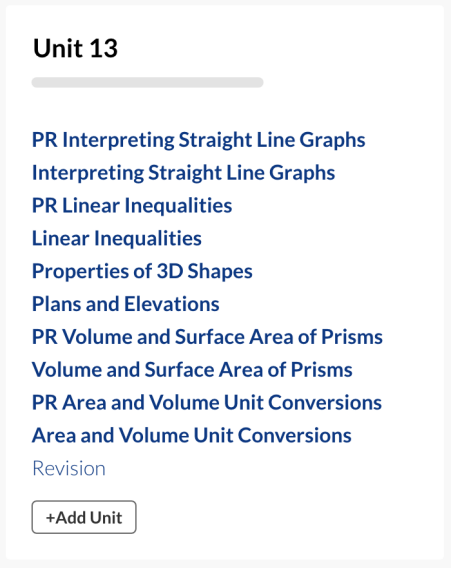
Year 9
Mathematics
Unit 13

Name: _____

Class: _____

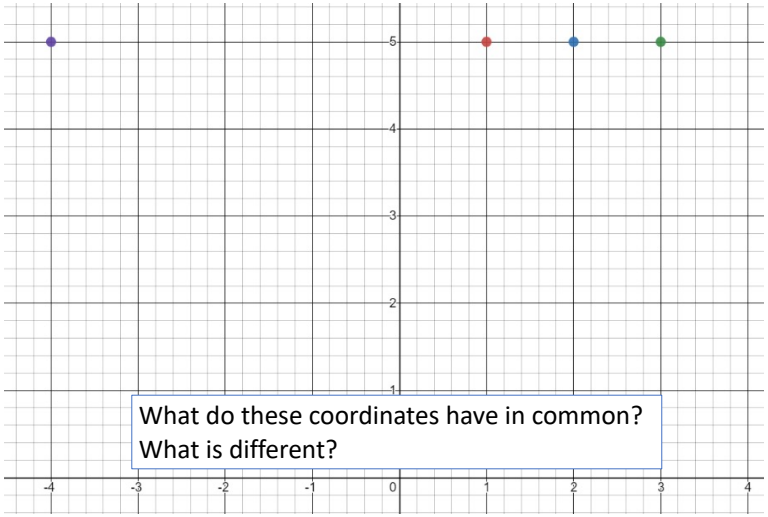
Contents Page

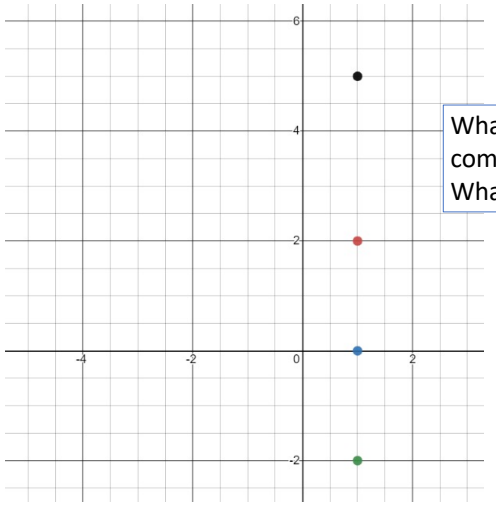
See unit 13 course on drfrostmaths.com



1 Interpreting Straight Line Graphs

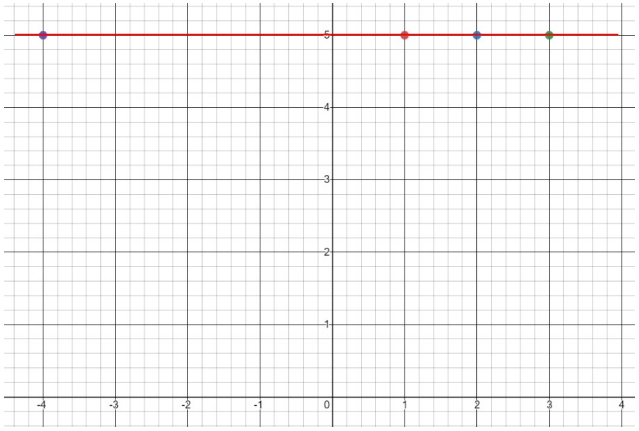
Horizontal and Vertical Lines





What do these coordinates have in common?
What is different?

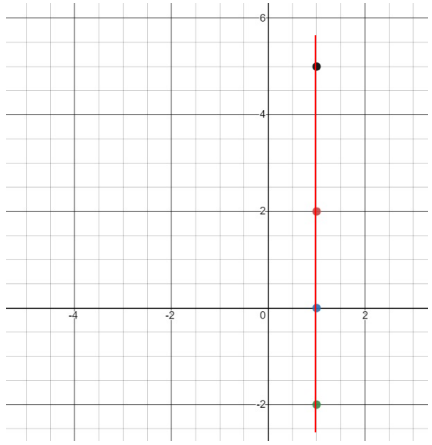
The relationship of the shared characteristic between points can be written as an equation.



All of these points have a y coordinate of 5.

The straight line can be described as y = 5 because this is true for every point on the line.

The relationship of the shared characteristic between points can be written as an equation.

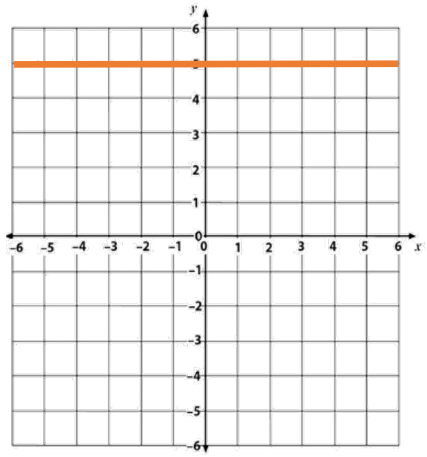


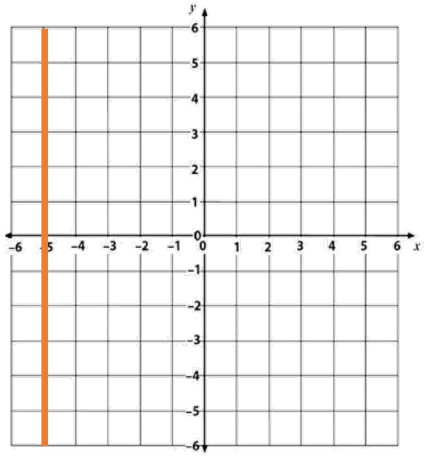
All of these points have an x coordinate of 1.

The straight line can be described as _____ because this is true for every point on the line.

Worked Example

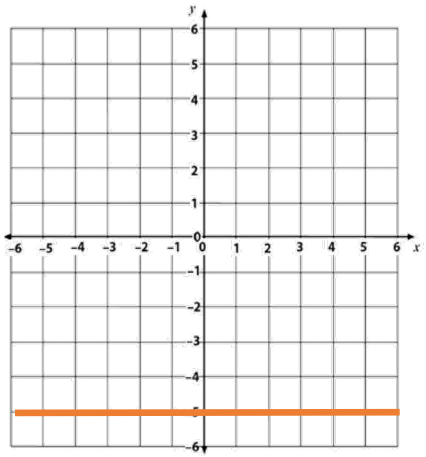
Find the equation of the line:

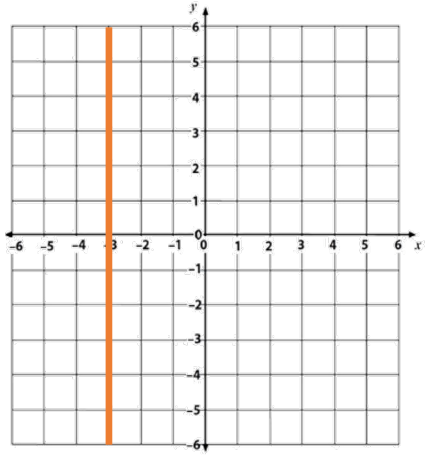




Your Turn

Find the equation of the line:

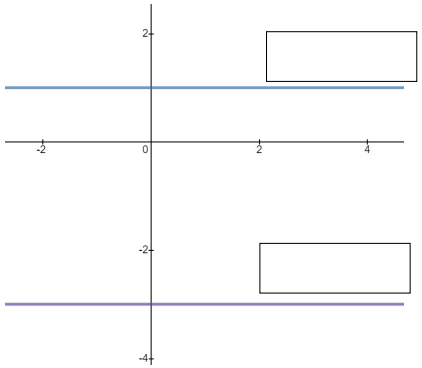


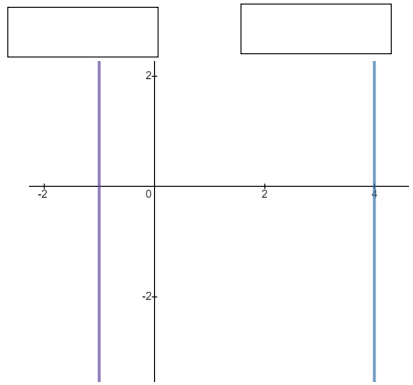


Fluency Practice

Vertical and horizontal lines.

1) Fill in the boxes with the equations of the straight lines.





2) Write the equation of the line that all of the following points will fall on.

(a) (4, 5), (4, 9), (4,0), (4,-3)

(b) (-10, 2), (173, 2), (10,2), (-0.3,2)

(c) (4.3, 0.1), (0, 0.1), (-9, 0.1)

(d) $(-\frac{1}{3}, 10)$, $(-\frac{1}{3}, -3)$, $(-\frac{1}{3}, 0.5)$, $(-\frac{1}{3}, -0.1)$

3) Thinking carefully about the coordinates can you find the equation of…

(a) The x-axis

(b) The y-axis

4) A point has the coordinates of (3, -5).

(a) What are the equations of the horizontal and vertical lines that this point is on?

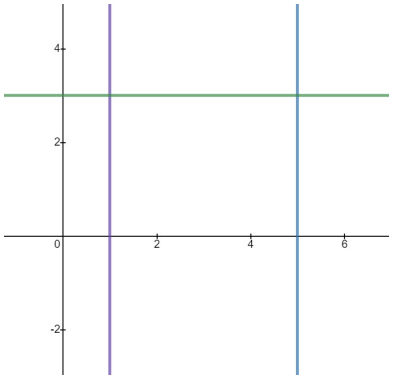
(b) The line is vertical. Which of those two equations from (a) will it be?

5) A shape is made by the area enclosed by the lines x = 1, x = 9, y = 2 and y = 5.

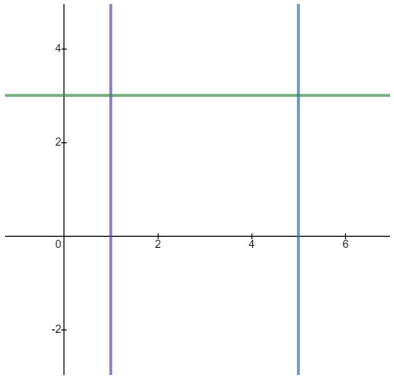
(a) What is the shape?

(b) What is the area of the shape?

6) Write down the equation of the straight line that would make the enclosed shape a square.



7) There is a rectangle below with a side missing. If the area of the rectangle is 24cm², what will be the equation of the missing line?



Gradient

The gradient tells us how steep a line is, therefore the bigger the gradient the steeper the line is.

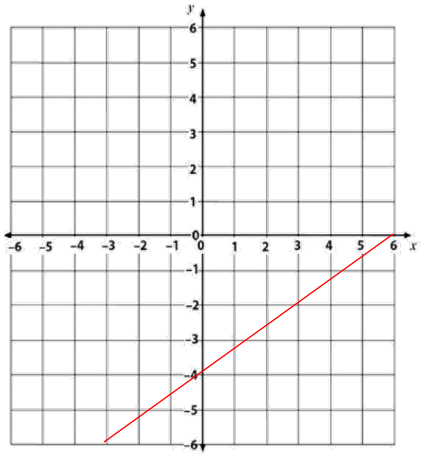
A positive gradient is a straight line which slopes up to the right.

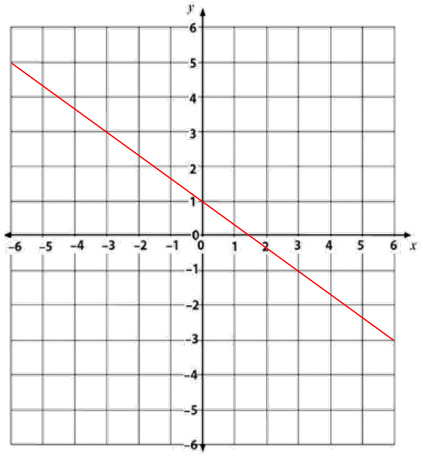
A negative gradient is a straight line which slopes down to the right.

Worked Example	Your Turn
Calculate the gradient between the coordinates: a) $(-2, -1)$ and $(5, 7)$ b) $(2, -1)$ and $(-5, -7)$	Calculate the gradient between the coordinates: a) $(-4, 2)$ and $(6, 8)$ b) $(-4, 2)$ and $(-6, -8)$

Worked Example

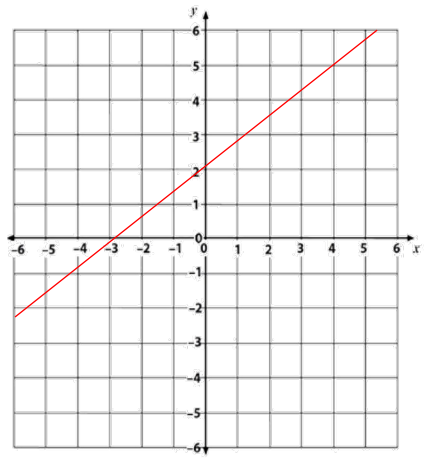
Find the gradient of:

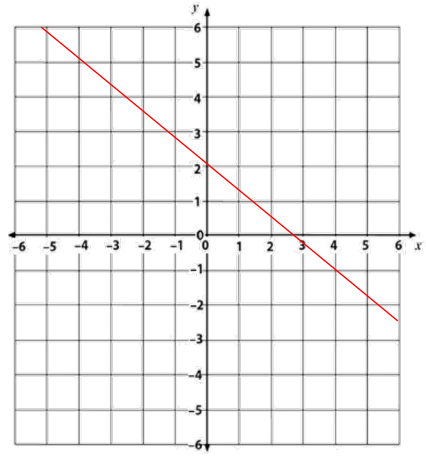


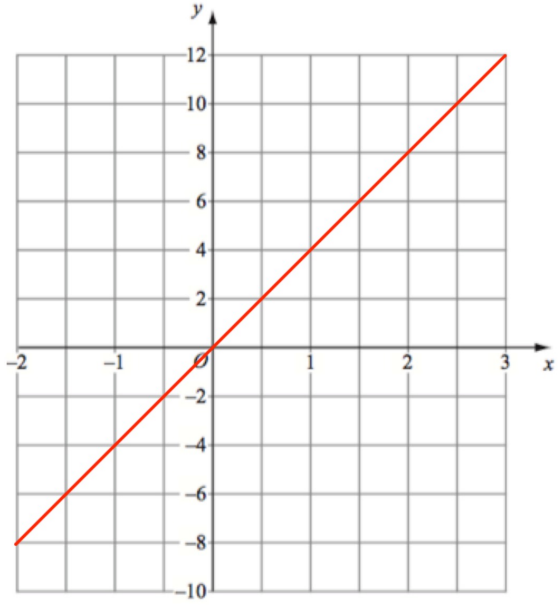
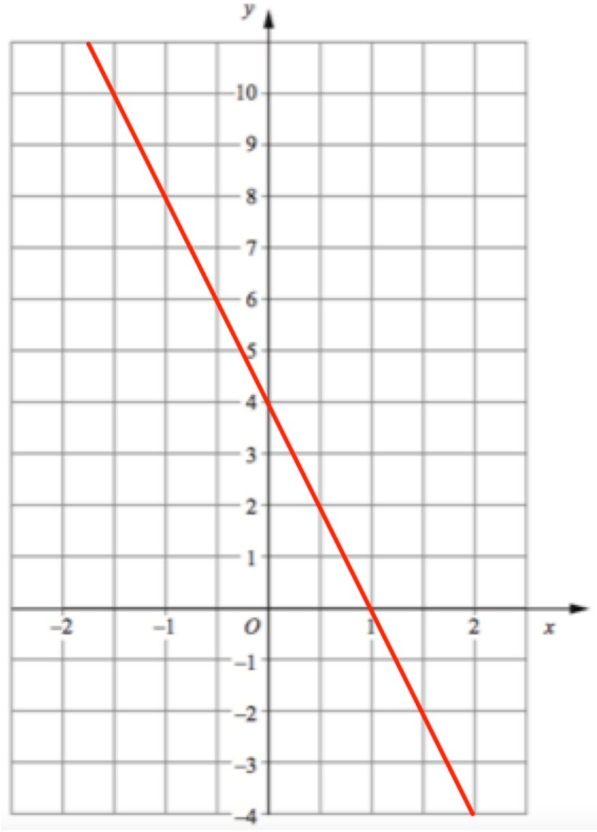


Your Turn

Find the gradient of:



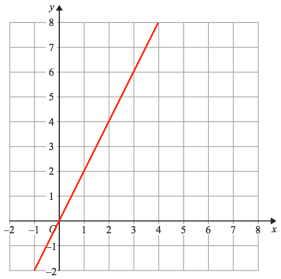


Worked Example	Your Turn
Find the gradient of:  	Find the gradient of: 

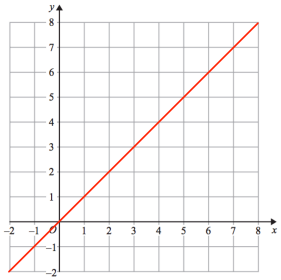
Fluency Practice

Question 1: Find the gradient of each of these lines

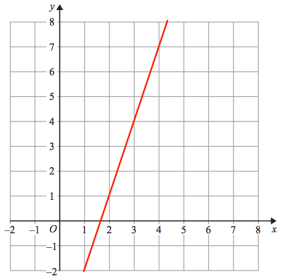
(a)



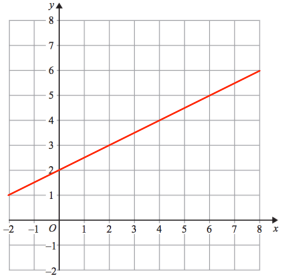
(b)



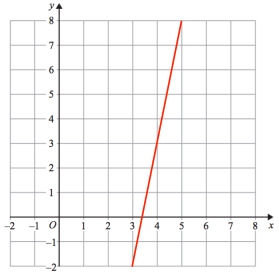
(c)



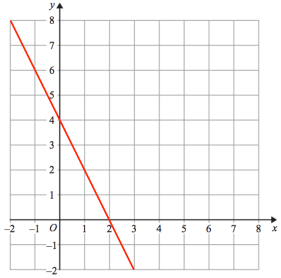
(d)



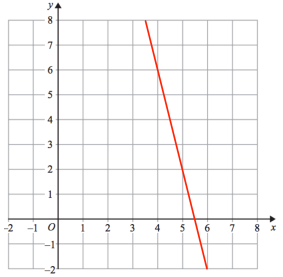
(e)



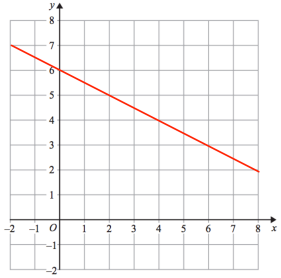
(f)



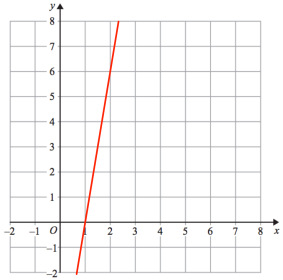
(g)



(h)



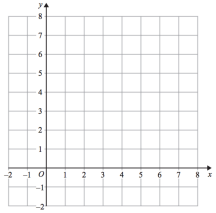
(i)



Question 2: Draw lines with the following gradients

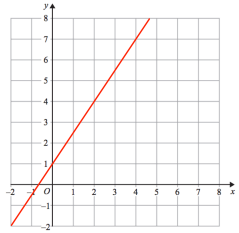
(a) 2 (b) 4 (c) 7 (d) −1

(e) −3 (f) −5 (g) $\frac{1}{2}$ (h) 10

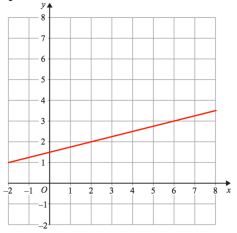


Question 3: Find the gradient of each of these lines

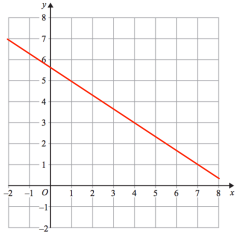
(a)



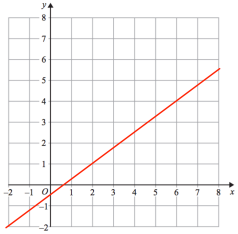
(b)



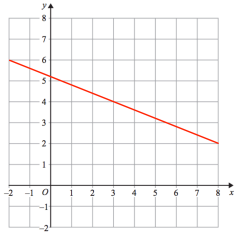
(c)



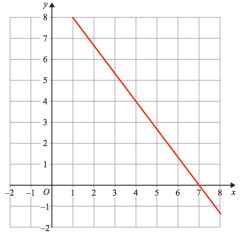
(d)



(e)



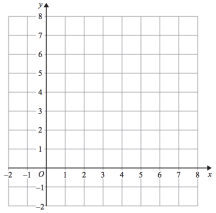
(f)



Question 4: Draw lines with the following gradients

(a) $2\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{5}$ (d) $-\frac{1}{6}$

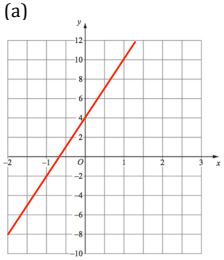
(e) $\frac{3}{10}$ (f) $\frac{4}{5}$ (g) $1\frac{1}{3}$ (h) $-\frac{3}{5}$



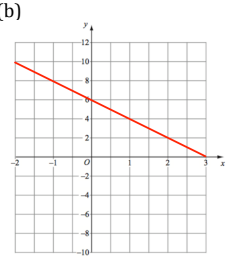
Fluency Practice

Question 5: Find the gradient of each of these lines

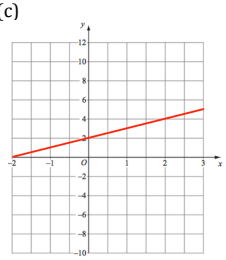
(a)



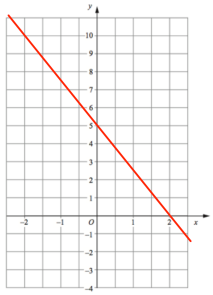
(b)



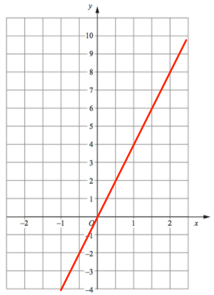
(c)



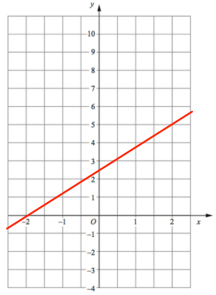
(d)



(e)

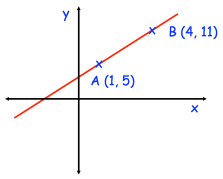


(f)

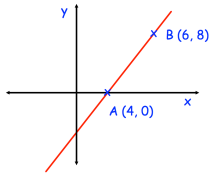


Question 6: Find the gradient of each line shown below

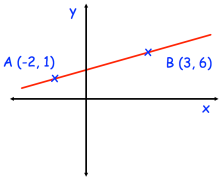
(a)



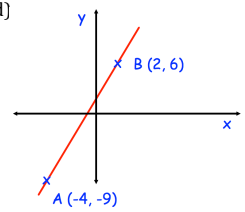
(b)



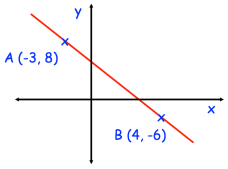
(c)



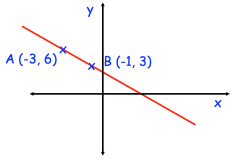
(d)



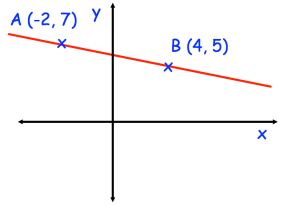
(e)



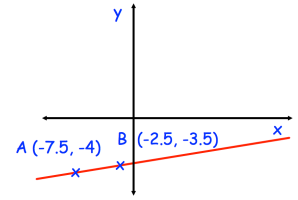
(f)



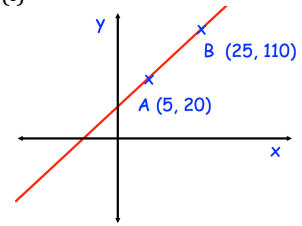
(g)



(h)



(i)



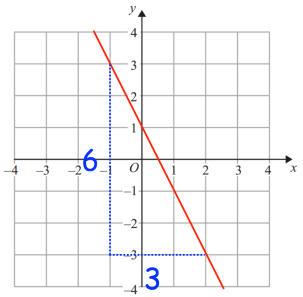
Question 7: Work out the gradient of the line passing through these pairs of points

(a) (1, 4) and (3, 10)
(b) (0, 0) and (3, 12)
(c) (5, −2) and (9, 14)
(d) (−8, 6) and (0, −2)
(e) (−5, −9) and (1, 3)
(f) (−7, −2) and (1, −4)
(g) (−2, 1) and (8, −7)
(h) (−2, 9) and (4, 7)
(i) (−4.5, 3) and (6, −7.5)

Worked Example	Your Turn
The gradient connecting the two points $(2a, 5)$ and $(7a, 8)$ is 6. Solve for a.	The gradient connecting the two points $(3a, 7)$ and $(5a, 12)$ is 6. Solve for a.

Worked Example	Your Turn
The gradient connecting the two points (2, 10) and (5, d) is 4. Solve for d.	The gradient connecting the two points (-3, -10) and (2, d) is 12. Solve for d.

Fluency Practice



Question 1: Alisha says that the gradient of the line is 2.
Explain her mistake.

Question 2: Find the gradient of the line passing through the points (4a, −a) and (6a, 5a)

Question 3: The line passing through (5, −2) and (8, c) has a gradient of 3.
Find c.

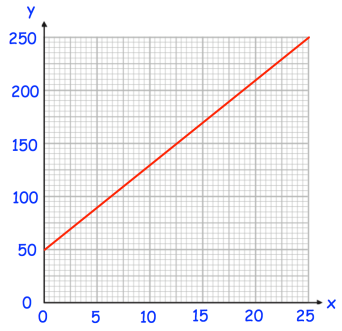
Question 4: The line passing through (−8, −9) and (−2, h) has a gradient of 4.
Find h.

Question 5: The line passing through (3, −4) and (m, 10) has a gradient of 2.
Find m.

Question 6: The line passing through (−2, 5) and (2, n) has a gradient of −½
Find n.

Question 7: The line passing through (1, p) and (5, 1) has a gradient of 0.75
Find p.

Question 8: Find the equation of the line shown



Worked Example	Your Turn
$y = 2x - 1$ Gradient: y-intercept:	$y = 3x - 4$ Gradient: y-intercept:
$y = -2x + 6$ Gradient: y-intercept:	$y = -3x + 6$ Gradient: y-intercept:
$2x + 3y = 6$ Gradient: y-intercept:	$3x + 2y = 6$ Gradient: y-intercept:

Worked Example	Your Turn
Write in the form y$= mx + c$ the line with:	Write in the form $y = mx + c$ the line with:
Gradient 2 and y-intercept 3	Gradient 3 and y-intercept 4
Gradient $\frac{2}{3}$ and y-intercept -3	Gradient $-\frac{5}{6}$ and y-intercept -1
Gradient $-\frac{3}{2}$ and y-intercept 0	Gradient $\frac{3}{4}$ and y-intercept 0
Gradient 0 and y-intercept 4	Gradient 0 and y-intercept -5

Equation of Straight Line Graphs

Straight line graphs can be written in the form $y = mx + c$, where m is the gradient, or steepness of the graph and c is the y-intercept of the graph, where the graph cuts through the y-axis.

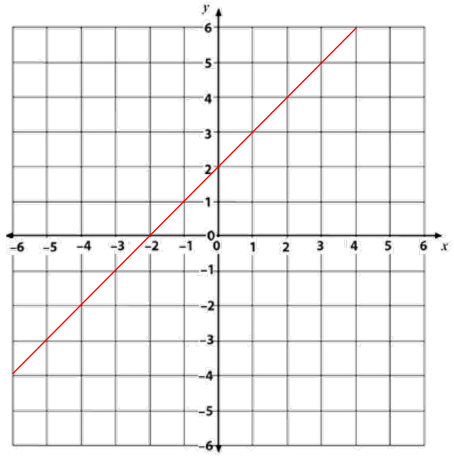
x	-3	-2	-1	0	1	2	3	4
y				c				

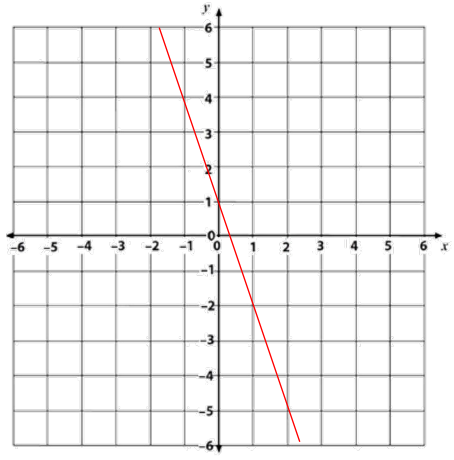
$+m$

$$y = mx + c$$

Worked Example

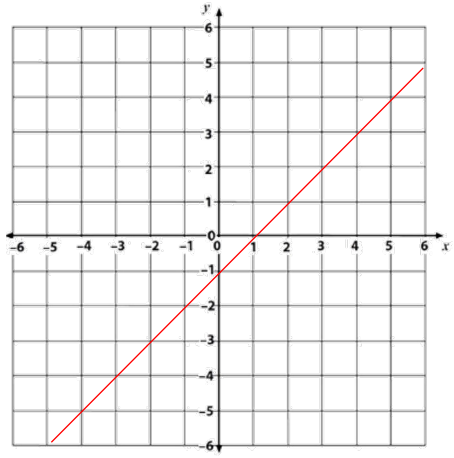
Find the equation of:

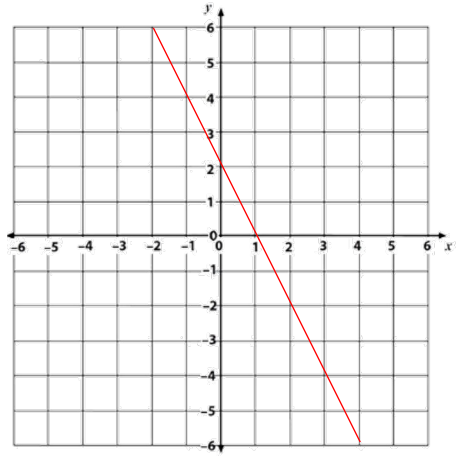




Your Turn

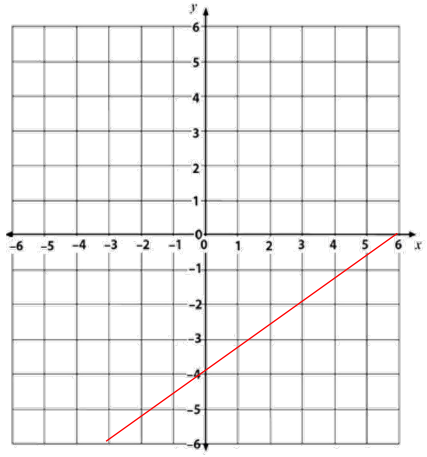
Find the equation of:

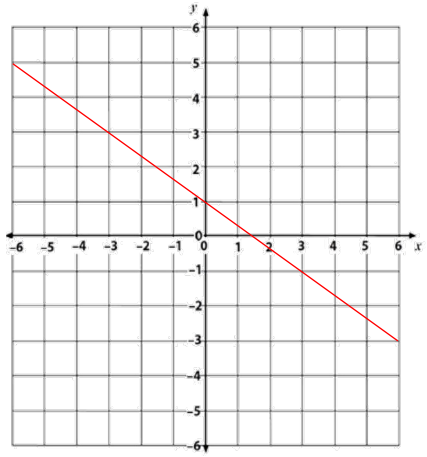




Worked Example

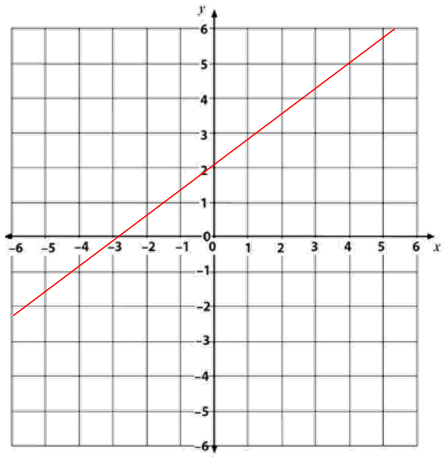
Find the equation of:

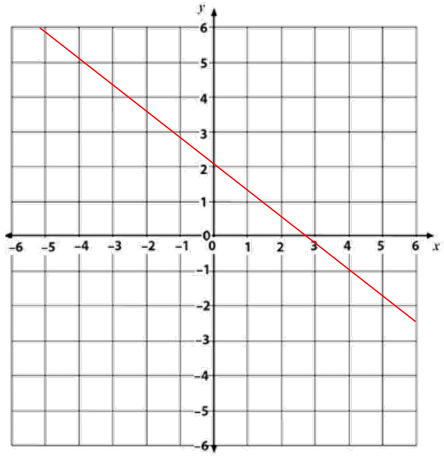


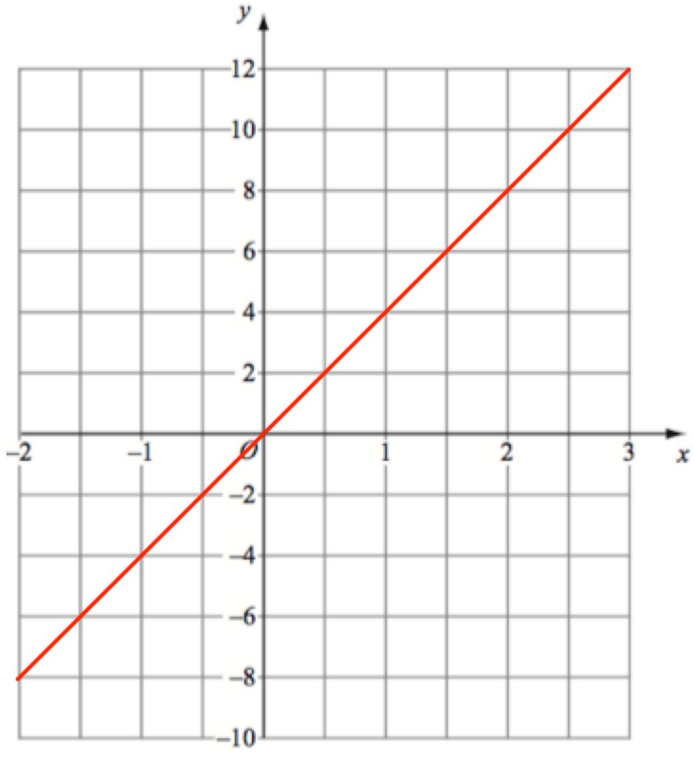
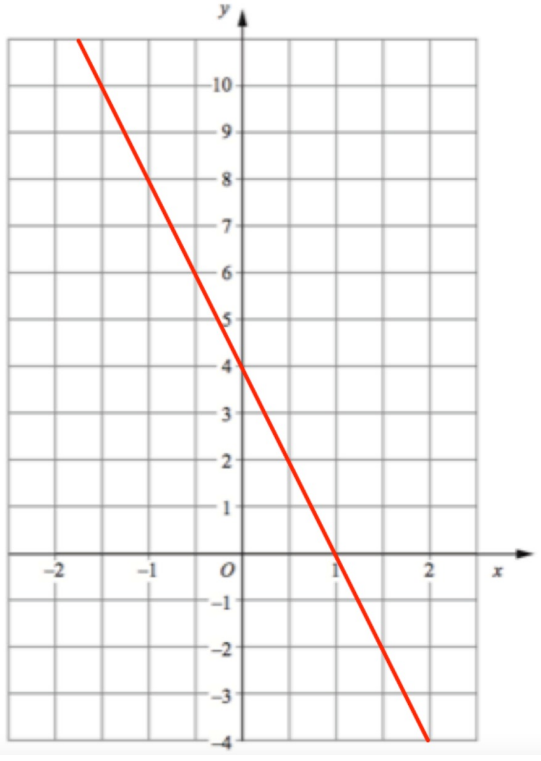


Your Turn

Find the equation of:



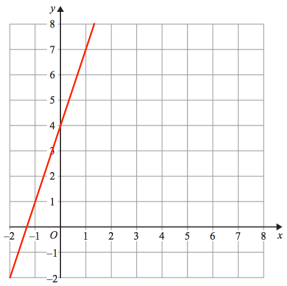


Worked Example	Your Turn
Find the equation of:  	Find the equation of: 

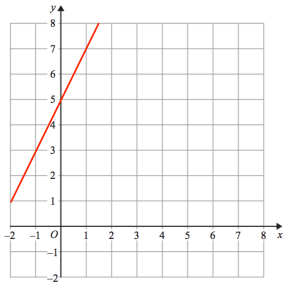
Fluency Practice

Question 5: Find the equation of each line

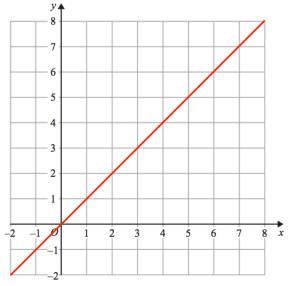
(a)



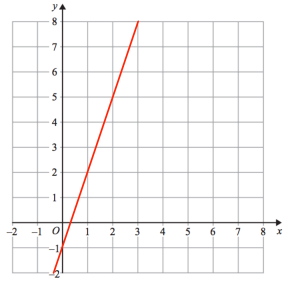
(b)



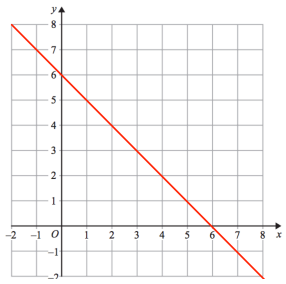
(c)



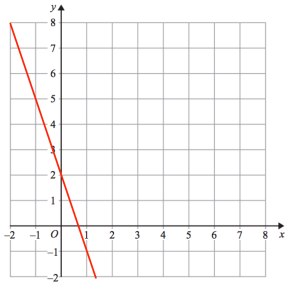
(d)



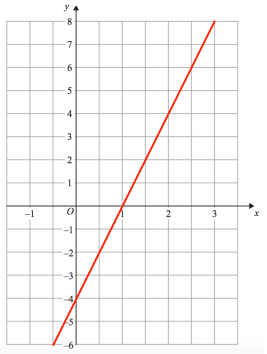
(e)



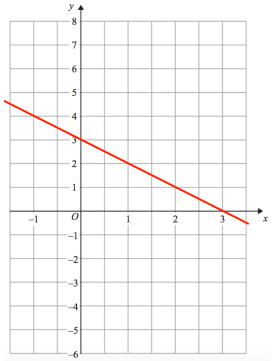
(f)



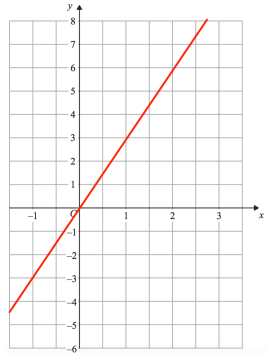
(g)



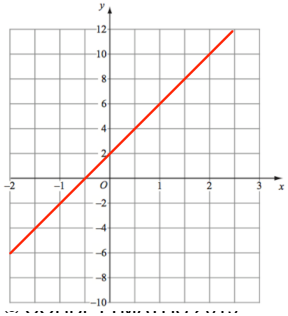
(h)



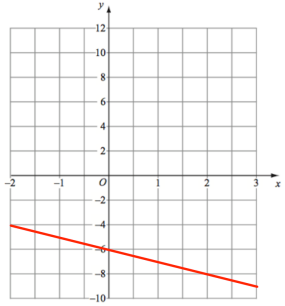
(i)



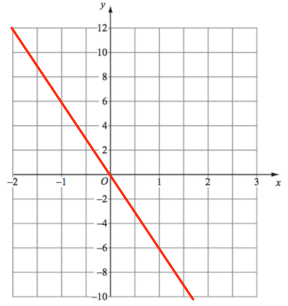
(j)



(k)



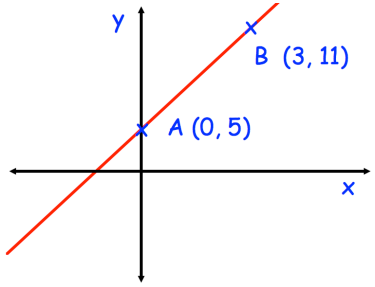
(l)



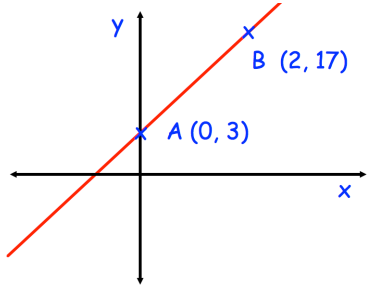
Fluency Practice

Question 6: Find the equation of each line below.

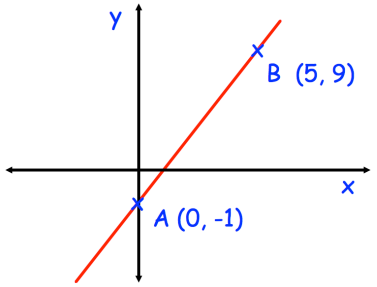
(a)



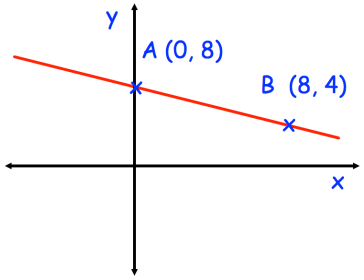
(b)



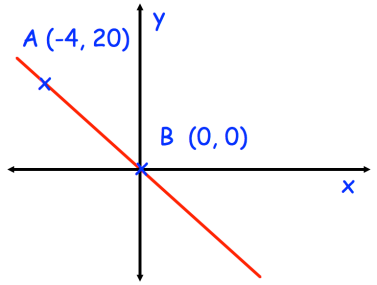
(c)



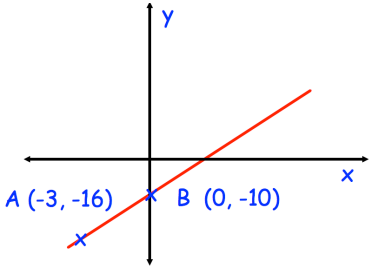
(d)



(e)



(f)



Question 7: Find the equation of the straight line that passes through the points

(a) (0, 3) and (4, 19)

(b) (0, 2) and (6, 20)

(c) (0, 0) and (1, 4)

(d) (0, −9) and (9, 0)

(e) (0, −6) and (7, 8)

(f) (−8, −10) and (0, 14)

(g) (0, 2) and (10, 7)

(h) (−4, 1) and (0, 7)

(i) (−4, 0) and (0, 18)

Worked Example	Your Turn
Find the equation of the line, given a point and the gradient: $(-6, 22)$ Gradient 3	Find the equation of the line, given a point and the gradient: $(-2, 5)$ Gradient 4

Worked Example	Your Turn
Write the equation of the line in the form $y = mx + c$ which passes through the points $(2, 3)$ and $(5, -9)$	Write the equation of the line in the form $y = mx + c$ which passes through the points $(3, 10)$ and $(-5, 18)$

Worked Example	Your Turn
Write the equation of the line in the form $y = mx + c$ which passes through the points $(2, -3)$ and $(7, -5)$	Write the equation of the line in the form $y = mx + c$ which passes through the points $(3, -2)$ and $(-7, 5)$

Worked Example

Find where the line intercepts the axes:

Line	x-intercept	y-intercept
$y = 2x + 3$		
$y = 2x - 3$		

Your Turn

Find where the line intercepts the axes:

Line	x-intercept	y-intercept
$y = 5x - 4$		
$y = 5x + 4$		

Worked Example

Find where the line intercepts the axes:

Line	x-intercept	y-intercept
$y = 3 - 2x$		
$y = 2 - 3x$		
$2x + 3y = 6$		

Your Turn

Find where the line intercepts the axes:

Line	x-intercept	y-intercept
$y = 5 - 4x$		
$y = 4 - 5x$		
$5x + 4y = 20$		

Worked Example	Your Turn
Does the point $(2, 9)$ lie on the line $y = 4x + 1$?	Does the point $(2, 9)$ lie on the line $y = 9 - 2x$?

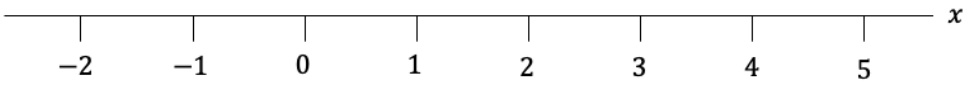
Extra Notes

2 Linear Inequalities

Inequalities on Number Lines

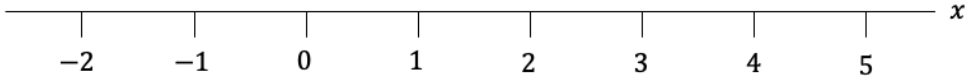
$x = 4$

We can use a filled circle on a number line to indicate we want to include the value.



$x \geq 1$

We again want to include 1, but our arrow is right this time to indicate values greater than 1.



But what about:

$x \leq 4$

We again use a filled circle to indicate that we want to include 4.

But we also have an arrow pointing left to say we also want any value less than 4.

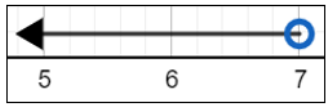
$x < 2$

We again have an arrow left to indicate "less than 2", but this time we **DON'T** want to include 2 itself. We use an **unfilled circle** to indicate that 2 is excluded.

Worked Example	Your Turn
a) Plot $x < 3$ on a number line b) Plot $x \geq 14$ on a number line	a) Plot $x > 14$ on a number line b) Plot $x \leq -2$ on a number line

Fill in the Gaps

For each sentence, write an inequality then draw a number line representation.

1) x is less than 7	$x < 7$	
2) x is less than or equal to 7		
3) x is more than 4		
4) x is more than 10		
5) x is more than 3.5		
6) x is more than or equal to 7.5		
7) x is less than or equal to 0		
8) x is more than or equal to 3.5		

Worked Example	Your Turn
a) Plot $2 < x < 3$ on a number line b) Plot $x < 3$ or $x > 7$ on a number line	a) Plot $2 \leq x \leq 3$ on a number line b) Plot $x \leq -3$ or $x > 5$ on a number line

Solving Linear Inequalities

Inequalities behave in a similar way to equations: whatever we do to one side of the equation, we have to do the same to the other.

'Solving an inequality' means to get x on its own on one side of the equation. This is so that the range is then clear.

When you divide or multiply both sides of an inequality by a negative number, **reverse the direction of the inequality**.

Why?
Consider the inequality $2 < 4$
This is clearly true as 2 is less than 4
But, if we multiple/divide by both sides by -1, we get $-2 < -4$, which is false.
However, if we reverse the inequality sign, we get $-2 > -4$, which is true as -2 is more than -4.

But it is probably easiest to avoid needing to divide by a negative number in the first place…

IF THERE IS A NEGATIVE COEFFICIENT OF THE VARIABLE THEN ADD TO BOTH SIDES TO GET A POSITIVE ONE.

Worked Example	Your Turn
Solve: a) $2x - 8 < 16$ b) $2(4 - x) < 16$	Solve: a) $3x - 9 > 27$ b) $3(3 - x) > 27$

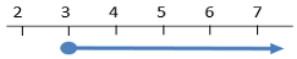
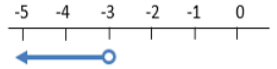
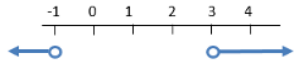
Worked Example	Your Turn
Solve: a) $10(x+3)+3(2x+6)<144$ b) $7(x+3)-3(2x-6)=84$	Solve: a) $5(x+3)+2(2x-6)\leq 111$ b) $5(x-3)-2(2x-6)\geq 111$

Worked Example	Your Turn
Solve: a) $9x + 4 < 2x + 60$ b) $3x - 23 \leq 7 - 2x$	Solve: a) $5x + 7 > 2x + 22$ b) $2x - 23 \geq 9 - 2x$

Worked Example	Your Turn
Solve: a) $3(x+2) < 2(x+3)$ b) $3(x+8) > 3(2-x)$	Solve: a) $7(x-3) \leq 2(x+7)$ b) $3(x-5) \geq 5(5-x)$

Worked Example	Your Turn
Solve: a) $-1 < 2x + 3 < 9$ b) $-1 \leq 2x + 6 < 9$	Solve: a) $-9 < 2x + 3 < 1$ b) $-9 \leq 2x + 6 \leq 1$

Fill in the Gaps

Q	*Inequality*	Represent on a number line	*Integer solutions*
1	$x > 3$		
2			$x = 3, 4, 5\ldots$
3			$x = -3, -4, -5\ldots$
4	$-3 \leq x$		
5	$x - 1 > 2$		
6			
7	$x + 5 \leq 2$		
8			
9			$x = 4, 5, 6 \ldots or$ $x = -1\ -2, -3\ldots.$
10	$< x \leq$		$x = -2, -1, 0, 1, 2, 3$
11	$x \geq 1\ and\ x < 3$		
12	$3x > 9$		

Combining Inequalities

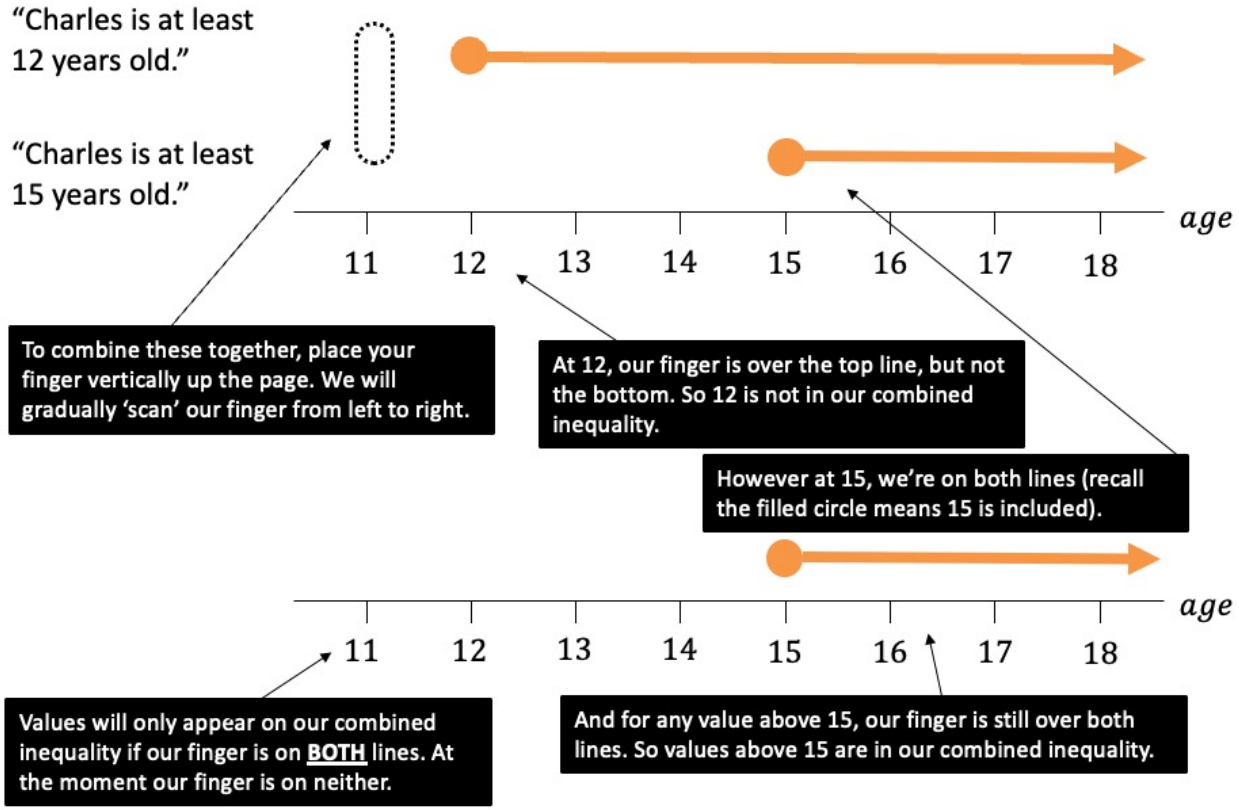
We have already seen examples where we've combined inequalities together:

"x is greater than 2 and less than 5."

$x > 2$

$x < 5$

$\Rightarrow 2 < x < 5$

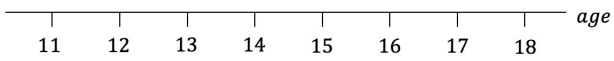


Worked Example

$12 \leq a \leq 17$

$a > 15$

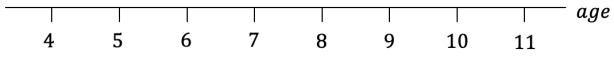
Combined



$x \leq 6$ or $x \geq 8$

$5 < x \leq 9$

Combined

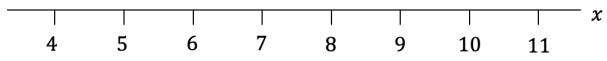


Your Turn

$x \leq 8$

$6 \leq x < 9$

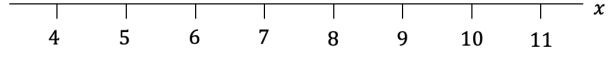
Combined



$x \leq 6$ or $x > 9$

$7 \leq x \leq 10$

Combined

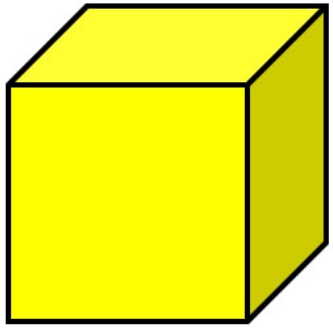


Worked Example	Your Turn
Solve: $3 - x \leq 2 < 10 - 2x$	Solve: $1 + x < 5 \leq 7 + 5x$

Extra Notes

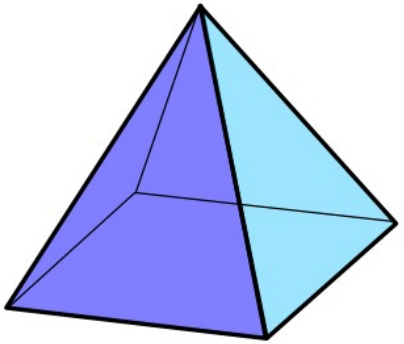
3 Properties of 3D Shapes

Cube

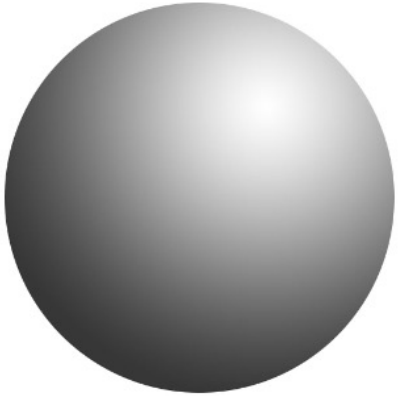


Cuboid

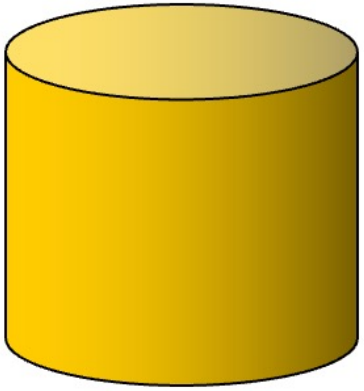
Square-based pyramid



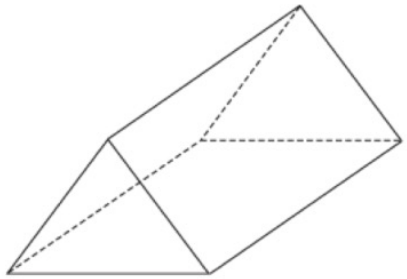
Sphere



Cylinder

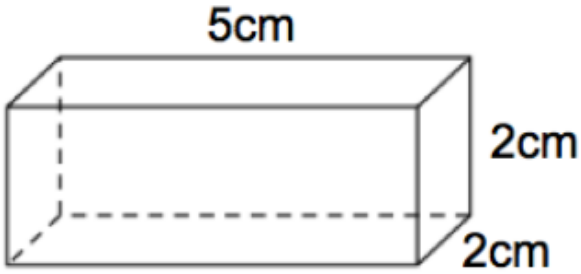


Cone

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

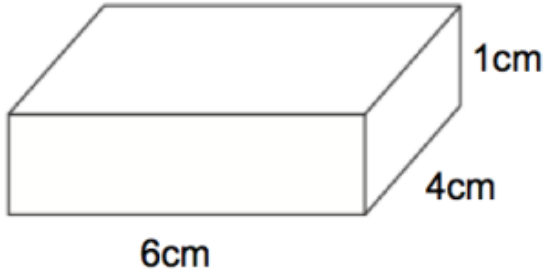
Draw a net for the cuboid.



Each square represents 1 cm^2

Your Turn

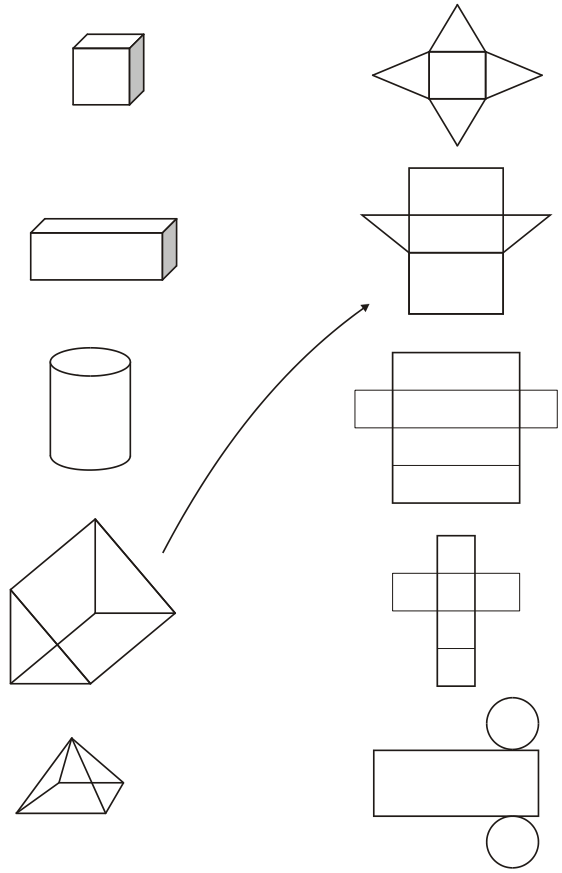
Draw a net for the cuboid.



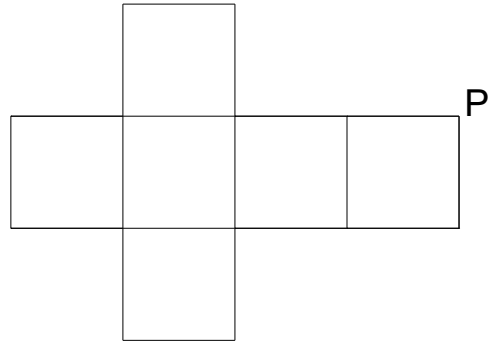
Each square represents 1 cm^2

Fluency Practice

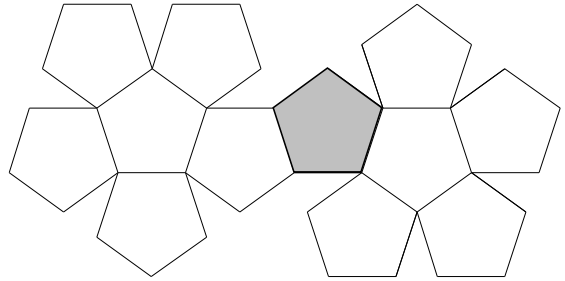
1. Match the 3D solids with their net



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

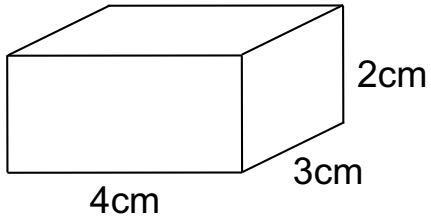


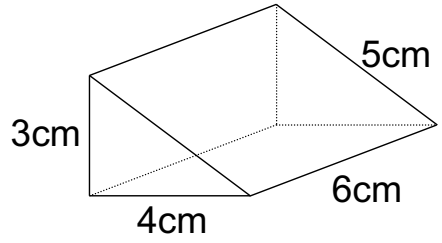
3. The net shown is folded to make a dodecahedron. Label the face which is opposite the shaded one



Fluency Practice

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





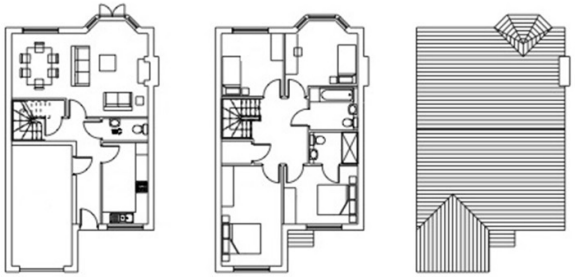
Extra Notes

4 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

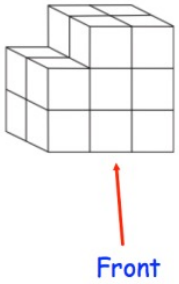
side elevation

back elevation

side elevation

Worked Example

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



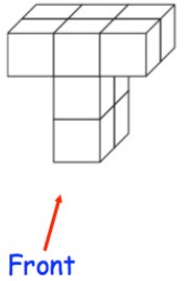
Front:

Side:

Plan:

Your Turn

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



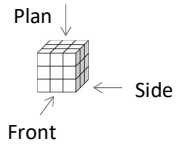
Front:

Side:

Plan:

Fluency Practice

Cutting Cubes 3 × 3 × 3



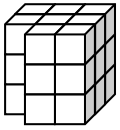
Draw the plan and elevations for each cube.

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

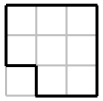
If we can see where all the missing cubes have been removed, we assume…?

①

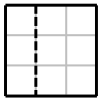
Ex.)



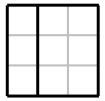
Plan



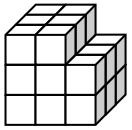
Side Elevation



Front Elevation



a)

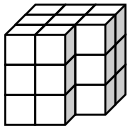


Plan

Side Elevation

Front Elevation

b)

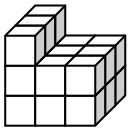


Plan

Side Elevation

Front Elevation

c)

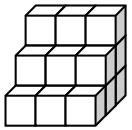


Plan

Side Elevation

Front Elevation

d)

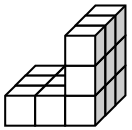


Plan

Side Elevation

Front Elevation

e)

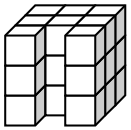


Plan

Side Elevation

Front Elevation

f)

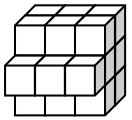


Plan

Side Elevation

Front Elevation

g)

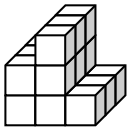


Plan

Side Elevation

Front Elevation

h)

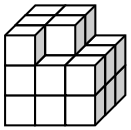


Plan

Side Elevation

Front Elevation

i)

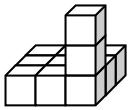


Plan

Side Elevation

Front Elevation

j)

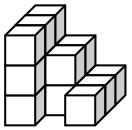


Plan

Side Elevation

Front Elevation

k)



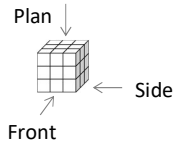
Plan

Side Elevation

Front Elevation

Fluency Practice

Cutting Cubes 3 × 3 × 3



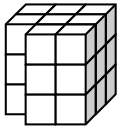
Draw the plan and elevations for each cube.

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

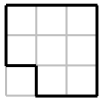
If we can see where all the missing cubes have been removed, we assume…?

②

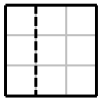
Ex.)



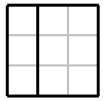
Plan



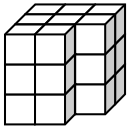
Side Elevation



Front Elevation



a)

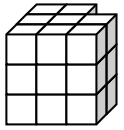


Plan

Side Elevation

Front Elevation

b)

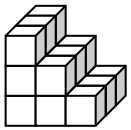


Plan

Side Elevation

Front Elevation

c)

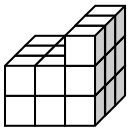


Plan

Side Elevation

Front Elevation

d)

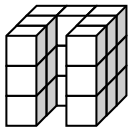


Plan

Side Elevation

Front Elevation

e)

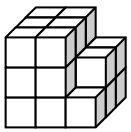


Plan

Side Elevation

Front Elevation

f)

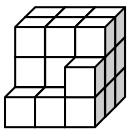


Plan

Side Elevation

Front Elevation

g)

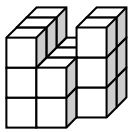


Plan

Side Elevation

Front Elevation

h)

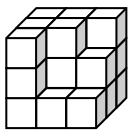


Plan

Side Elevation

Front Elevation

i)

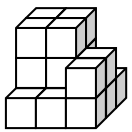


Plan

Side Elevation

Front Elevation

j)

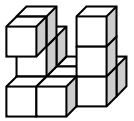


Plan

Side Elevation

Front Elevation

k)



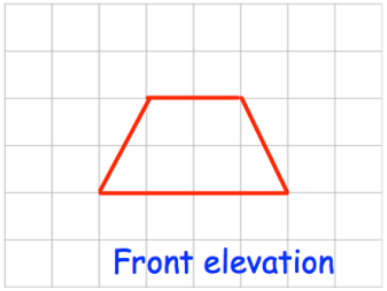
Plan

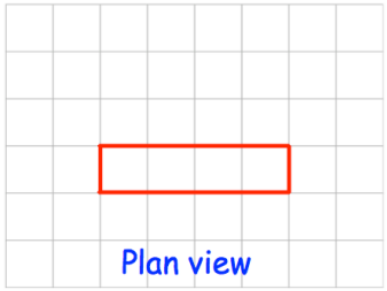
Side Elevation

Front Elevation

Worked Example

Given the elevations



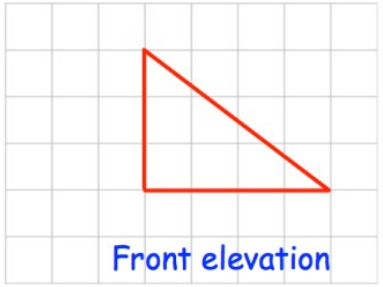


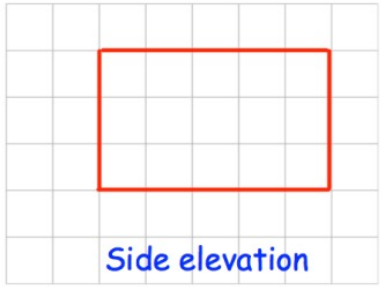
Draw the plan view

Sketch the solid shape

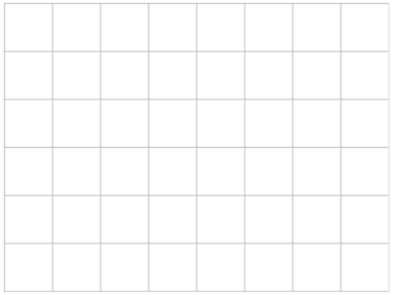
Your Turn

Given the elevations





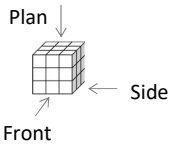
Draw the plan view



Sketch the solid shape

Fluency Practice

Counting Cubes
3 × 3 × 3

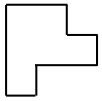


The plans & elevations for different shapes are shown.

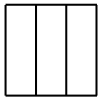
How many cubes are in each shape?

EX.)

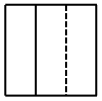
Plan



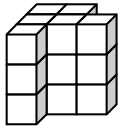
Side Elevation



Front Elevation

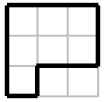


18 cubes

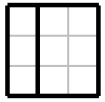


a)

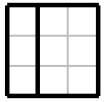
Plan



Side Elevation

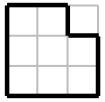


Front Elevation

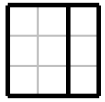


b)

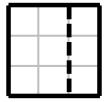
Plan



Side Elevation

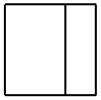


Front Elevation

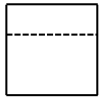


c)

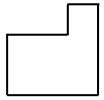
Plan



Side Elevation

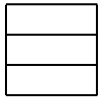


Front Elevation

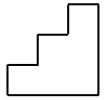


d)

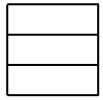
Plan



Side Elevation

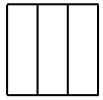


Front Elevation

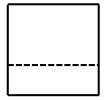


e)

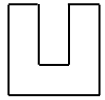
Plan



Side Elevation

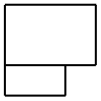


Front Elevation

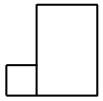


f)

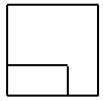
Plan



Side Elevation

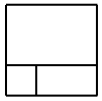


Front Elevation

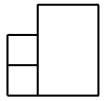


g)

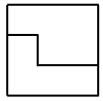
Plan



Side Elevation

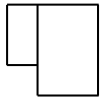


Front Elevation

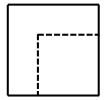


h)

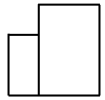
Plan



Side Elevation

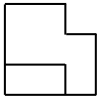


Front Elevation

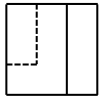


i)

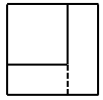
Plan



Side Elevation

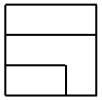


Front Elevation

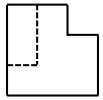


j)

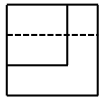
Plan



Side Elevation

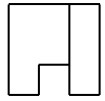


Front Elevation

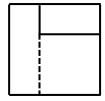


k)

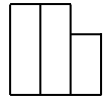
Plan



Side Elevation



Front Elevation



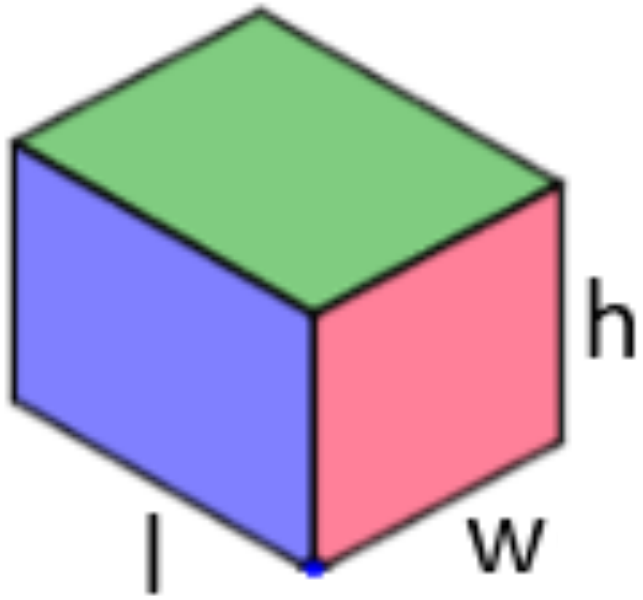
Extra Notes

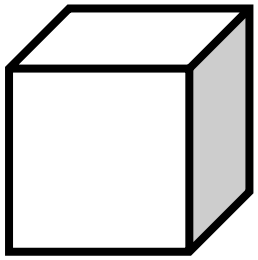
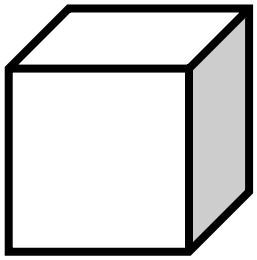
5 Volume and Surface Area of Prisms

Volume of Cuboids

Volume of Cuboid = Length × Width × Height

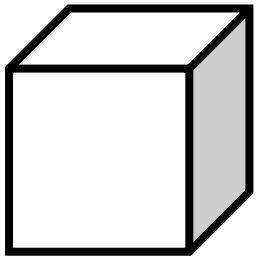
Volume of Cuboid = l × w × h



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

Worked Example

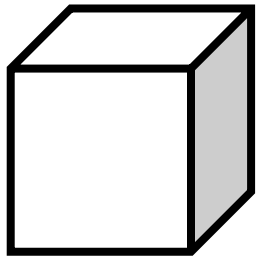
Find x, given that the volume of the cube is $27\ cm^3$



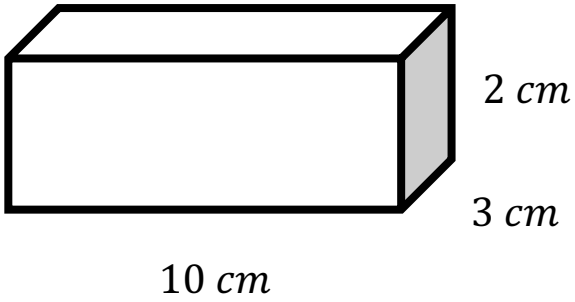
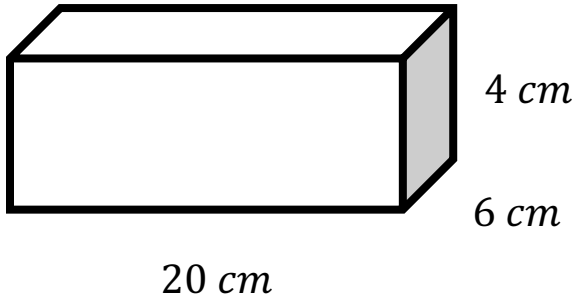
$x\ cm$

Your Turn

Find x, given that the volume of the cube is $125\ cm^3$

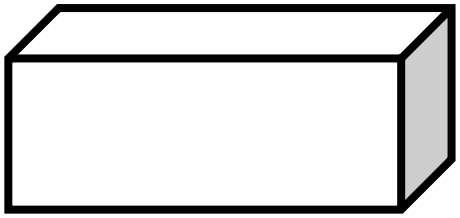


$x\ cm$

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 $60\ cm^3$



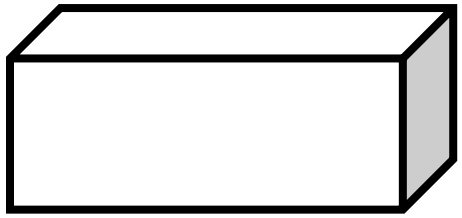
$2\ cm$

$3\ cm$

$x\ cm$

Your Turn

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



$4\ cm$

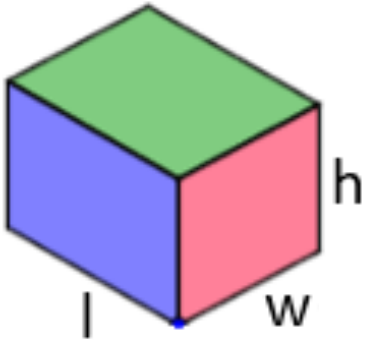
$x\ cm$

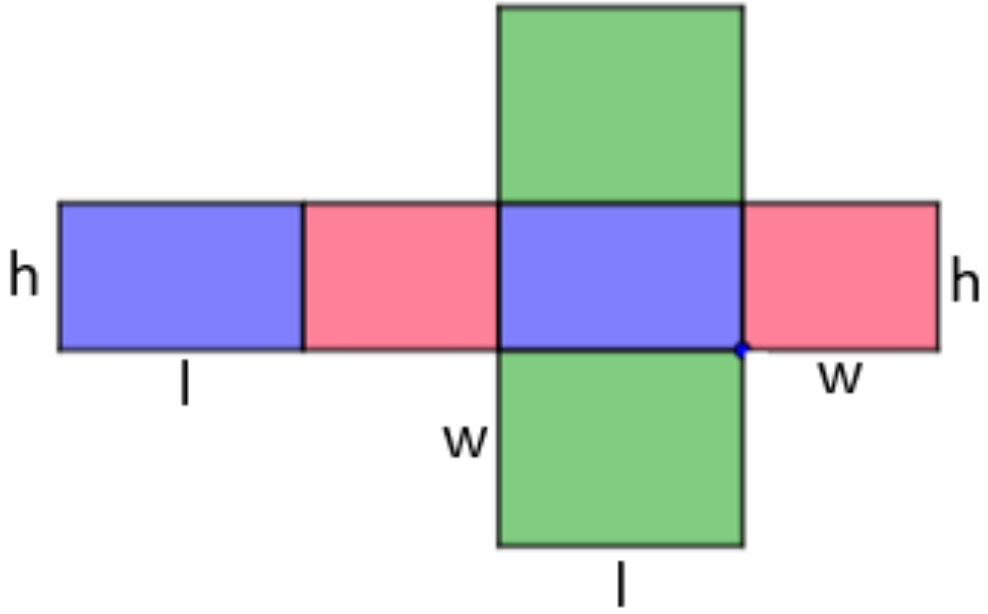
$20\ cm$

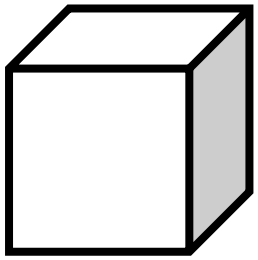
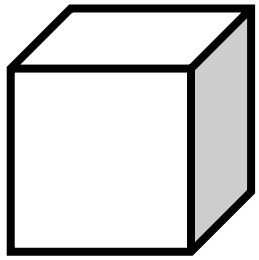
Surface Area of Cuboids

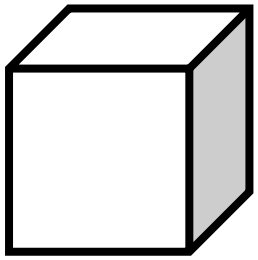
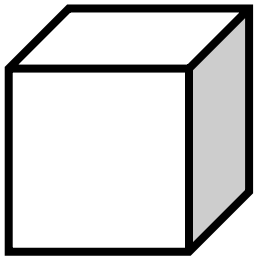
Surface Area of Cuboid = 2 × Length × Width + 2 × Length × Height + 2 × Width × Height

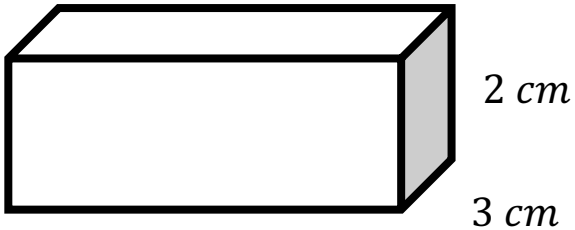
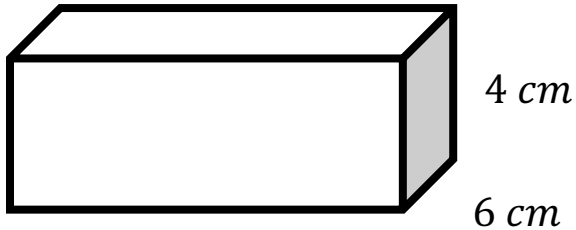
Surface Area of Cuboid = 2lw + 2lh + 2wh





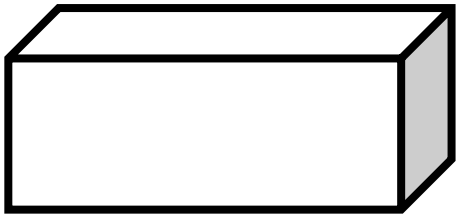
Worked Example	Your Turn
Calculate the surface area of the cube:  $3\ cm$	Calculate the surface area of the cube:  $5\ cm$

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	Your Turn
Calculate the total surface area of the cuboid:  	Calculate the total surface area of the cuboid: 

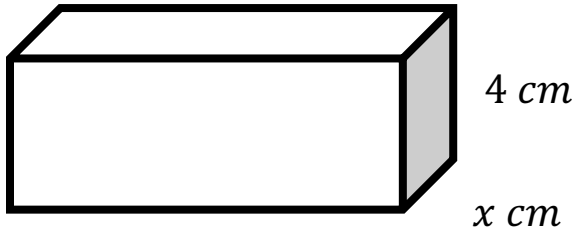
Worked Example

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



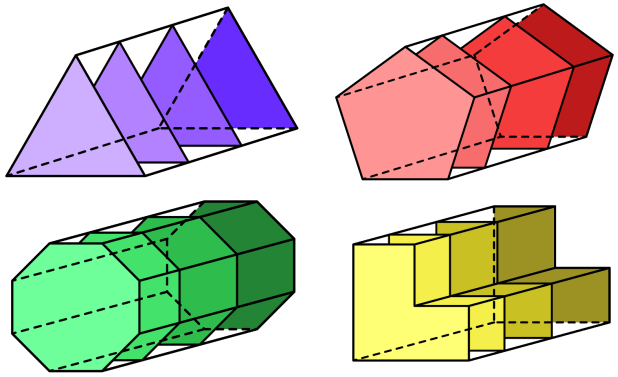
Your Turn

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



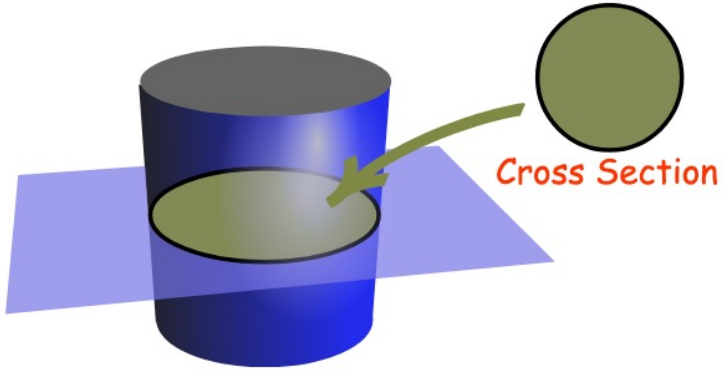
Prisms

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



Cross-Section

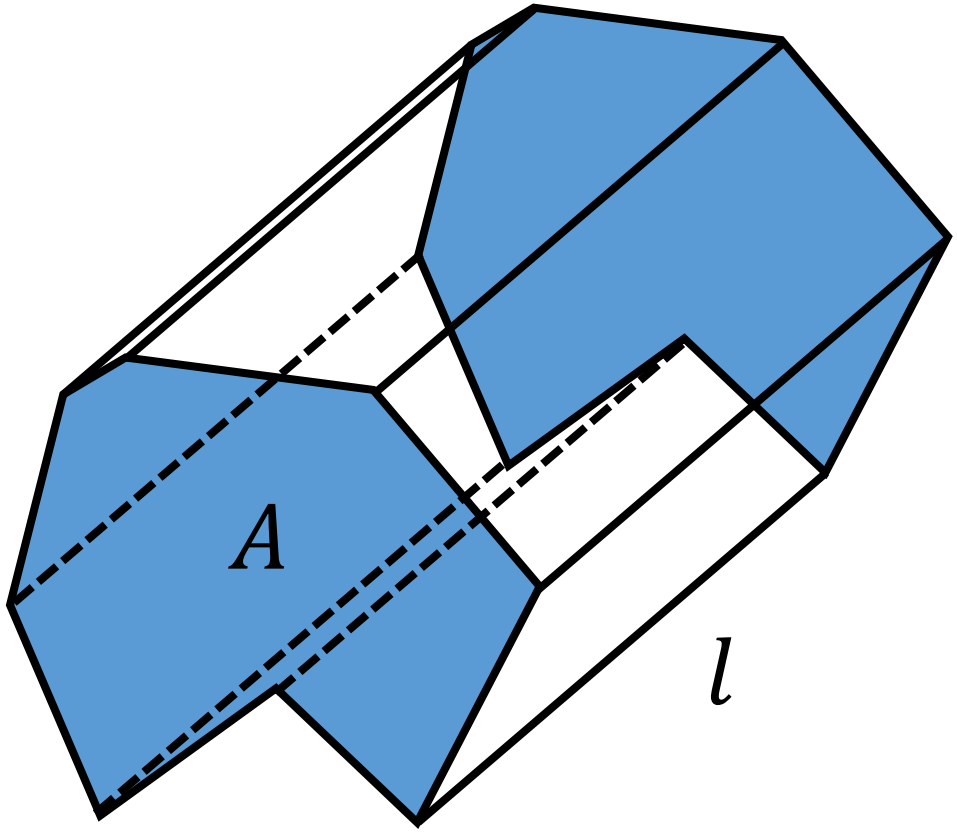
It is the shape made when a solid is cut through parallel to the base.

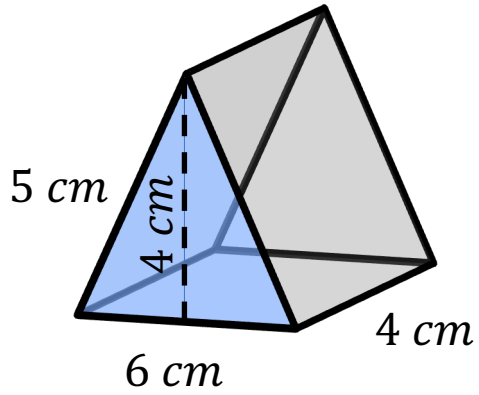
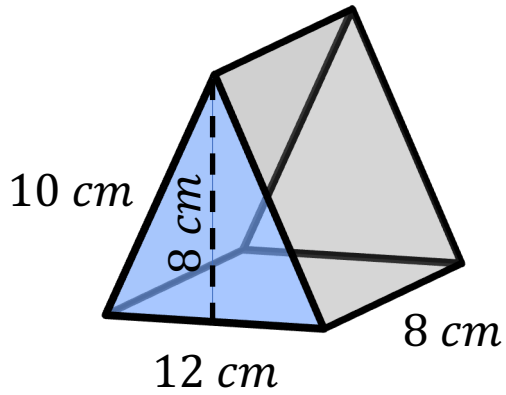


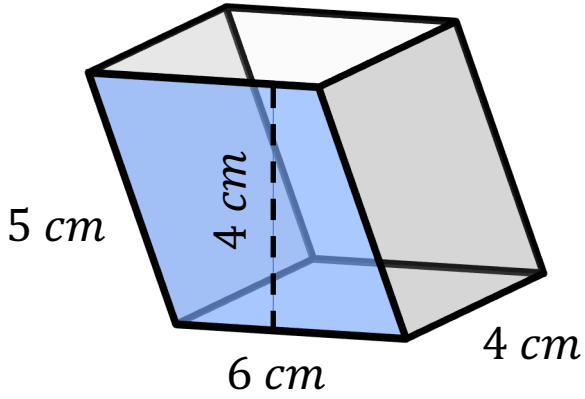
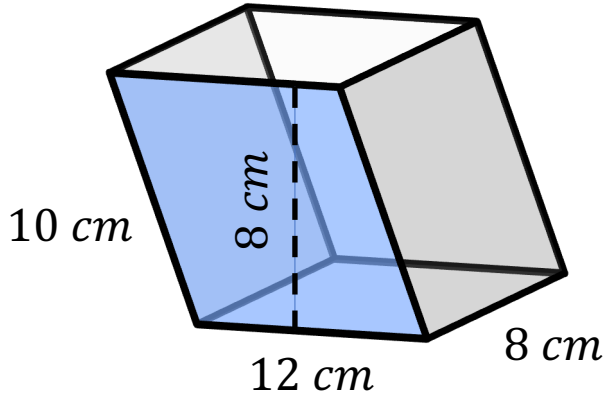
Volume of Prisms

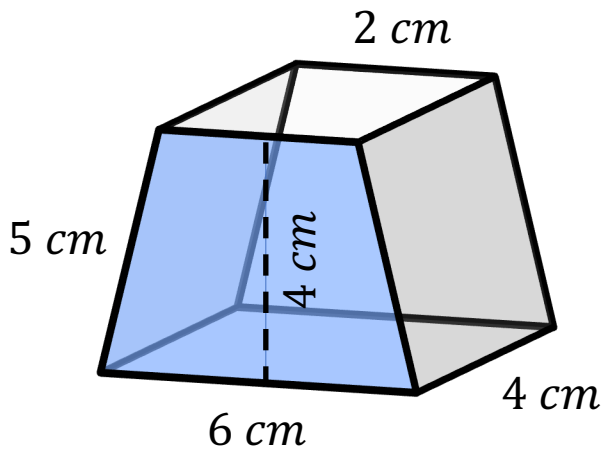
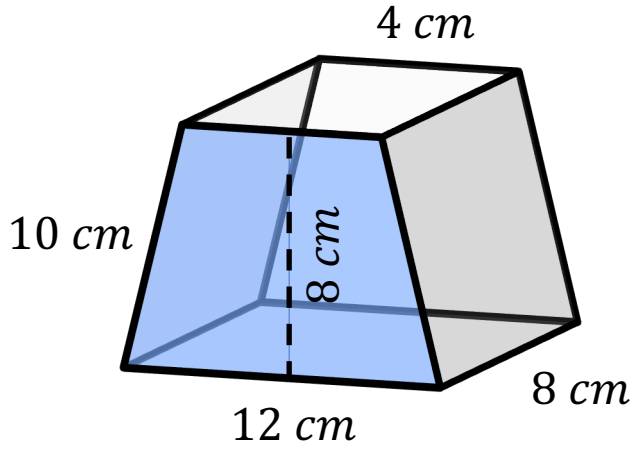
Volume of Prism = Area of Cross Section × Length

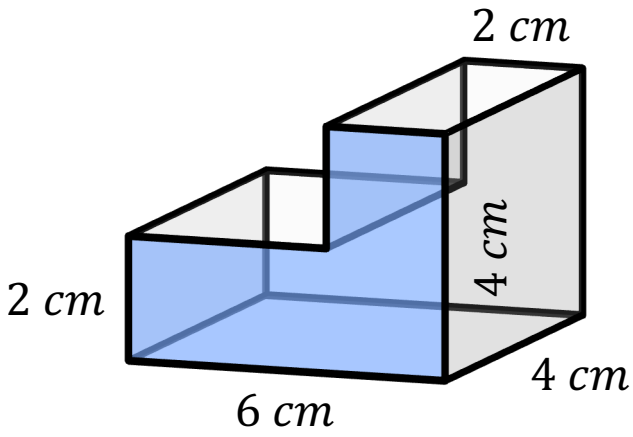
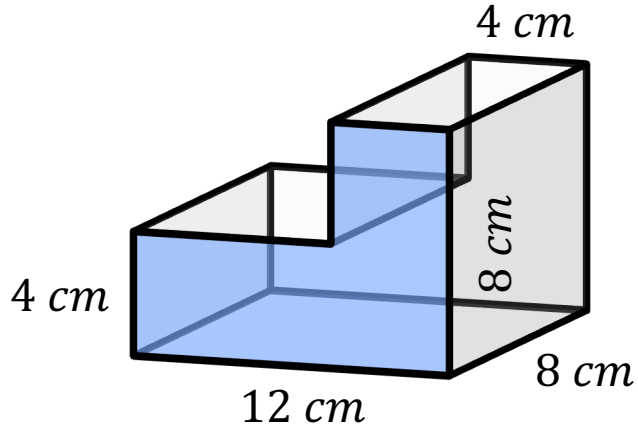
Volume of Prism = A × l



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: 

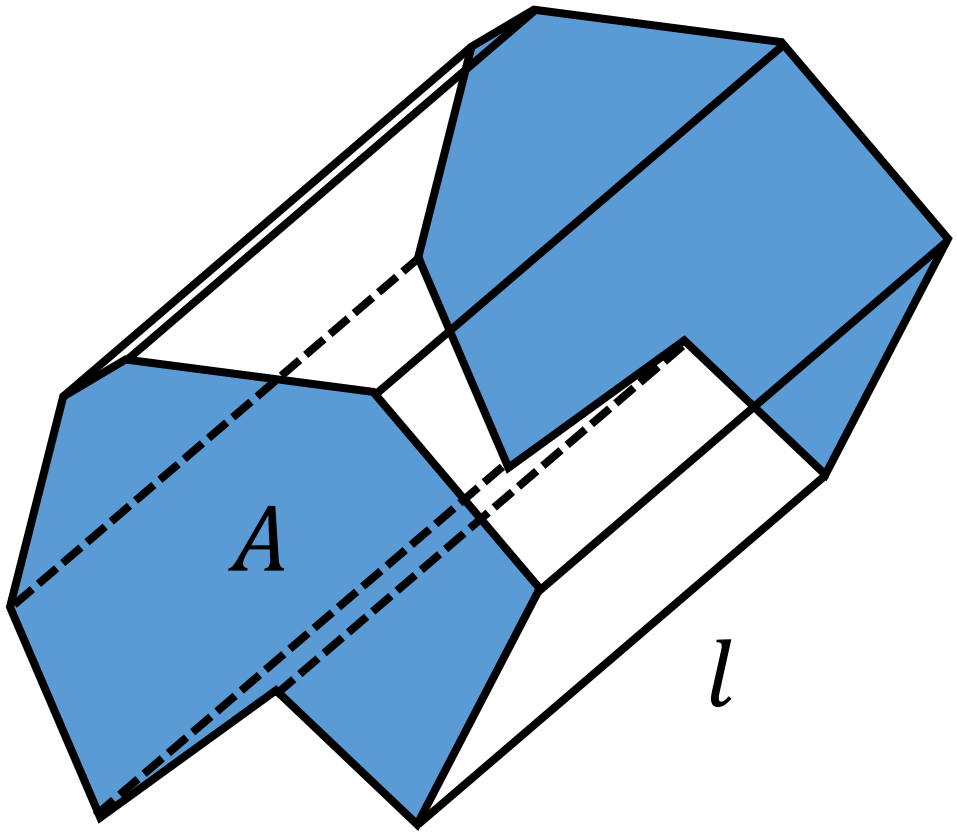
Worked Example	Your Turn
Calculate the volume of the trapezium prism:  	Calculate the volume of the trapezium prism: 

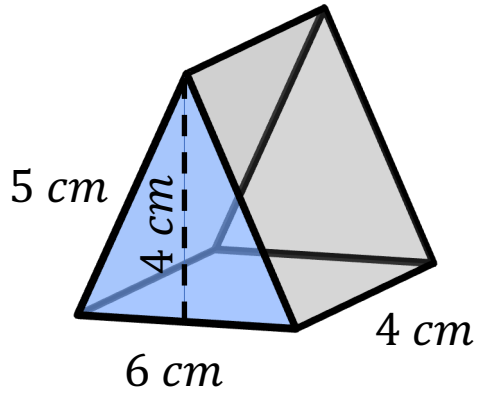
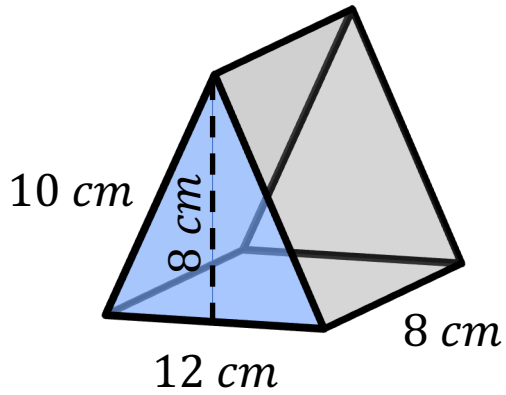
Worked Example	Your Turn
Calculate the volume of the trapezium prism:  	Calculate the volume of the trapezium prism: 

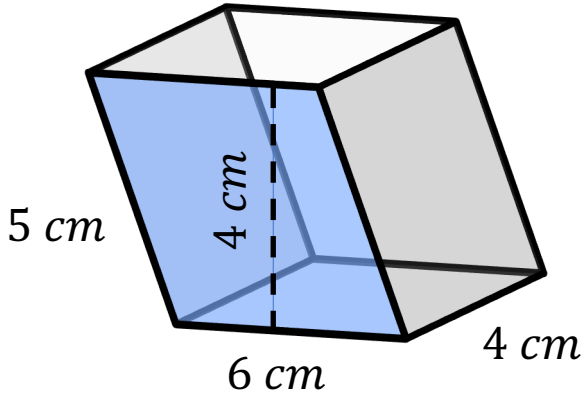
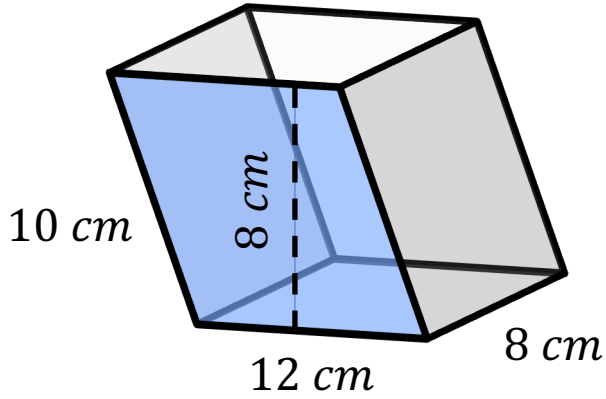
Surface Area of Prisms

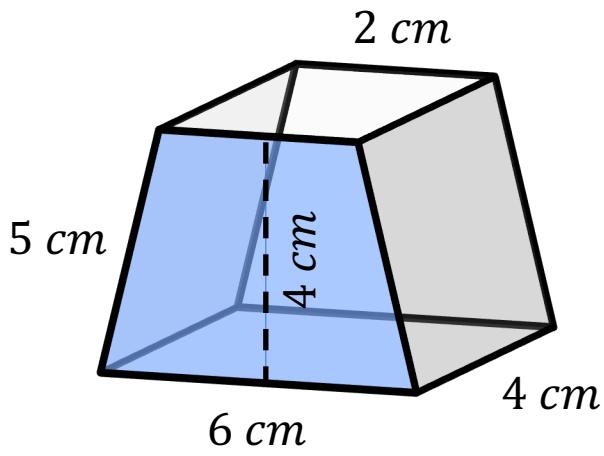
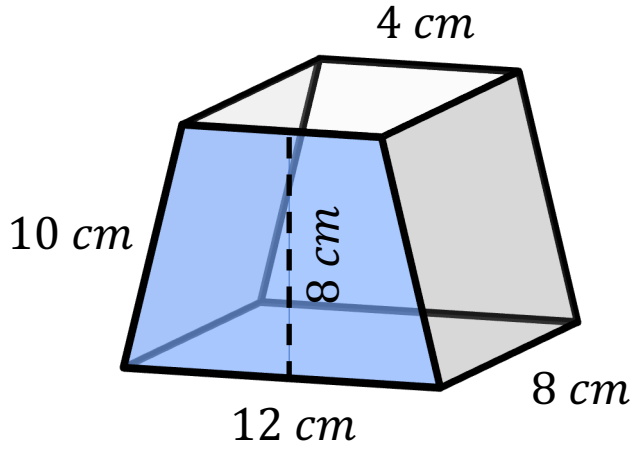
Surface Area of Prism $= 2 \times$ Area of Cross Section $+$ Length $\times$ Perimeter of Cross Section

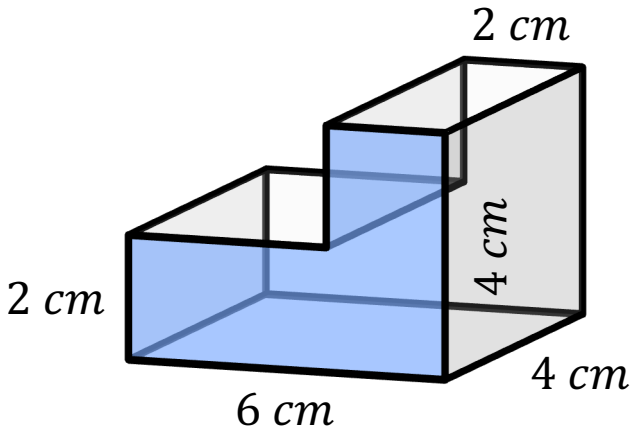
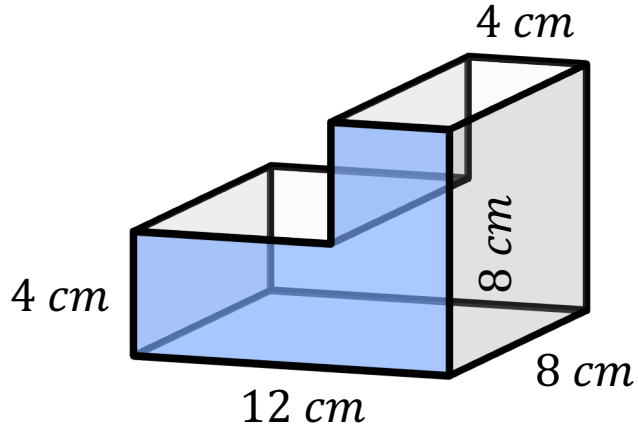
Surface Area of Prism $= 2A + LP$



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: 

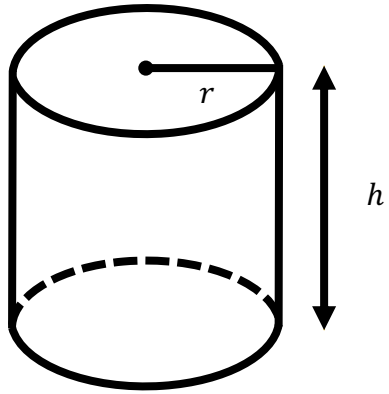
Worked Example	Your Turn
Calculate the surface area of the L-shaped prism:  	Calculate the surface area of the L-shaped prism: 

Volume of Cylinders

Volume of Cylinder = Area of circle × height

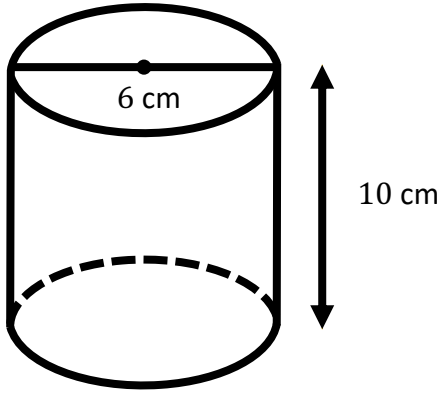
Volume of Cylinder = $\pi \times \text{radius}^2 \times \text{height}$

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



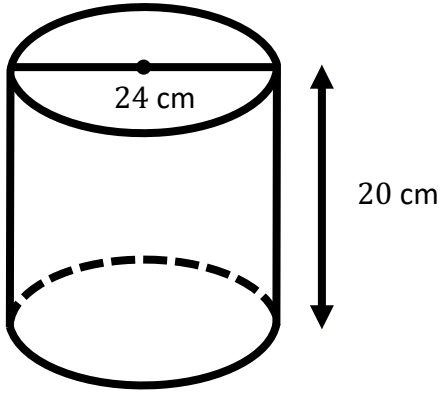
Worked Example

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



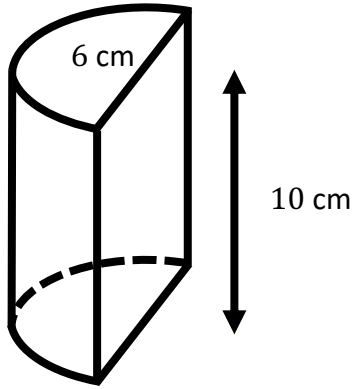
Your Turn

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



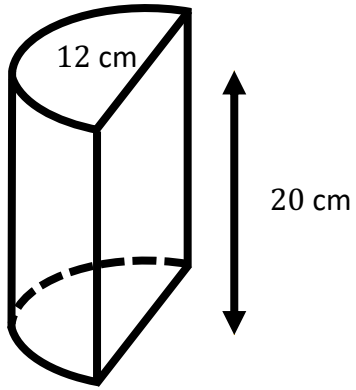
Worked Example

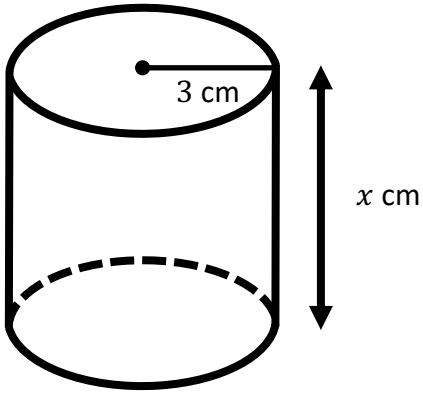
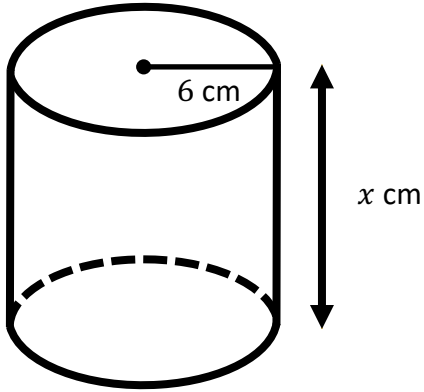
Calculate the volume of the following half cylinder. Give your answer in terms of π and to 1 decimal place.



Your Turn

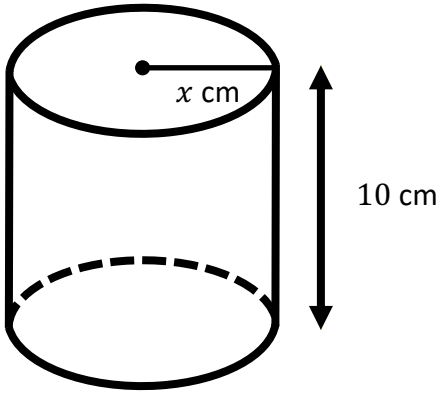
Calculate the volume of the following half cylinder. Give your answer in terms of π and to 1 decimal place.



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. 

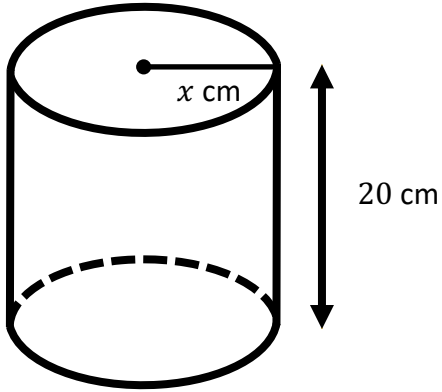
Worked Example

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



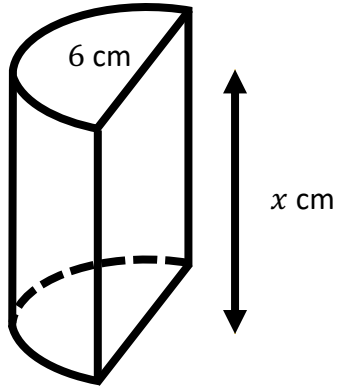
Your Turn

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



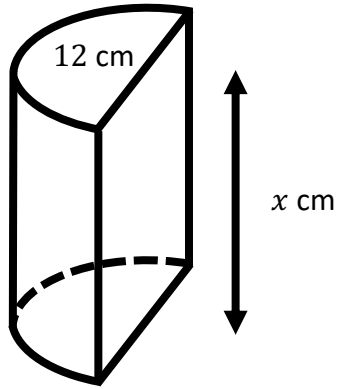
Worked Example

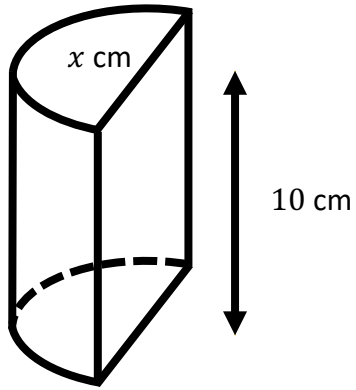
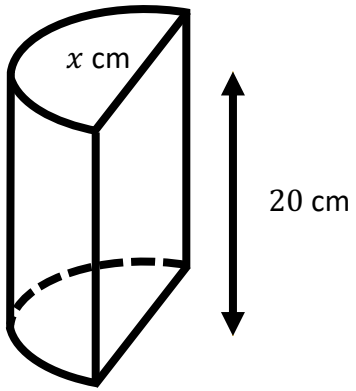
Find the height, x, given that the volume of the following half cylinder is $141.4\ cm^3$. Give your answer to 1 decimal place.



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. 

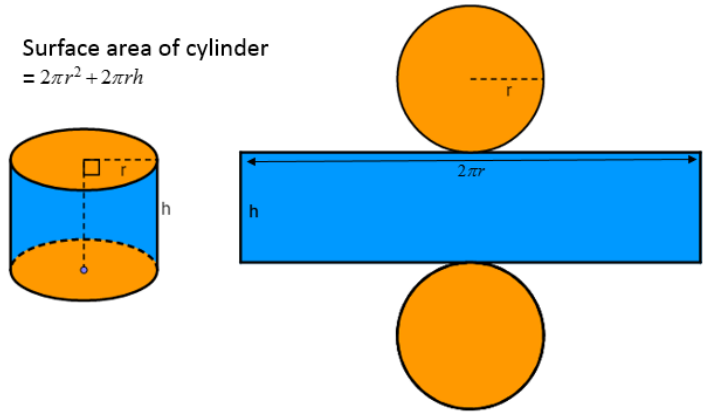
Surface Area of Cylinders

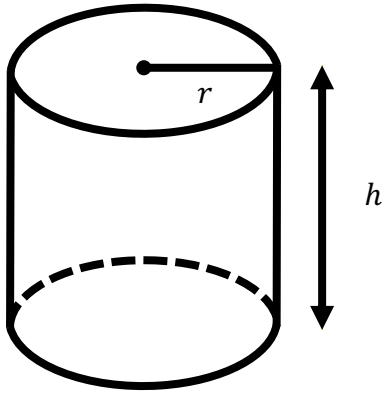
Curved Surface Area of Cylinder = $2 \times \pi \times$ radius $\times$ height

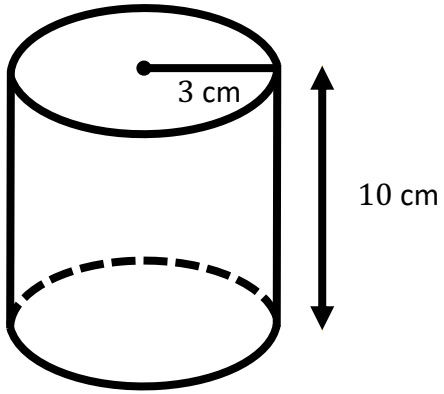
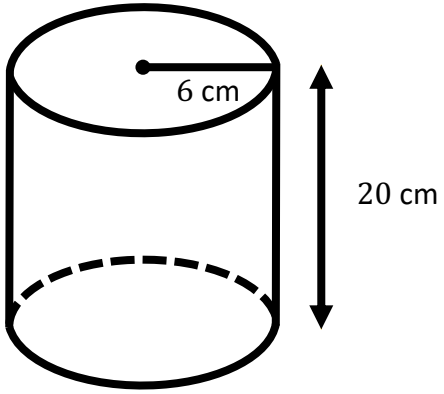
Curved Surface Area of Cylinder = $2\pi rh$

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

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

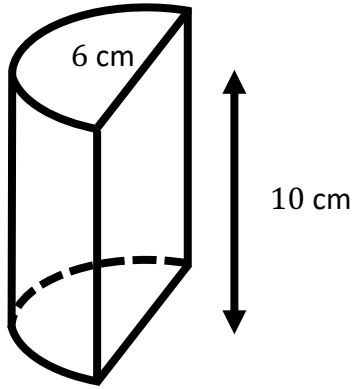




Worked Example	Your Turn
Calculate the total surface area of the following cylinder. Give your answer in terms of π and to 1 decimal place.  	Calculate the total surface area of the following cylinder. Give your answer in terms of π and to 1 decimal place. 

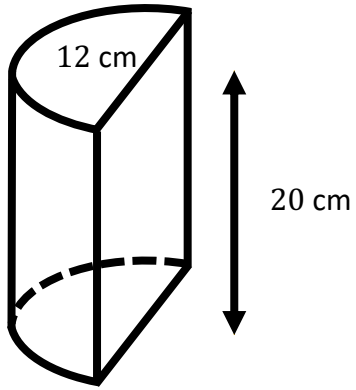
Worked Example

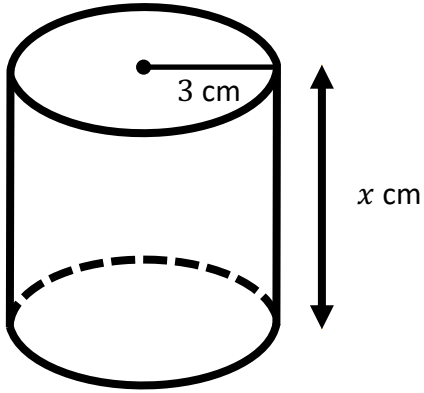
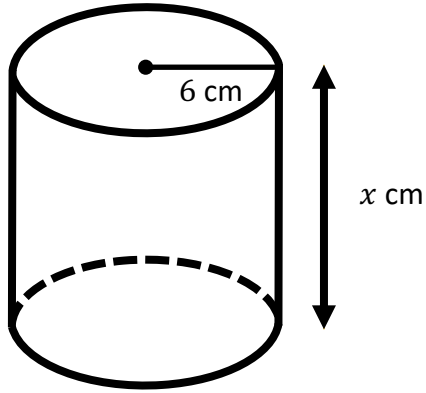
Calculate the total surface area of the following half cylinder.
Give your answer in terms of π and to 1 decimal place.



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	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. 

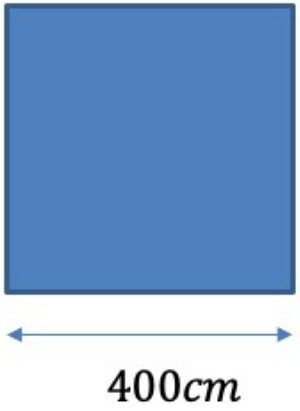
Extra Notes

6 Area and Volume Unit Conversions

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?



$$Area = 400 \times 400$$

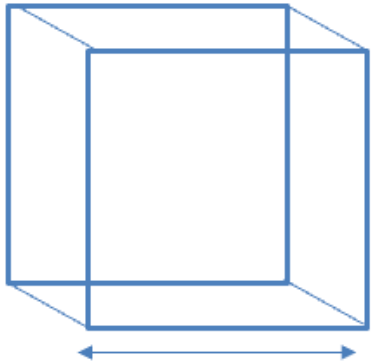
$$Area = 160{,}000cm^2$$

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

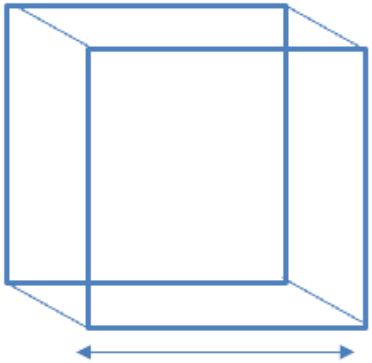
Let's now consider a cube of side 4 m.



$4m$

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

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

Extra Notes