Fluency Practice

Cutting Cubes 3 × 3 × 3



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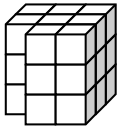
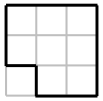
②

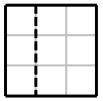
Ex.)



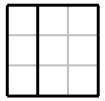
Plan



Side Elevation



Front Elevation



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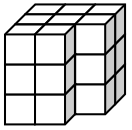
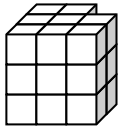


Plan

Side Elevation

Front Elevation

b)

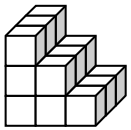


Plan

Side Elevation

Front Elevation

c)

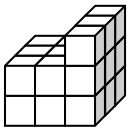


Plan

Side Elevation

Front Elevation

d)

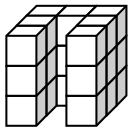


Plan

Side Elevation

Front Elevation

e)

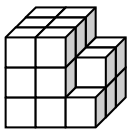


Plan

Side Elevation

Front Elevation

f)

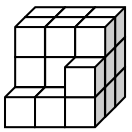


Plan

Side Elevation

Front Elevation

g)

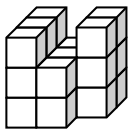


Plan

Side Elevation

Front Elevation

h)

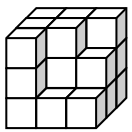


Plan

Side Elevation

Front Elevation

i)

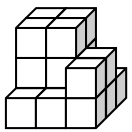


Plan

Side Elevation

Front Elevation

j)

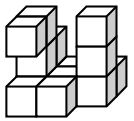


Plan

Side Elevation

Front Elevation

k)



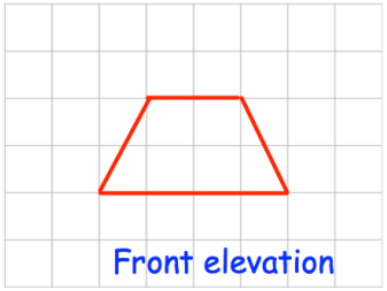
Plan

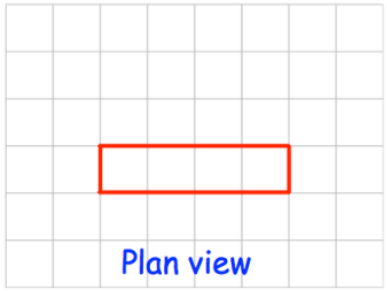
Side Elevation

Front Elevation

Worked Example

Given the elevations



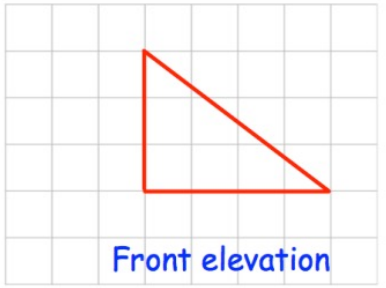


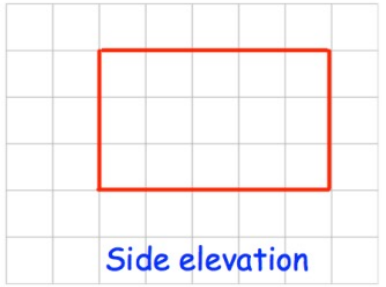
Draw the plan view

Sketch the solid shape

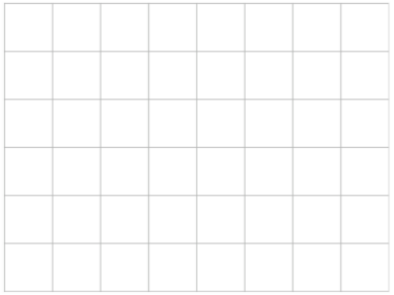
Your Turn

Given the elevations





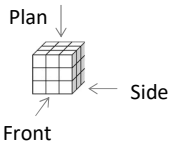
Draw the plan view



Sketch the solid shape

Fluency Practice

Counting Cubes
3 × 3 × 3

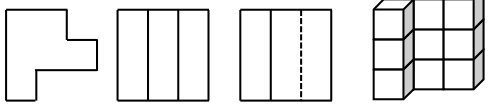


The plans & elevations for different shapes are shown.

How many cubes are in each shape?

EX.)

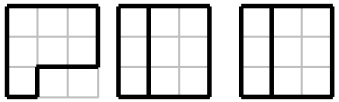
Plan | Side Elevation | Front Elevation



18 cubes

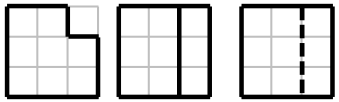
a)

Plan | Side Elevation | Front Elevation



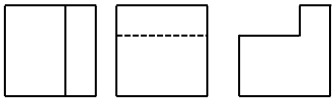
b)

Plan | Side Elevation | Front Elevation



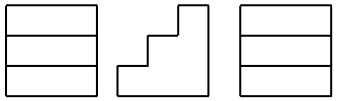
c)

Plan | Side Elevation | Front Elevation



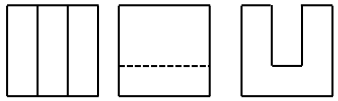
d)

Plan | Side Elevation | Front Elevation



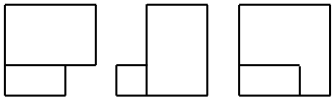
e)

Plan | Side Elevation | Front Elevation



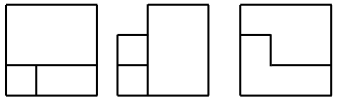
f)

Plan | Side Elevation | Front Elevation



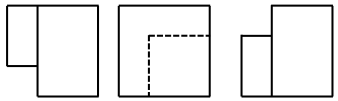
g)

Plan | Side Elevation | Front Elevation



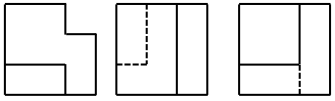
h)

Plan | Side Elevation | Front Elevation



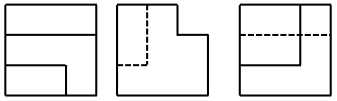
i)

Plan | Side Elevation | Front Elevation



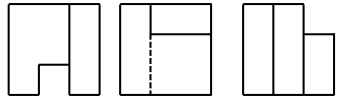
j)

Plan | Side Elevation | Front Elevation



k)

Plan | Side Elevation | Front Elevation



3 Volume and Surface Area of Prisms

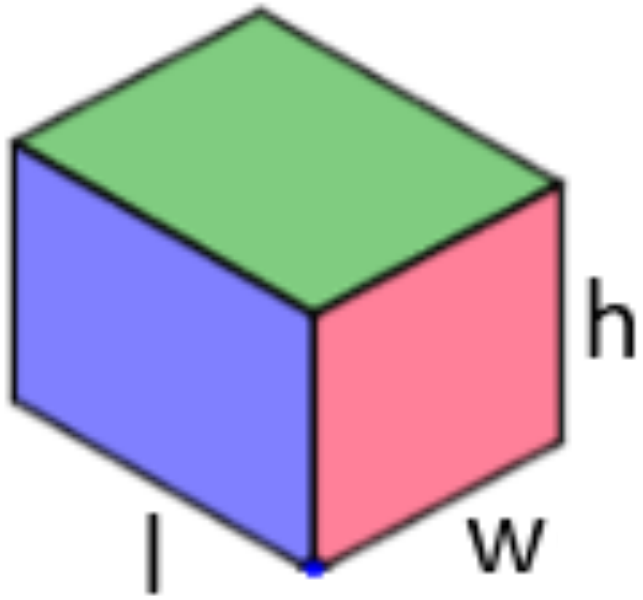
Volume is the amount of space an object takes up.

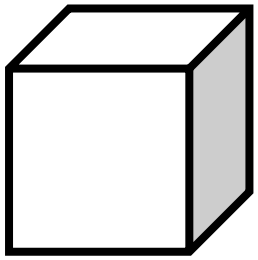
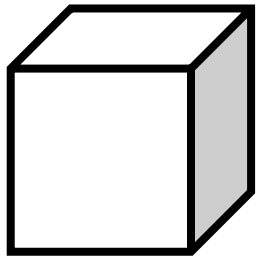
Surface Area is the total area across the surface.

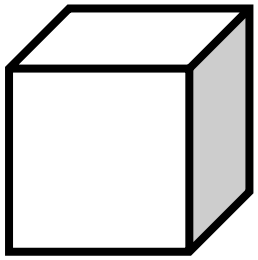
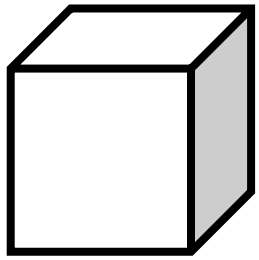
Volume of Cuboids

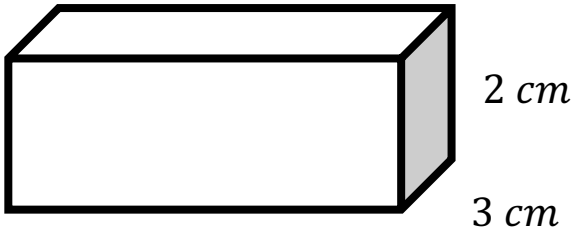
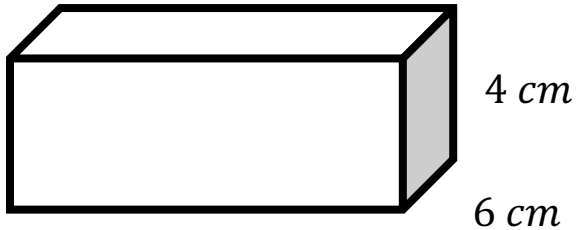
Volume of Cuboid = Length × Width × Height

Volume of Cuboid = l × w × h



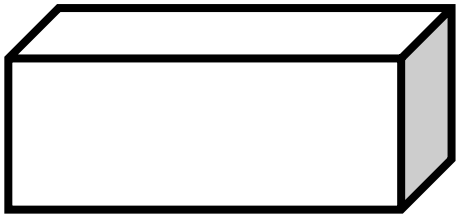
Worked Example	Your Turn
Calculate the volume of the cube:  $3\ cm$	Calculate the volume of the cube:  $5\ cm$

Worked Example	Your Turn
Find x, given that the volume of the cube is $27\ cm^3$  $x\ cm$	Find x, given that the volume of the cube is $125\ cm^3$  $x\ cm$

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 $60\ cm^3$



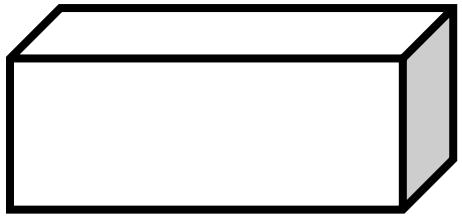
$2\ cm$

$3\ cm$

$x\ cm$

Your Turn

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



$4\ cm$

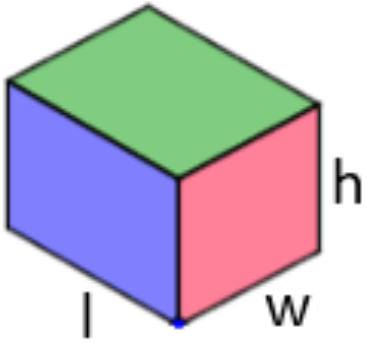
$x\ cm$

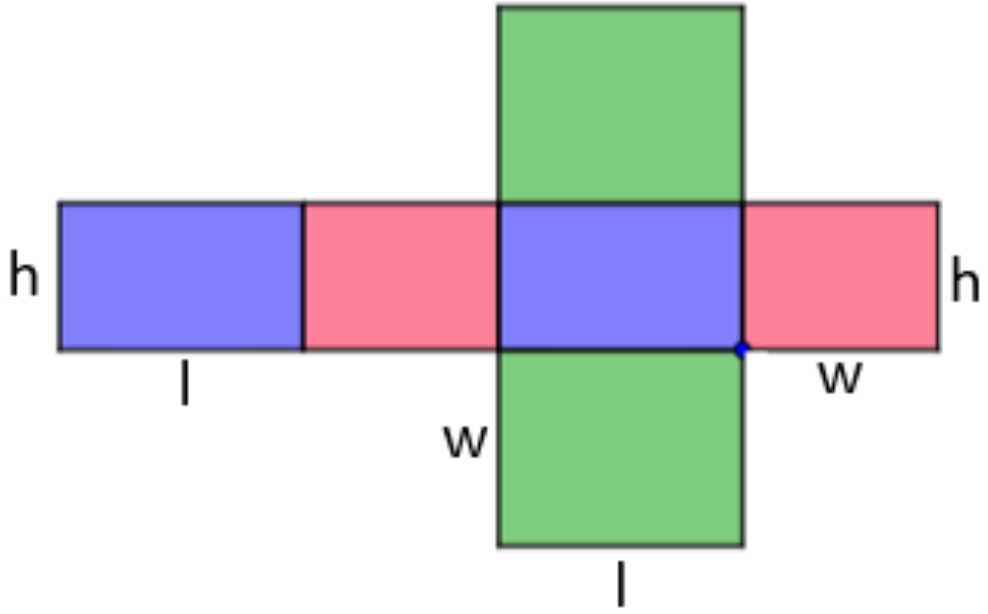
$20\ cm$

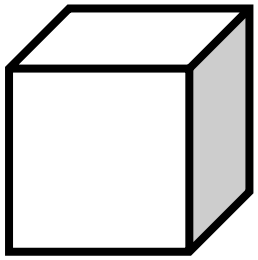
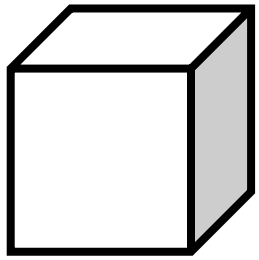
Surface Area of Cuboids

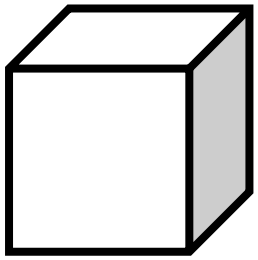
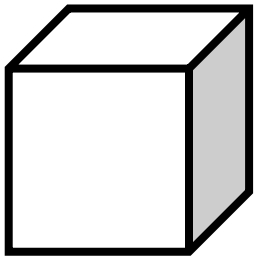
Surface Area of Cuboid = $2 \times \text{Length} \times \text{Width} + 2 \times \text{Length} \times \text{Height} + 2 \times \text{Width} \times \text{Height}$

Surface Area of Cuboid = $2lw + 2lh + 2wh$



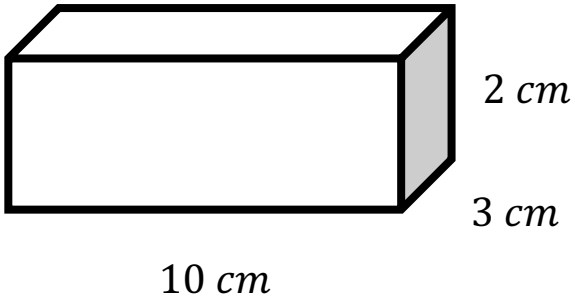


Worked Example	Your Turn
Calculate the surface area of the cube:  $3\ cm$	Calculate the surface area of the cube:  $5\ cm$

Worked Example	Your Turn
Find x,given that the total surface area of the cube is $54\ cm^2$:  $x\ cm$	Find x,given that the total surface area of the cube is $150\ cm^2$:  $x\ cm$

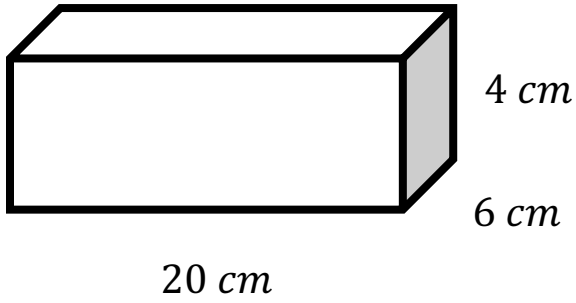
Worked Example

Calculate the total surface area of the cuboid:



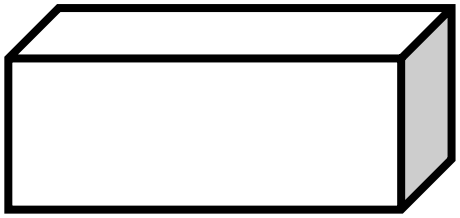
Your Turn

Calculate the total surface area of the cuboid:



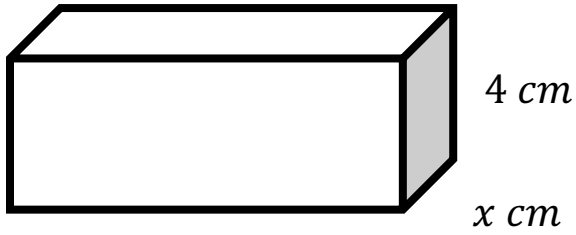
Worked Example

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



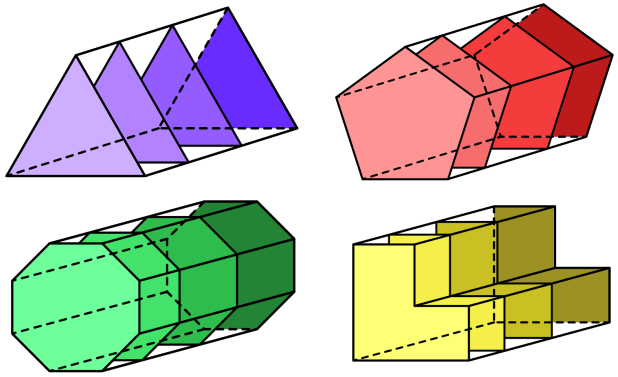
Your Turn

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



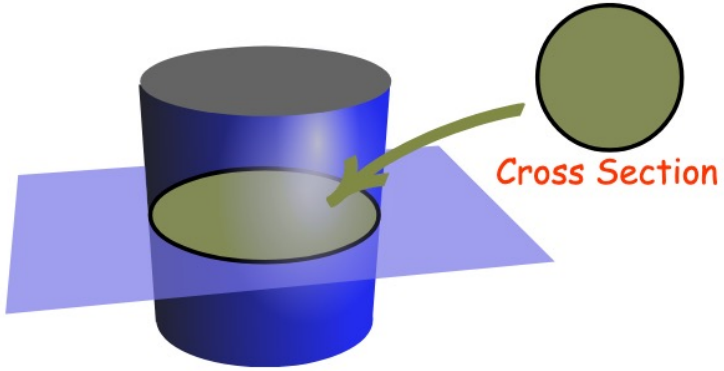
Prisms

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

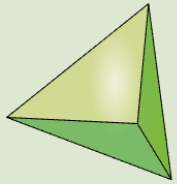
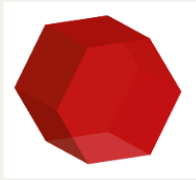
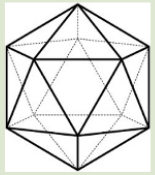
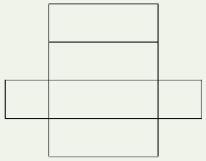
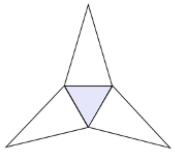


Cross-Section

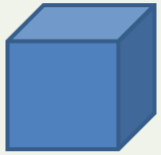
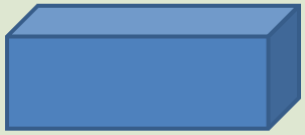
It is the shape made when a solid is cut through parallel to the base.

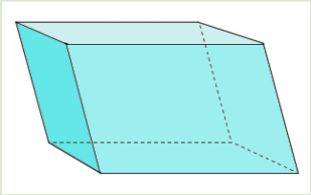
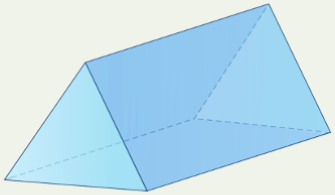
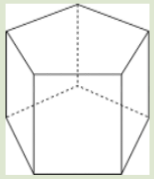
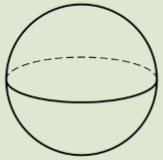


What is a Prism?

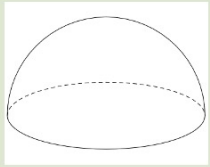
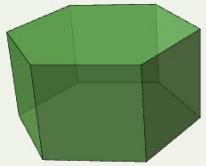
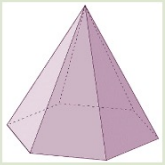
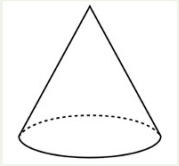
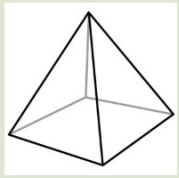
Shape	Prism?
	
	
	
Net 	
Net 	

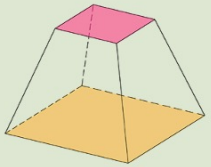
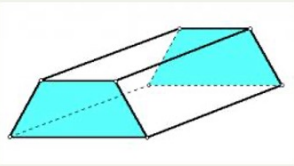
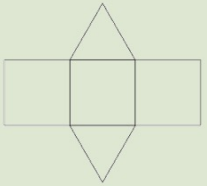
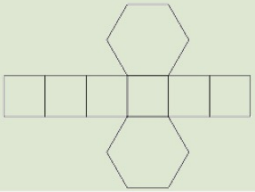
Fluency Practice

Shape	Prism?
	
	
	
	
	

Shape	Prism?
	
	
	
	
	

Fluency Practice

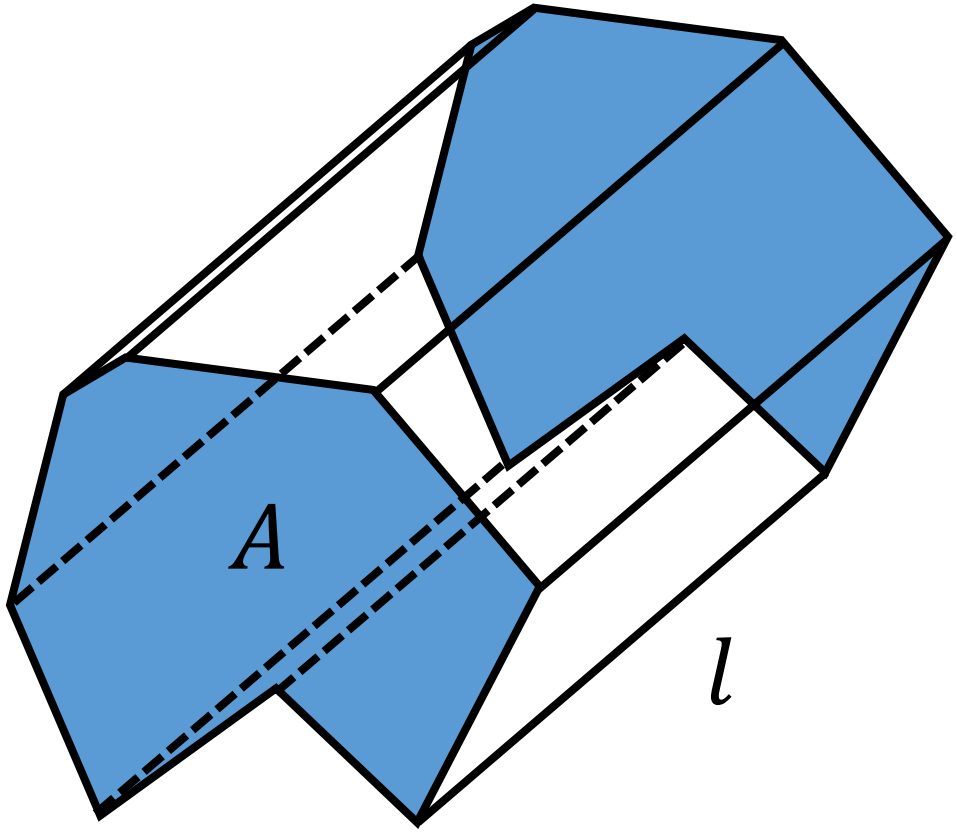
Shape	Prism?
	
	
	
	
	

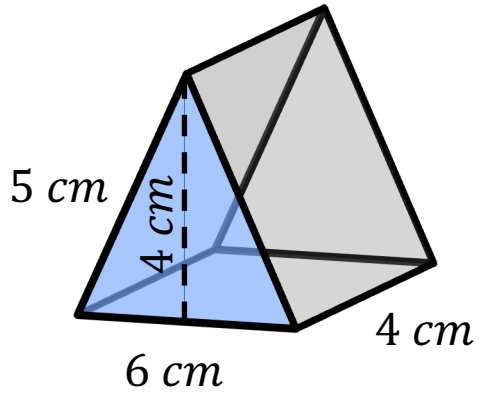
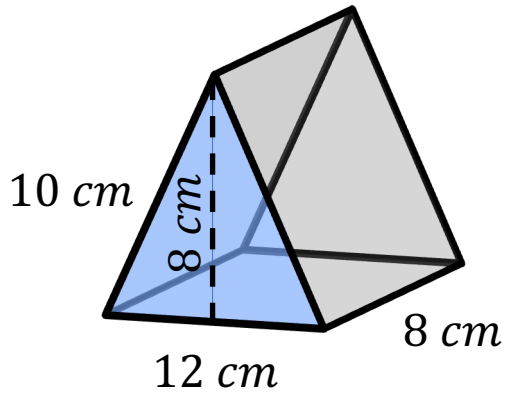
Shape	Prism?
	
	
Net 	
Net 	
Net 	

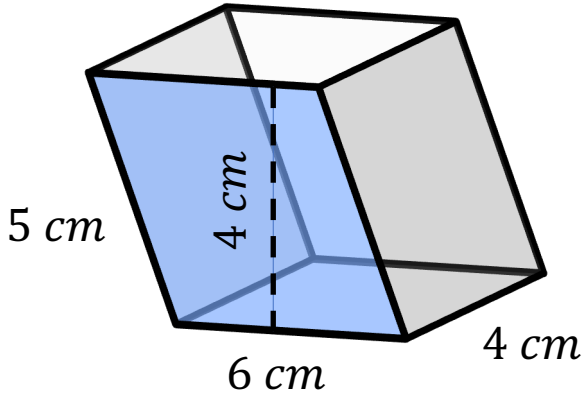
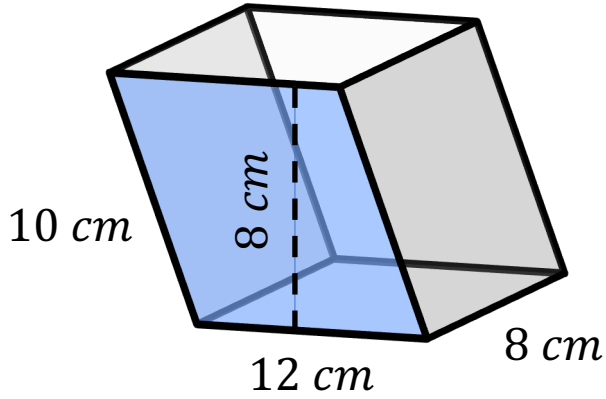
Volume of Prisms

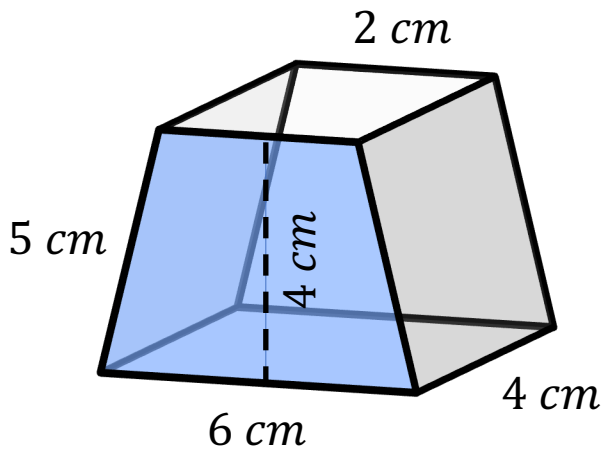
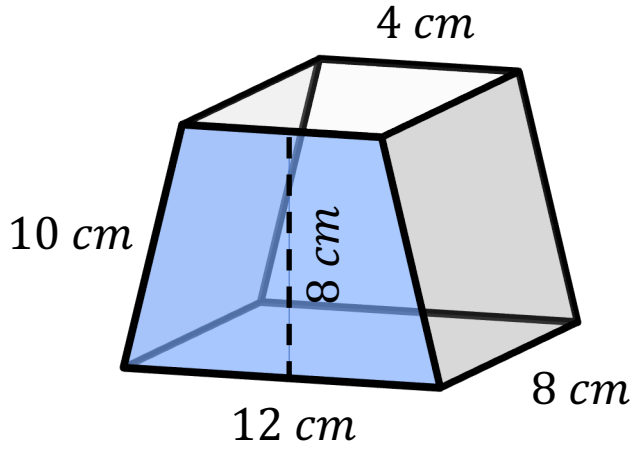
Volume of Prism = Area of Cross Section × Length

Volume of Prism = A × l



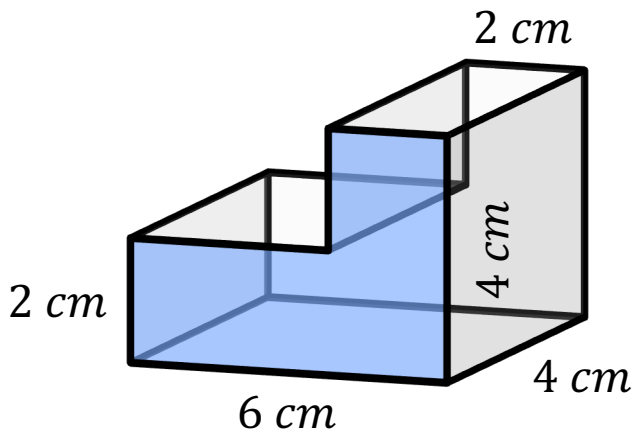
Worked Example	Your Turn
Calculate the volume of the triangular prism:  	Calculate the volume of the triangular prism: 

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: 

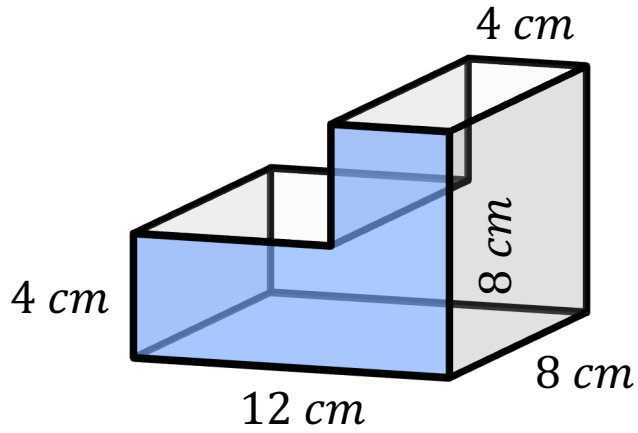
Worked Example

Calculate the volume of the trapezium prism:

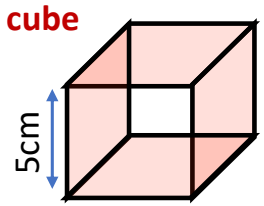


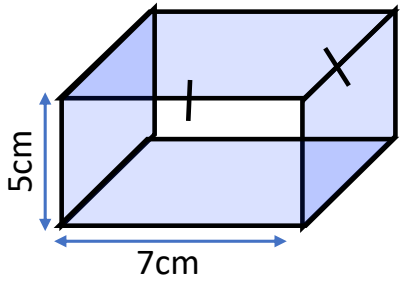
Your Turn

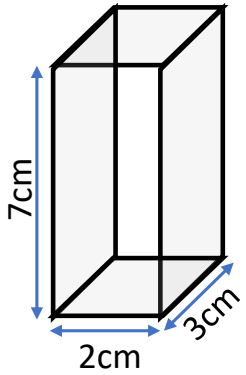
Calculate the volume of the trapezium prism:

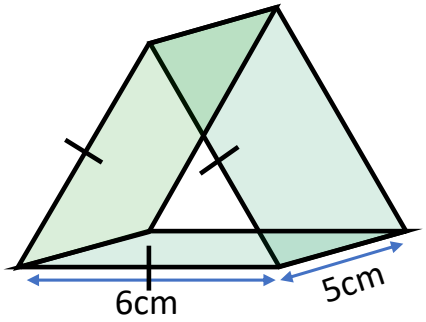


Tubes





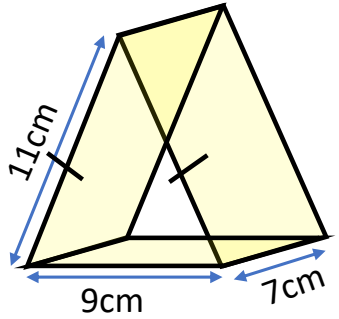


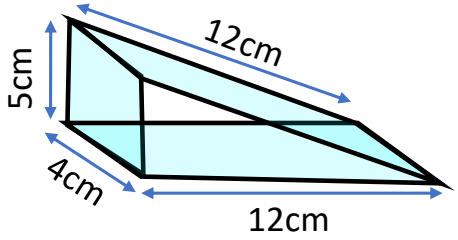


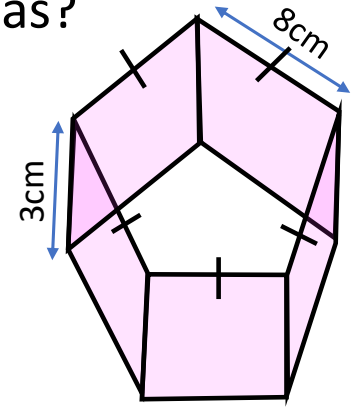
Here are 7 prism “tubes”

Calculate the area of the net that makes each of the 7 tubes

Is there are quick way the find the areas?



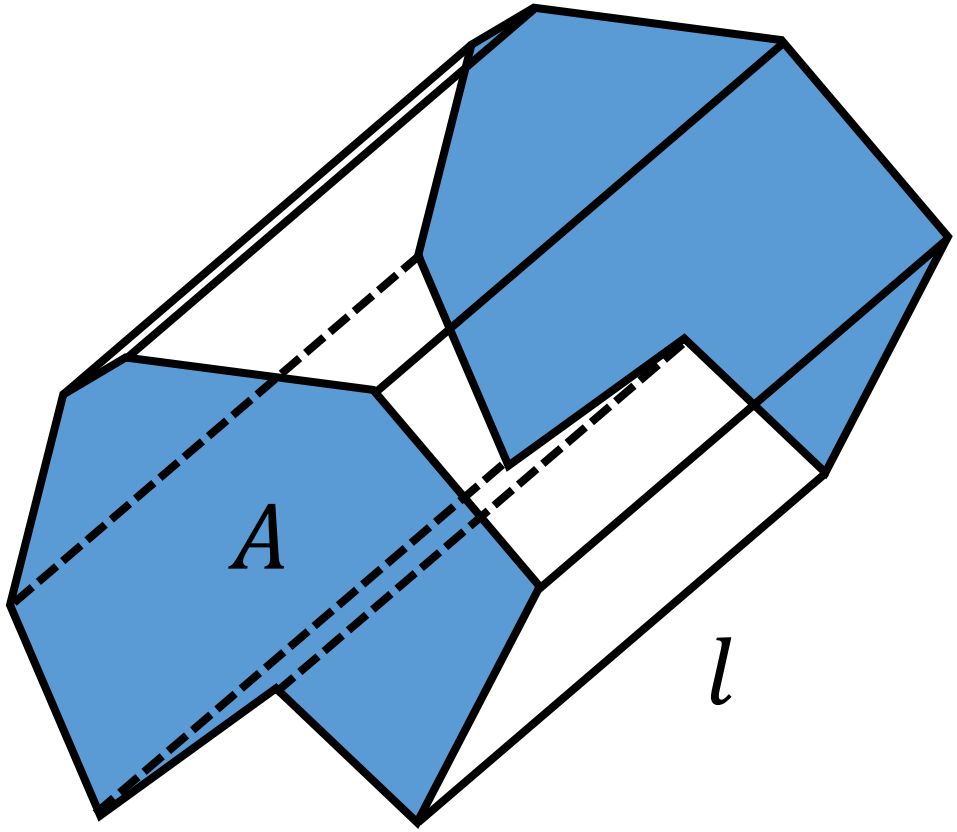


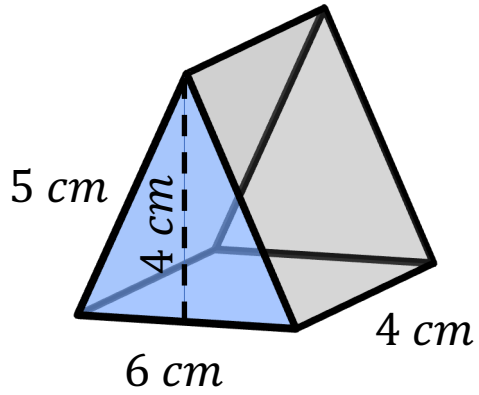
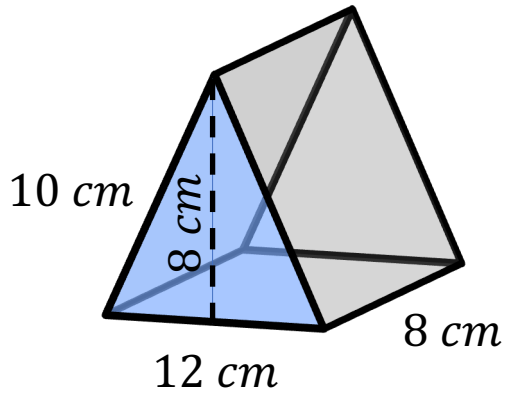


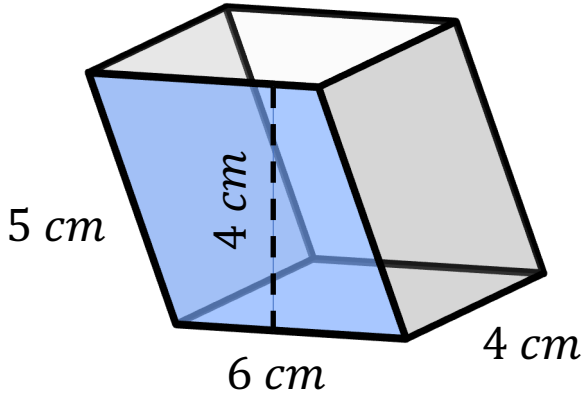
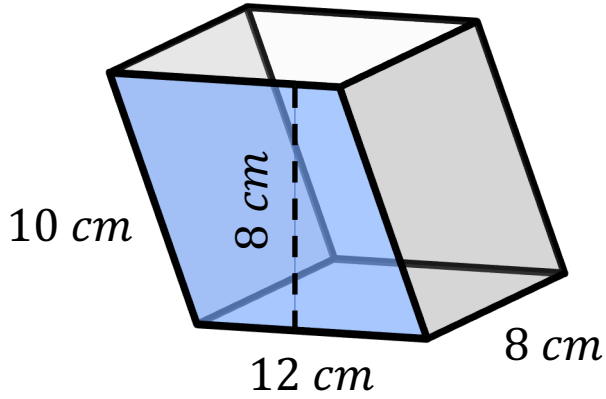
Surface Area of Prisms

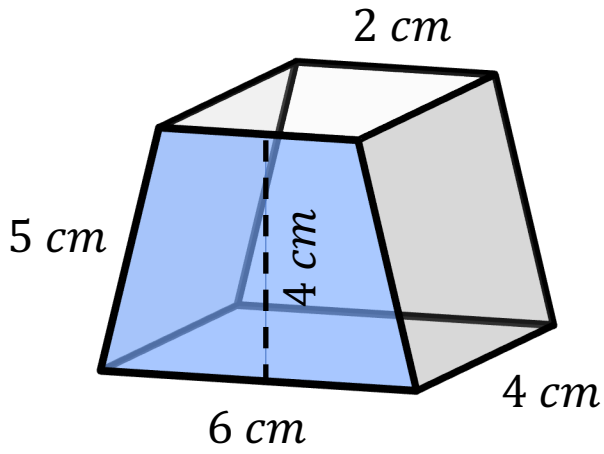
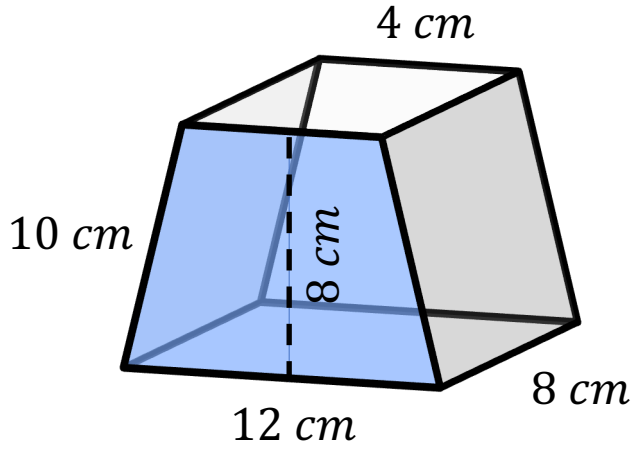
Surface Area of Prism $= 2 \times$ Area of Cross Section $+$ Length $\times$ Perimeter of Cross Section

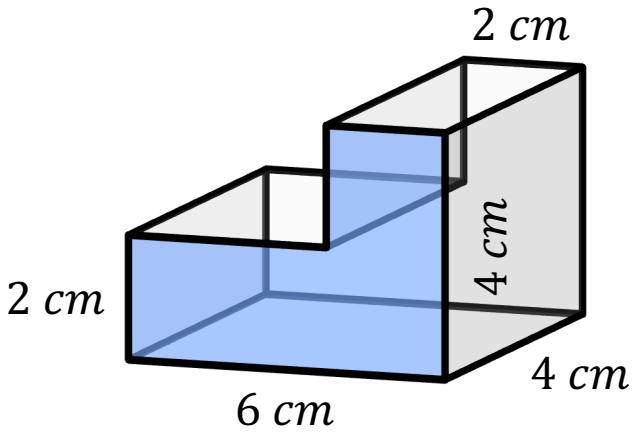
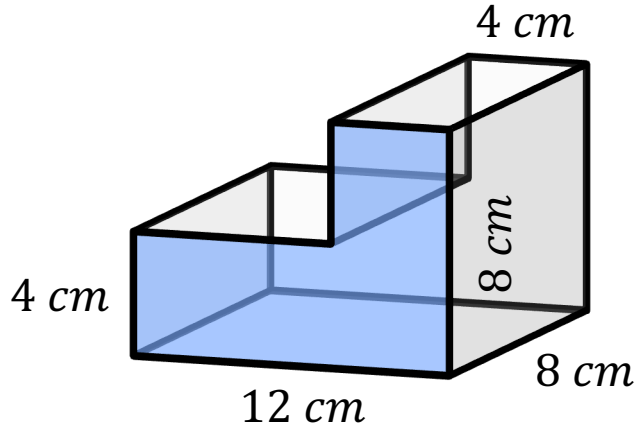
Surface Area of Prism $= 2A + LP$



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: 

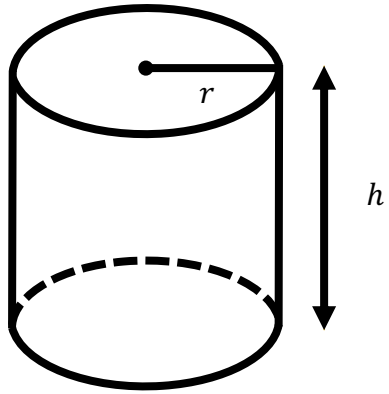
Worked Example	Your Turn
Calculate the surface area of the L-shaped prism:  	Calculate the surface area of the L-shaped prism: 

Volume of Cylinders

Volume of Cylinder = Area of circle × height

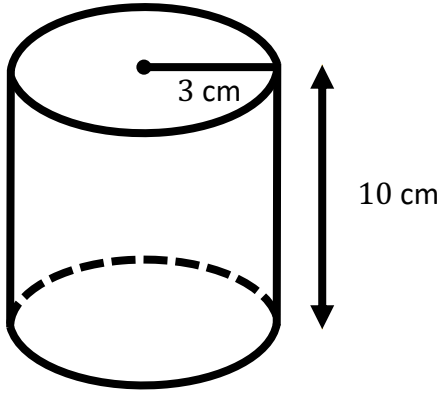
Volume of Cylinder = $\pi \times \text{radius}^2 \times \text{height}$

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



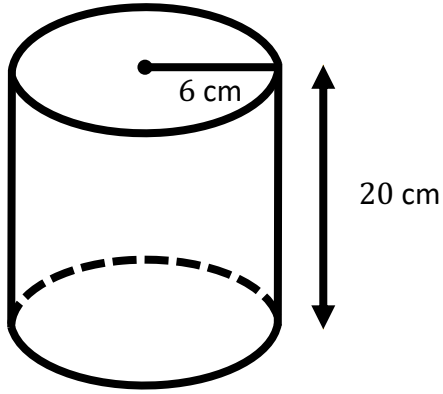
Worked Example

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



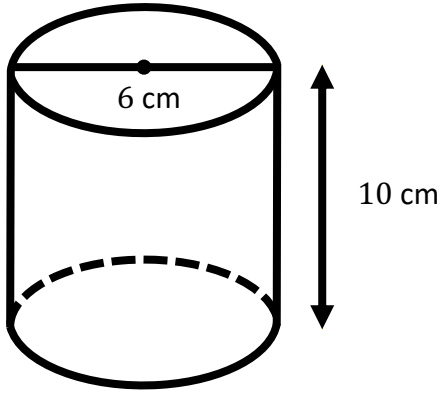
Your Turn

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



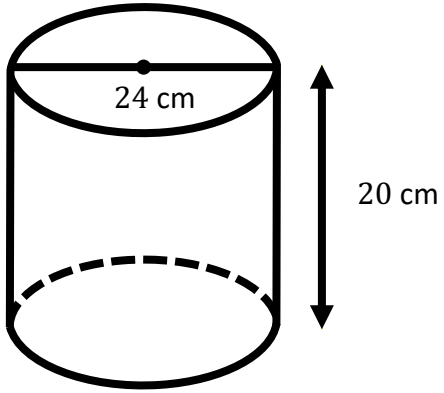
Worked Example

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



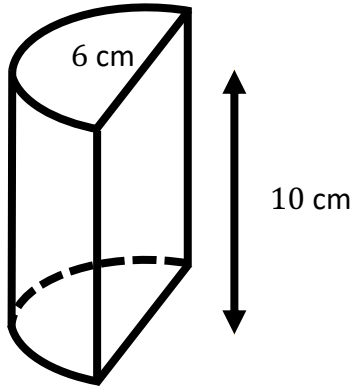
Your Turn

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



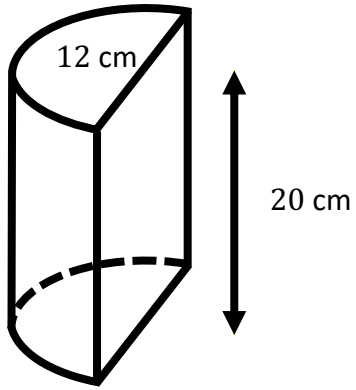
Worked Example

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



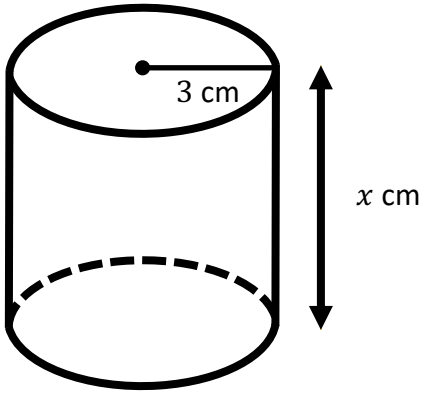
Your Turn

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



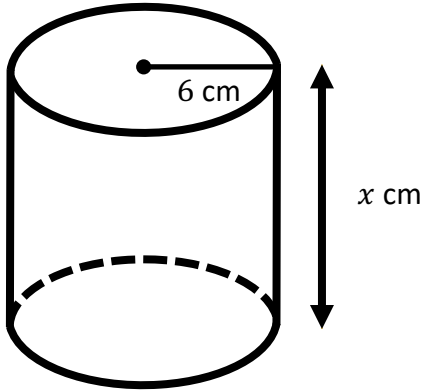
Worked Example

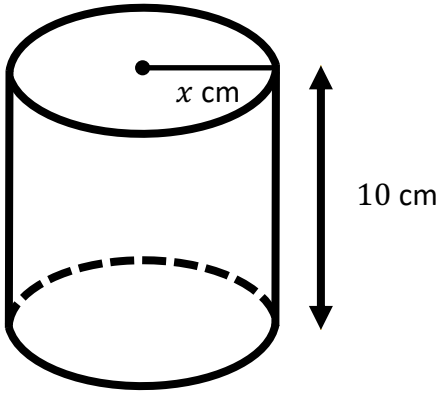
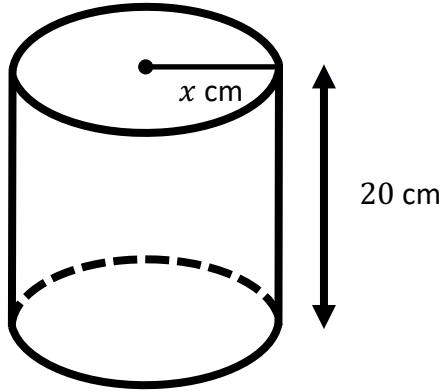
Find the height, x, given that the volume of the following cylinder is $282.7\ cm^3$. Give your answer to 1 decimal place.



Your Turn

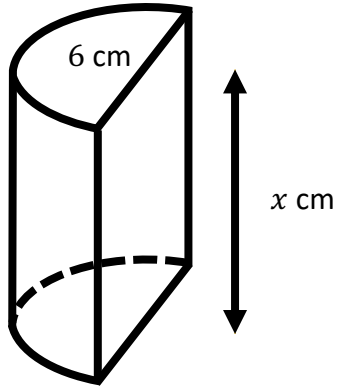
Find the height, x, given that the volume of the following cylinder is $2261.9\ cm^3$. Give your answer to 1 decimal place.



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. 

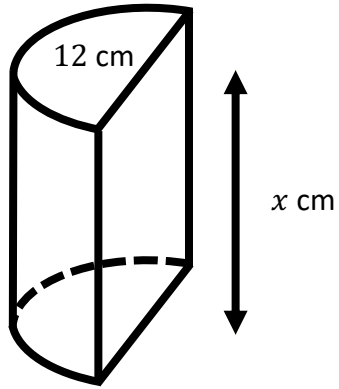
Worked Example

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.



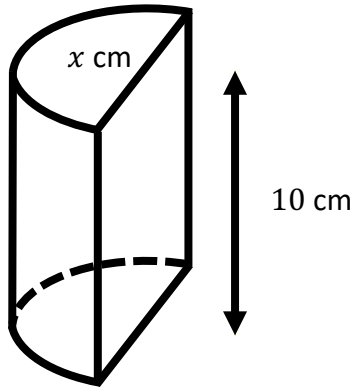
Your Turn

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.



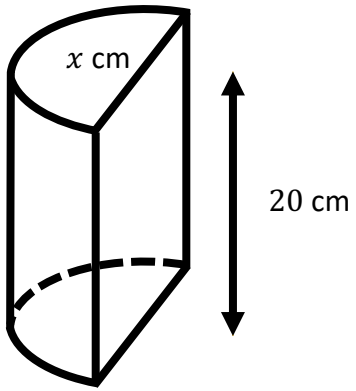
Worked Example

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.



Your Turn

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.



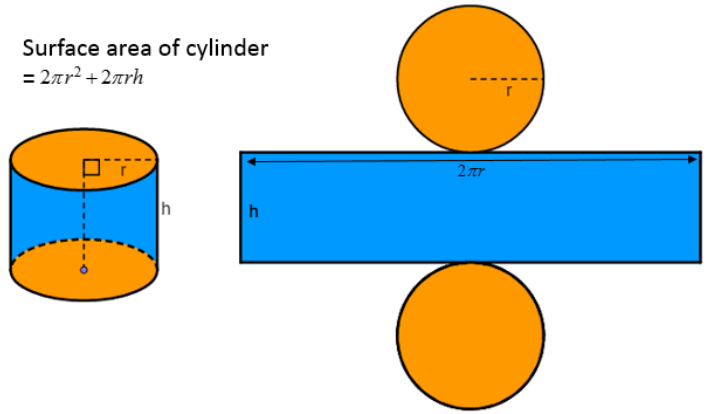
Surface Area of Cylinders

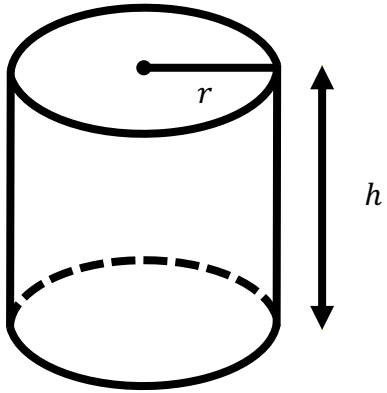
Curved Surface Area of Cylinder = $2 \times \pi \times$ radius $\times$ height

Curved Surface Area of Cylinder = $2\pi rh$

Total Surface Area of Cylinder = $2 \times \pi \times$ radius $\times$ height $+ 2 \times \pi \times$ radius^2

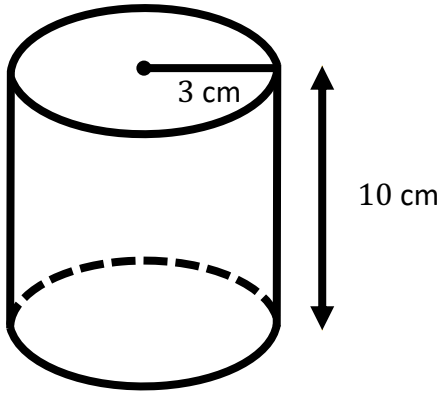
Total Surface Area of Cylinder = $2\pi rh + 2\pi r^2$





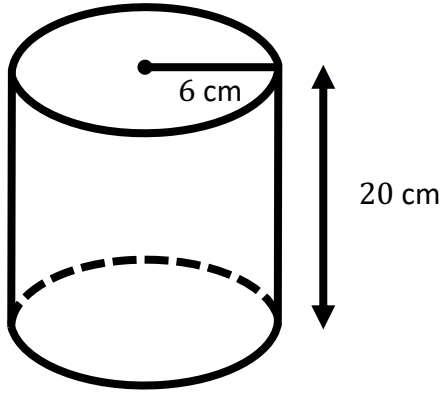
Worked Example

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



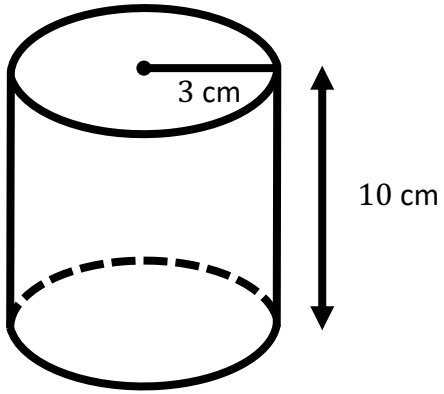
Your Turn

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



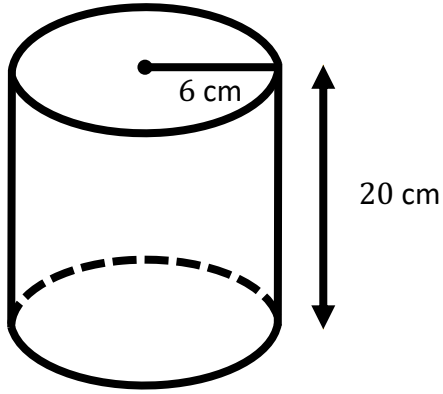
Worked Example

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



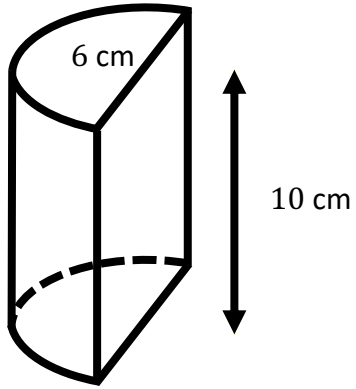
Your Turn

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



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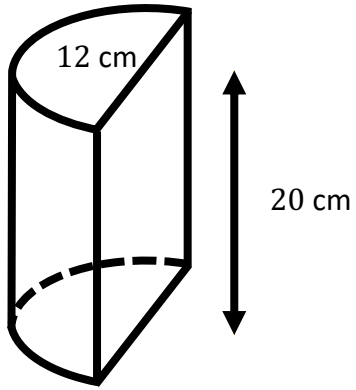
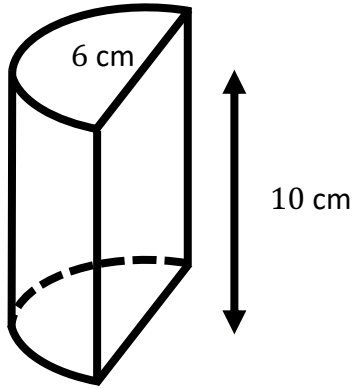


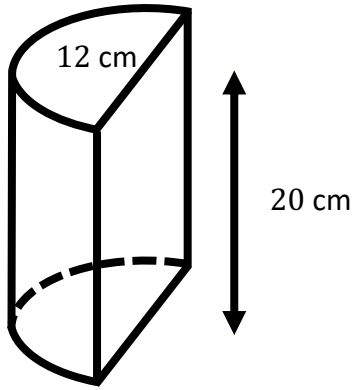
Worked Example

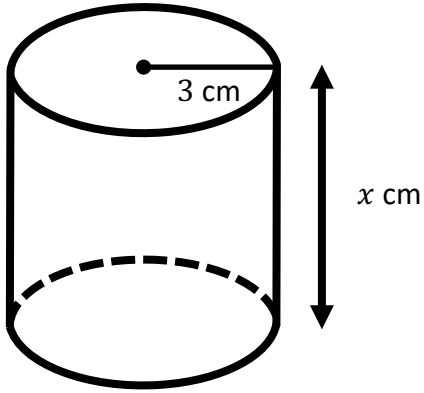
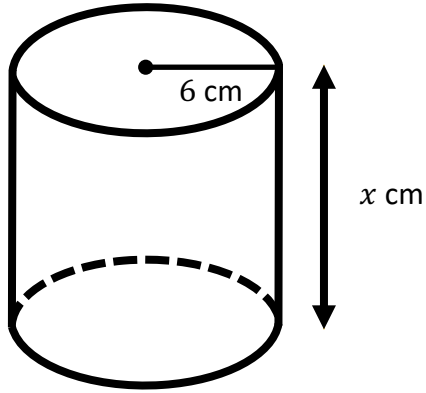
Calculate the total surface area of the following half cylinder.
Give your answer in terms of π and to 1 decimal place.



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	Your Turn
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. 	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. 

4 Area and Volume Unit Conversions

Units of Length Recap

$1\ km\ =\ 1{,}000\ m$

$1\ m\ =\ 100\ cm$

$1\ cm\ =\ 10\ mm$

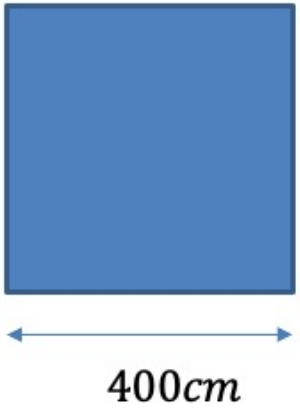
Fill in the Gaps

Q	km	m	cm	mm
1	1			
2		1		
3			1	
4				1
5				10
6			17	
7		1.7		
8	1.07			
9	0.07			
10		0.07		
11			0.07	
12		$\frac{1}{3}$		
13		n		

Let's consider this square.

$$Area = 4 \times 4 = 16m^2$$

Imagine we want to convert the area of this shape into cm^2. What scale factor would we use?



$$Area = 400 \times 400$$

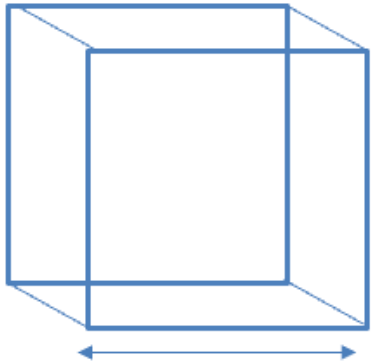
$$Area = 160{,}000cm^2$$

Is this what we expected?

Our scale factor is not 100, but 10,000. 100^2

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) $2500\ mm^2\ to\ cm^2$

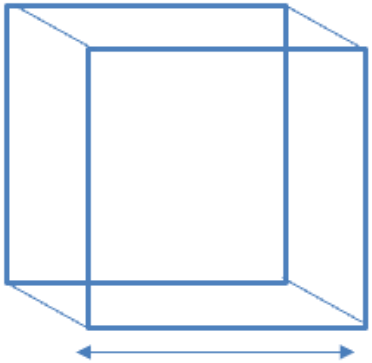
Let's now consider a cube of side 4 m.



$4m$

$$Volume = 4 \times 4 \times 4 = 64m^3$$

Imagine we want to convert the area of this shape into cm^3. What scale factor would we use?



$400cm$

$$Volume = 400 \times 400 \times 400 = 64{,}000{,}0000cm^3$$

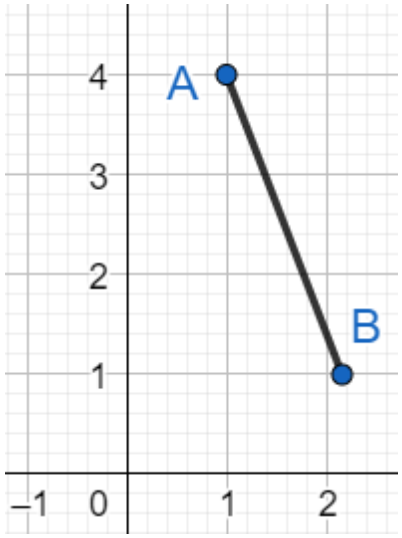
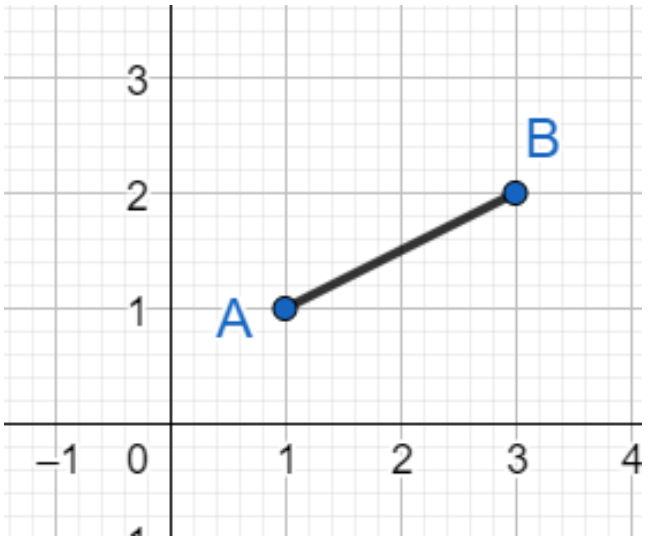
Our scale factor is not 100, but 1,000,000. 100^3

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) $5\ cm^3\ to\ m^3$

5 Basic Vectors

A vector has magnitude (how long it is) and direction.

Column Vector: $\begin{pmatrix} x \\ y \end{pmatrix}$ where x is movement right or left and y is movement up or down. Right and up are taken to be positive.

Worked Example	Your Turn
Write the vector $\overrightarrow{AB}$ in column form 	Write the vector $\overrightarrow{AB}$ in column form 

Fluency Practice

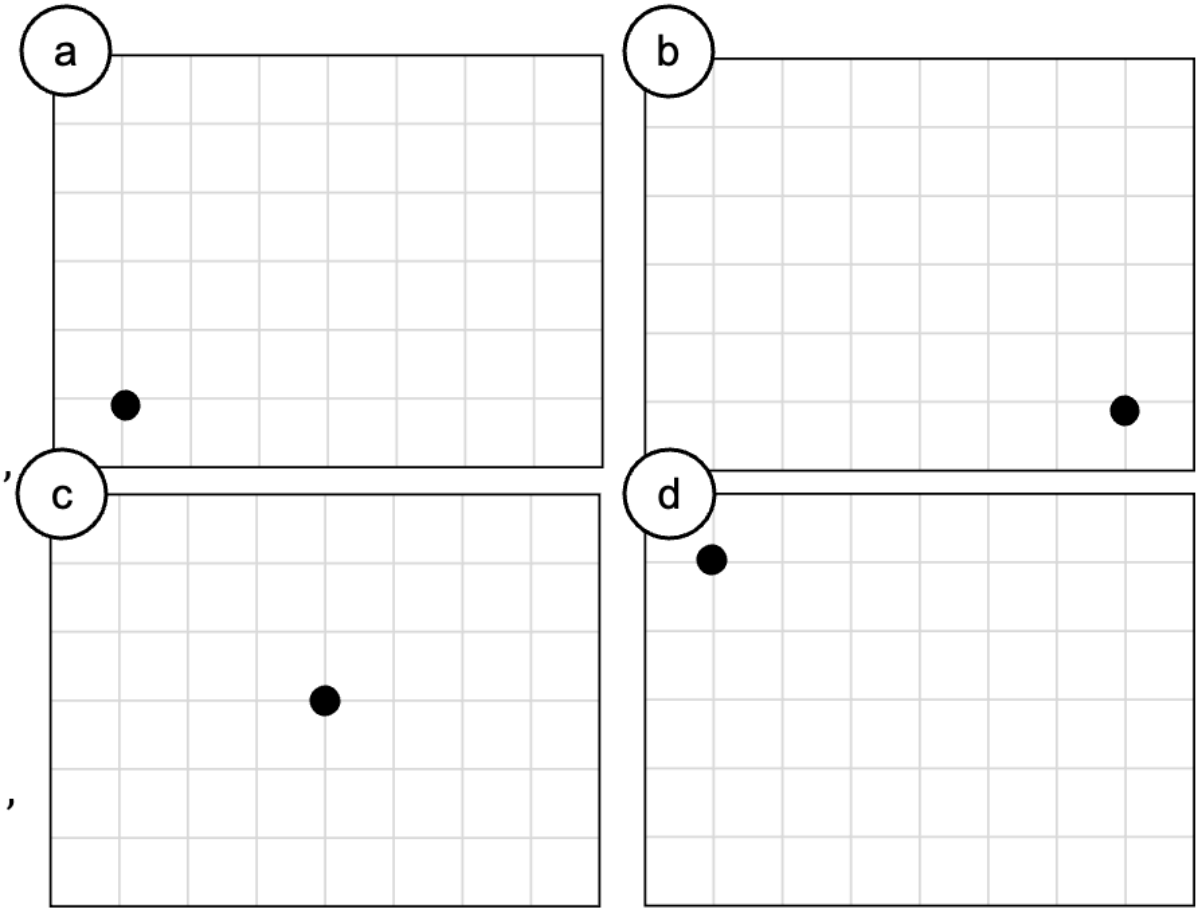
On each grid, start at the dot, then draw each vector in turn.

a) $\begin{pmatrix}0\\4\end{pmatrix}, \begin{pmatrix}3\\-2\end{pmatrix}, \begin{pmatrix}3\\2\end{pmatrix}, \begin{pmatrix}0\\-4\end{pmatrix}$

b) $\begin{pmatrix}-3\\4\end{pmatrix}, \begin{pmatrix}-3\\0\end{pmatrix}, \begin{pmatrix}0\\-4\end{pmatrix}, \begin{pmatrix}3\\0\end{pmatrix}, \begin{pmatrix}0\\2\end{pmatrix}, \begin{pmatrix}3\\-2\end{pmatrix}$

c) $\begin{pmatrix}-2\\0\end{pmatrix}, \begin{pmatrix}0\\1\end{pmatrix}, \begin{pmatrix}1\\0\end{pmatrix}, \begin{pmatrix}0\\-1\end{pmatrix}, \begin{pmatrix}2\\0\end{pmatrix}, \begin{pmatrix}0\\1\end{pmatrix}, \begin{pmatrix}1\\0\end{pmatrix}, \begin{pmatrix}0\\-1\end{pmatrix}, \begin{pmatrix}-2\\0\end{pmatrix}, \begin{pmatrix}0\\-1\end{pmatrix}, \begin{pmatrix}-2\\0\end{pmatrix}, \begin{pmatrix}4\\0\end{pmatrix}$

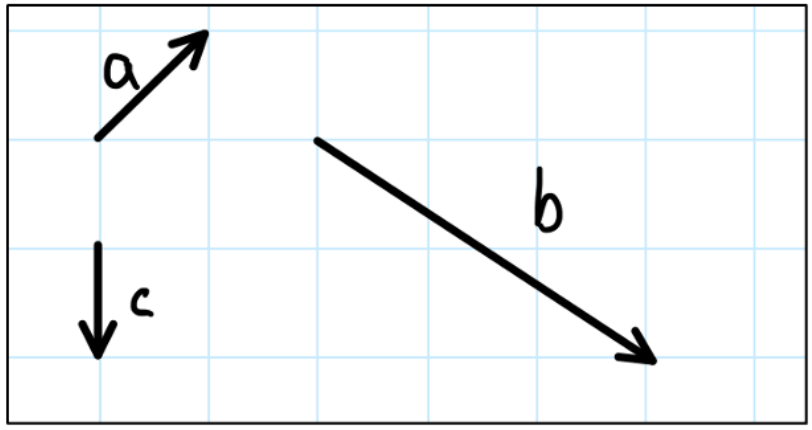
d) $\begin{pmatrix}0\\-2\end{pmatrix}, \begin{pmatrix}3\\2\end{pmatrix}, \begin{pmatrix}-3\\-4\end{pmatrix}, \begin{pmatrix}0\\6\end{pmatrix}, \begin{pmatrix}0\\4\end{pmatrix}, \begin{pmatrix}-1\\-2\end{pmatrix}, \begin{pmatrix}-2\\0\end{pmatrix}, \begin{pmatrix}0\\2\end{pmatrix}, \begin{pmatrix}-3\\0\end{pmatrix}$



Worked Example	Your Turn
$\boldsymbol{a} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ Find 3**a**	$\boldsymbol{a} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ Find -2**a**

Fluency Practice

Write each vector in column form



1) $2\mathbf{a}$	2) $-4\mathbf{a}$	3) $\frac{1}{2}\boldsymbol{a}$	4) $\frac{3}{2}\boldsymbol{a}$	5) $2\mathbf{c}$
6) $-2\mathbf{c}$	7) $-\mathbf{c}$	8) $-\mathbf{b}$	9) $-\frac{1}{2}\boldsymbol{b}$	10) $\frac{3}{2}\boldsymbol{b}$

Worked Example	Your Turn
$\boldsymbol{a} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\boldsymbol{b} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$ Find 2**a** - **b**	$\boldsymbol{a} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\boldsymbol{b} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$ Find 3**a** + 2**b**

Fluency Practice

Write these vectors in column form. Can you spot any links between questions?

$$\boldsymbol{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} \quad \boldsymbol{b} = \begin{pmatrix} -2 \\ 1 \end{pmatrix} \quad \boldsymbol{c} = \begin{pmatrix} 9 \\ -5 \end{pmatrix} \quad \boldsymbol{d} = \begin{pmatrix} -6 \\ 4 \end{pmatrix}$$

1) **a** + **b**	2) **a** - **b**	3) **b** - **a**	4) **c** - **d**	5) **d** - **c**
6) **a** - **a**	7) **b** - **b**	8) **a** + **b** + **c**	9) **a** + **b** - **c**	10) **a** - **b** + **c**
11) 2**a** + 2**b**	12) 2**a** - 2**b**	13) 2**c** – 3**d**	14) 4**c** – 6**d**	15) 20**c** – 30**d**

6 Reflections

A transformation that flips all points so that they are the same distance from a given mirror line as the original points, but in the opposite direction.

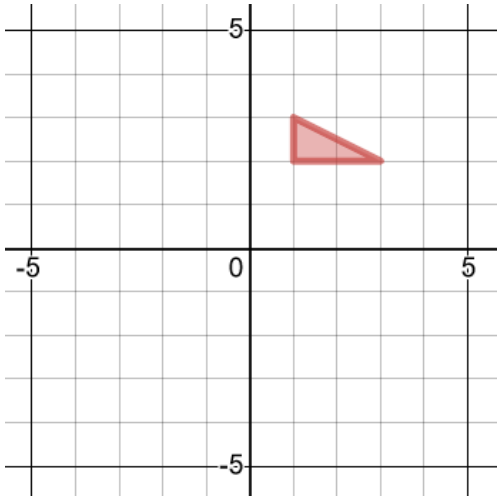
- Shapes flip over a mirror line.
- A shape and its reflection lie perfectly on top of each other if the page is folded in the mirror line.
- Produces a congruent shape.

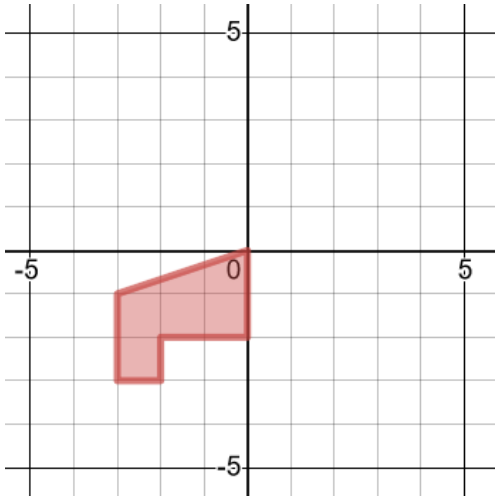
To fully describe a reflection, you need to give two pieces of information:

1. Type of Transformation: Reflection
2. The Line of Reflection:
    - $x-\text{axis}$ or $y-\text{axis}$
    - $y=$ ‘a number’ or $x=$ ‘a number’
    - $y=x$ or $y=-x$

Worked Example

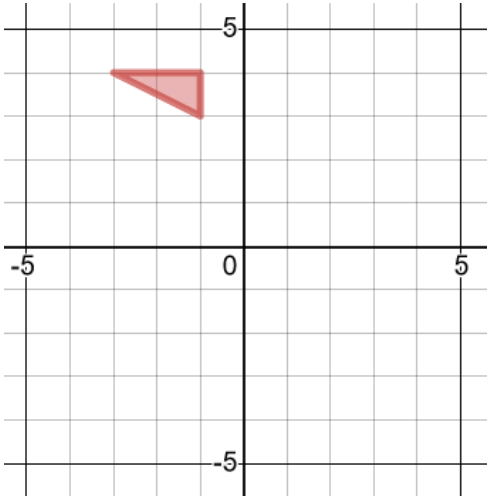
Reflect in the x-axis

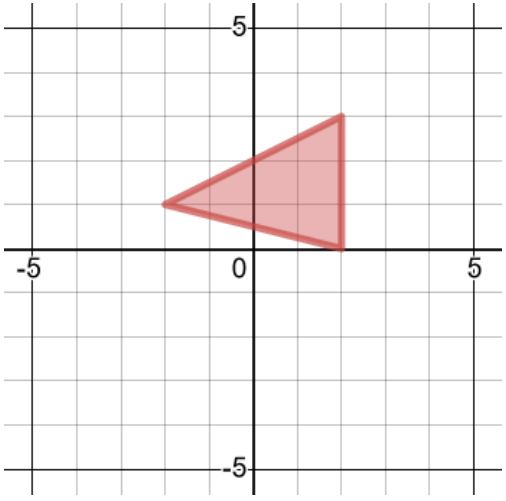




Your Turn

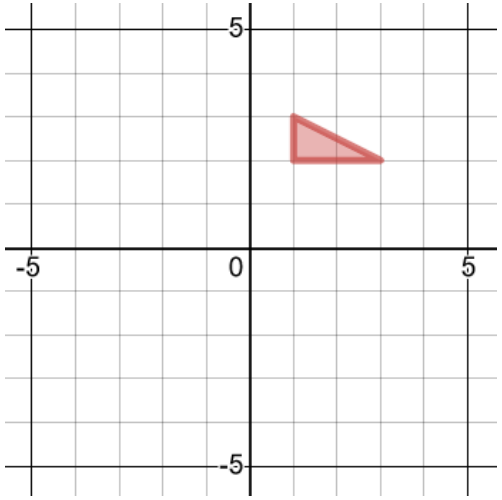
Reflect in the x-axis

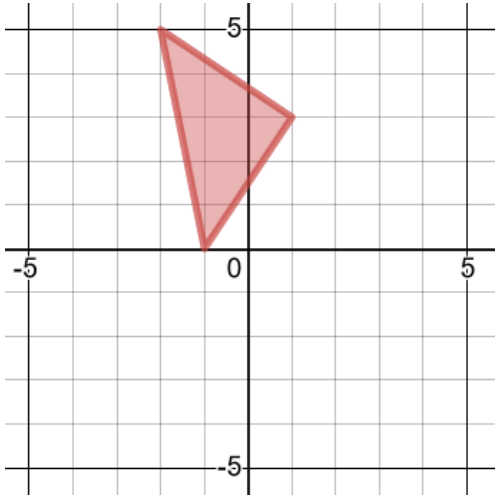




Worked Example

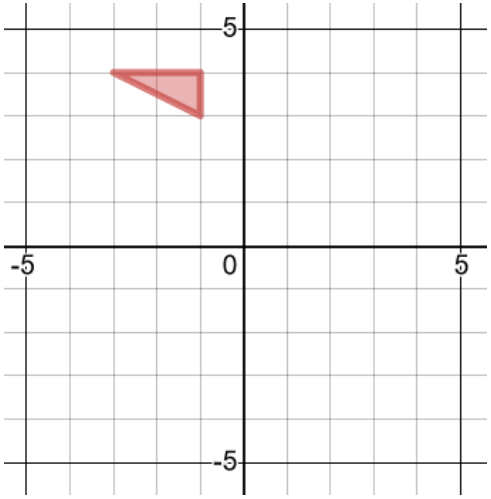
Reflect in the y-axis

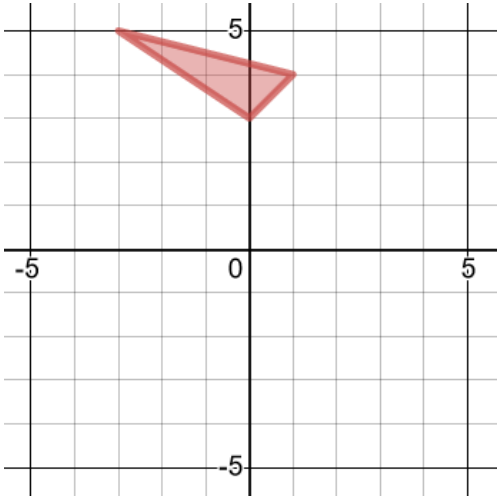




Your Turn

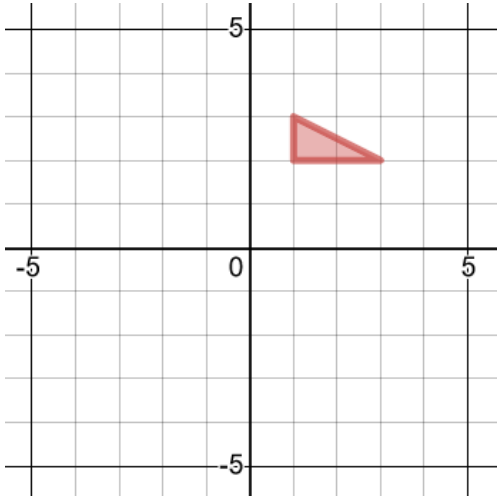
Reflect in the y-axis



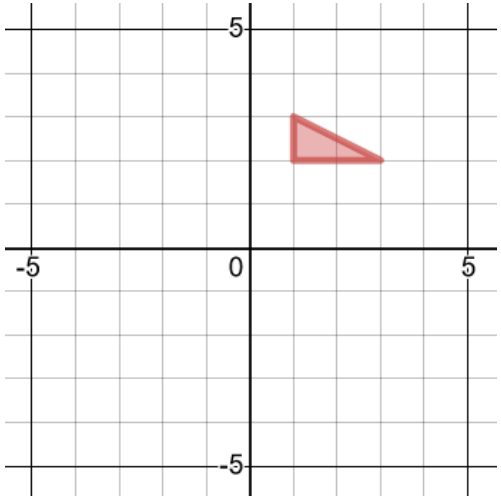


Worked Example

Reflect in the line $y = 1$

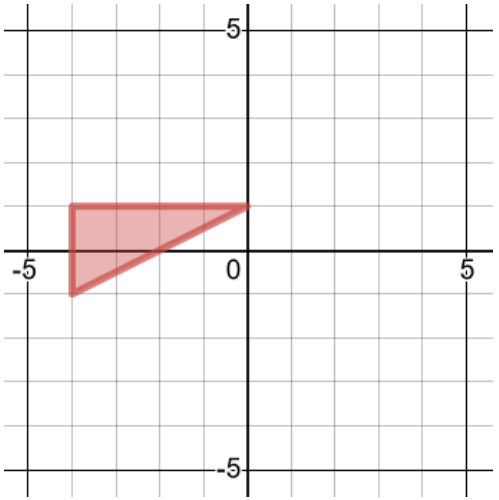


Reflect in the line $x = 3$

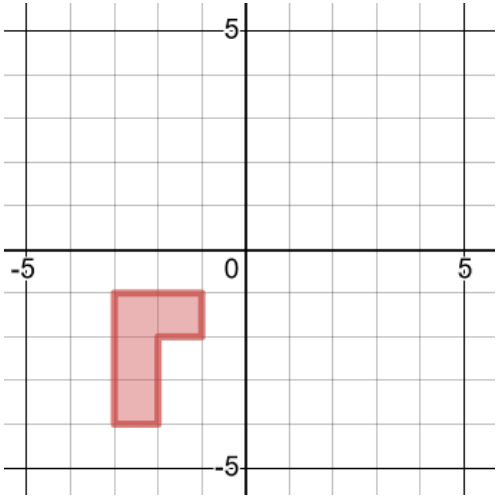


Your Turn

Reflect in the line $y = 2$

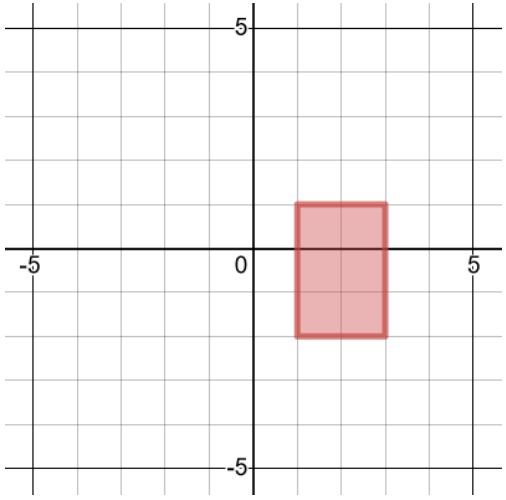


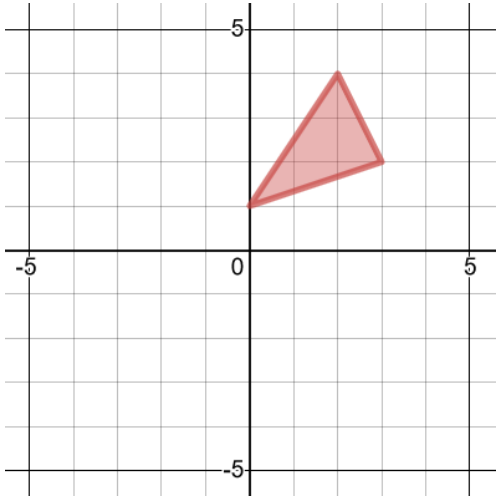
Reflect in the line $x = 1$



Worked Example

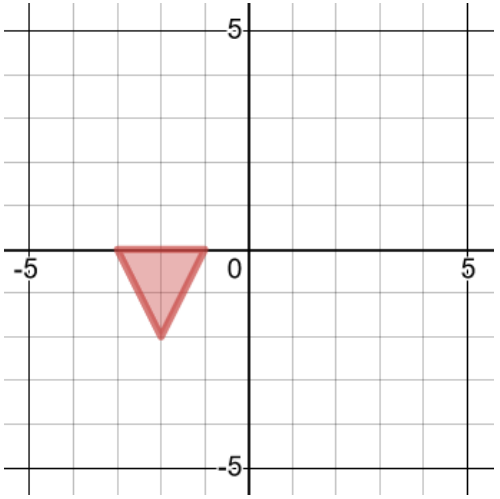
Reflect in the line $y = x$

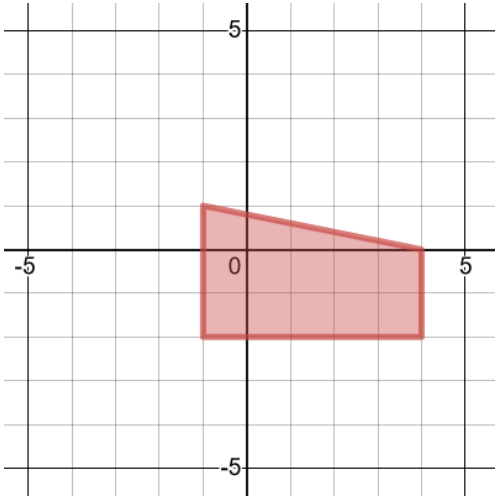




Your Turn

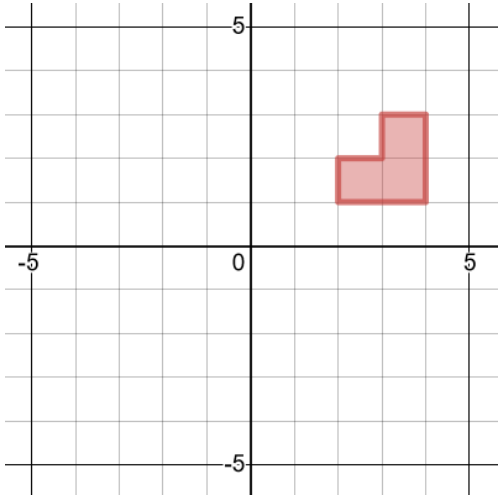
Reflect in the line $y = x$

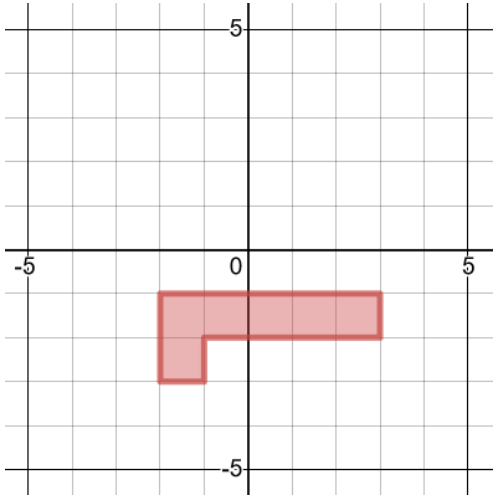




Worked Example

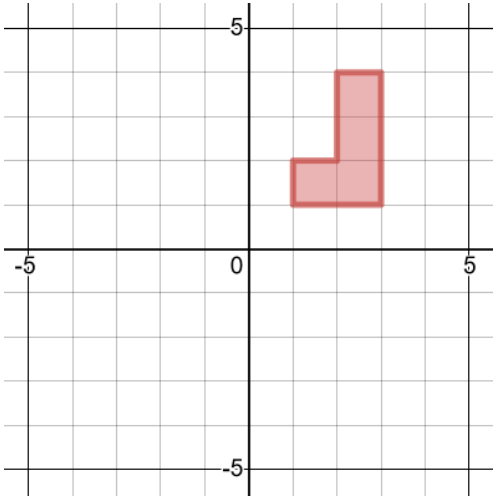
Reflect in the line $y = -x$

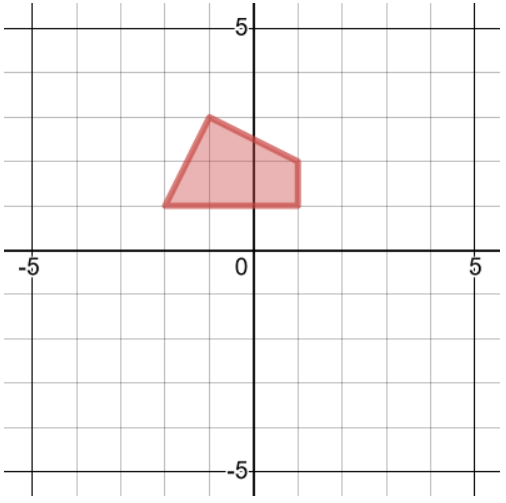




Your Turn

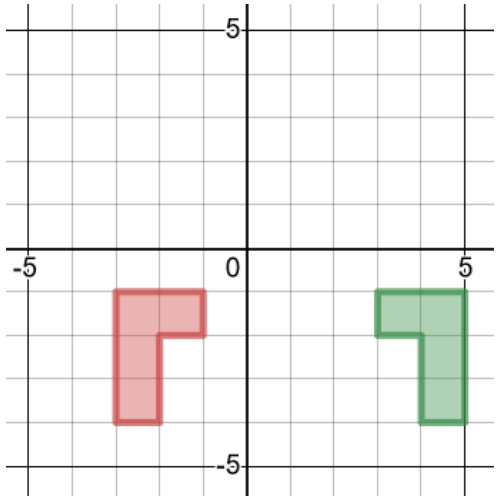
Reflect in the line $y = -x$

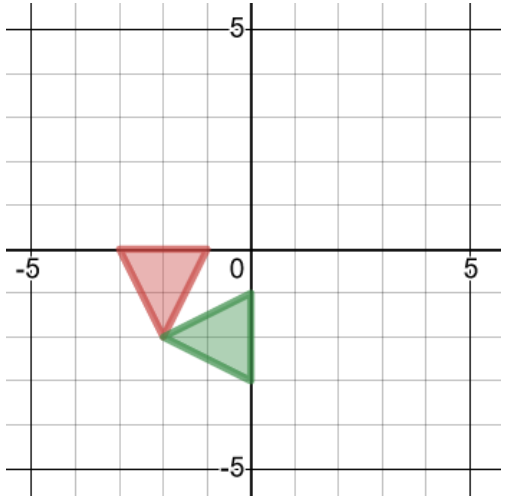




Worked Example

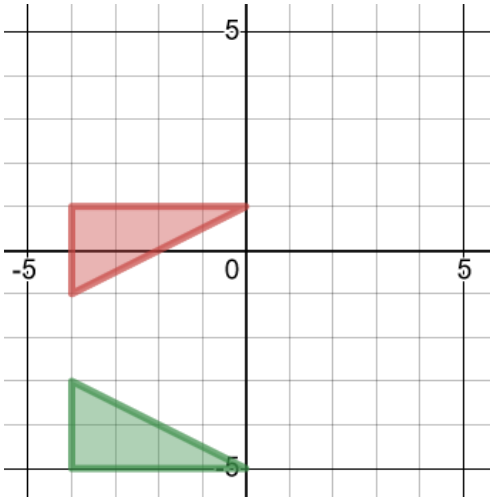
Describe the single transformation of the red object onto the green image

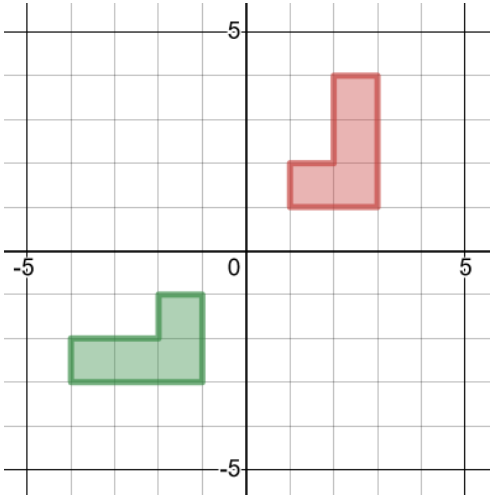




Your Turn

Describe the single transformation of the red object onto the green image

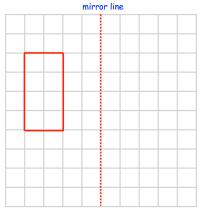




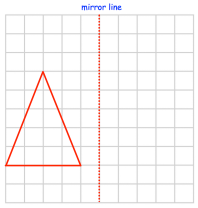
Fluency Practice

Question 1: Reflect each shape in the mirror line given

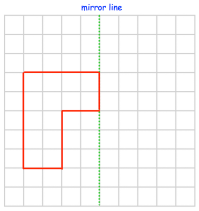
(a)



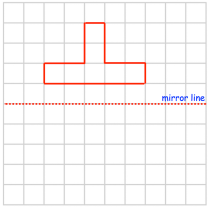
(b)



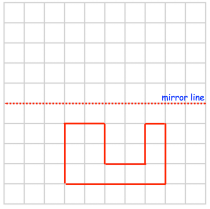
(c)



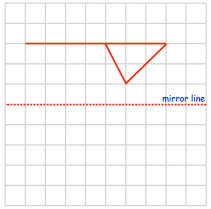
(d)



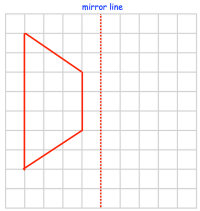
(e)



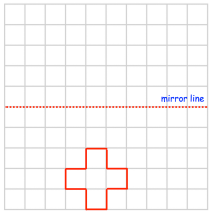
(f)



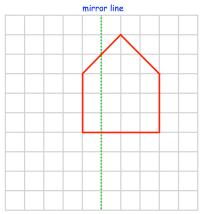
(g)



(h)

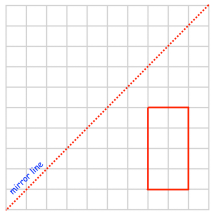


(i)

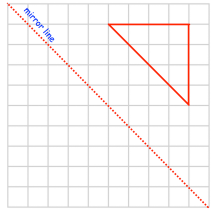


Question 2: Reflect each shape in the mirror line given

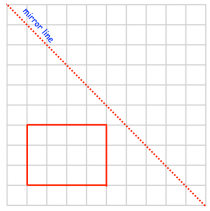
(a)



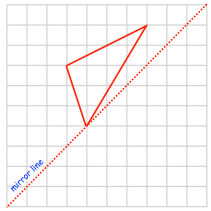
(b)



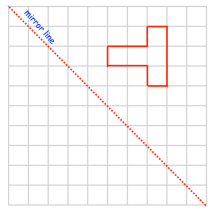
(c)



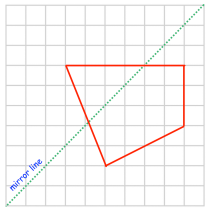
(d)



(e)

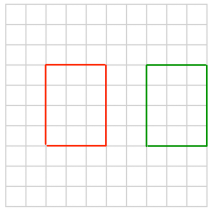


(f)

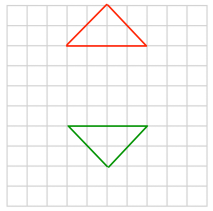


Question 3: Find the mirror line for each of the reflections below.

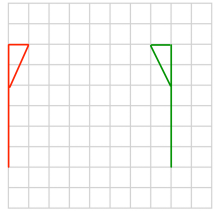
(a)



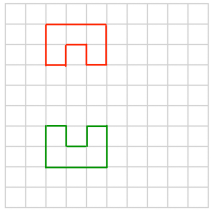
(b)



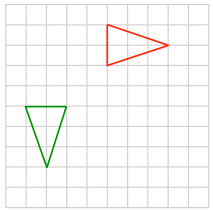
(c)



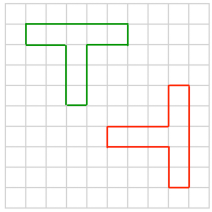
(d)



(e)



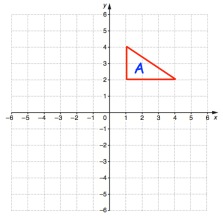
(f)



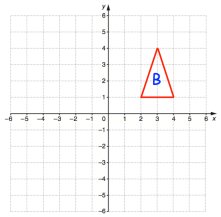
Fluency Practice

Question 4:

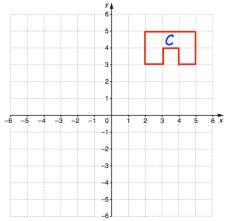
(a) Reflect triangle A in the x-axis



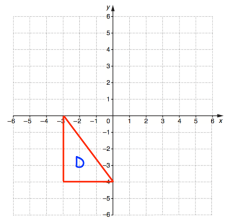
(b) Reflect triangle B in the y-axis



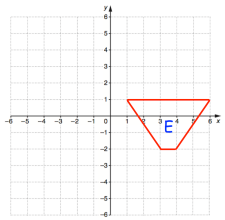
(c) Reflect shape C in the x-axis



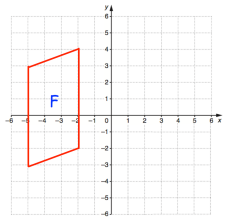
(d) Reflect shape D in the y-axis



(e) Reflect shape E in the y-axis

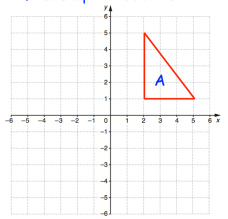


(f) Reflect shape F in the x-axis

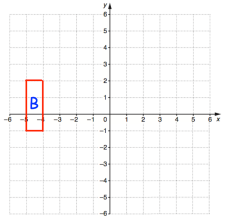


Question 5:

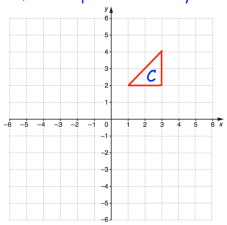
(a) Reflect shape A in the line x = 1



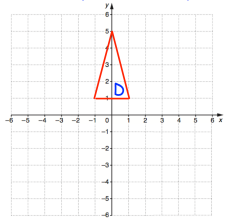
(b) Reflect shape B in the line x = -2



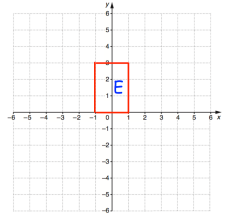
(c) Reflect shape C in the line y = -1



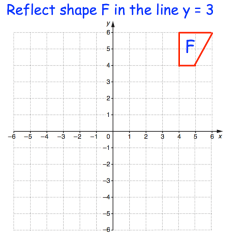
(d) Reflect shape D in the line y = 2



(e) Reflect shape E in the line x = -1

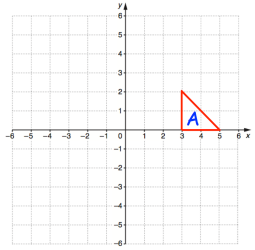


(f) Reflect shape F in the line y = 3

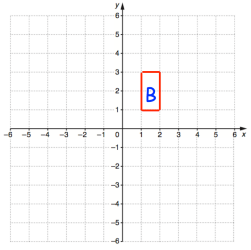


Question 6:

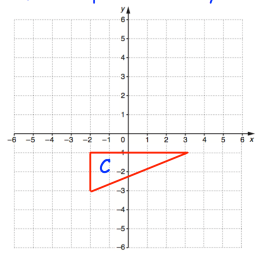
(a) Reflect shape A in the line y = x



(b) Reflect shape B in the line y = -x

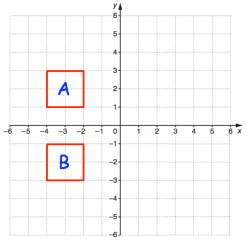


(c) Reflect shape C in the line y = x

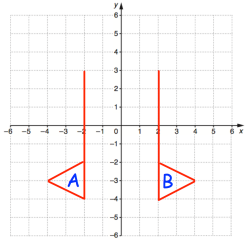


Question 7: Describe fully the single transformation that takes shape A to shape B.

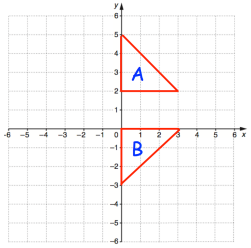
(a)



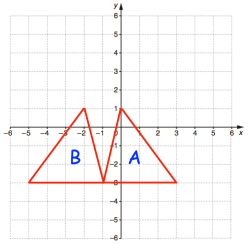
(b)



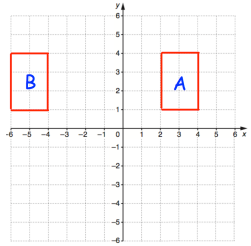
(c)



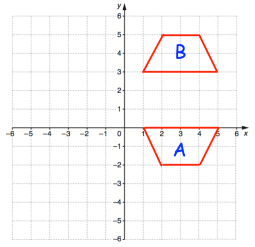
(d)



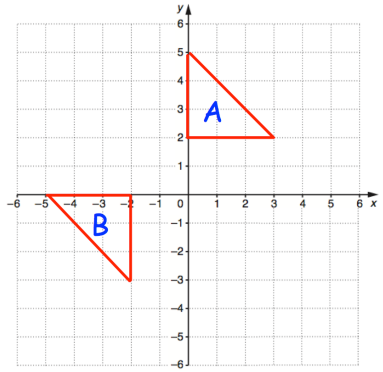
(e)



(f)



(g)



(h)