Block 2 S3 4+

Topics

Patterns and Relationships

Surface Area and Volume

Extending a straightforward number pattern

1. Find the next three terms in each of these number patterns:

(a) 1, 3, 5, 7, 9..... **(b)** 3, 6, 9, 12 .....

(c) 10, 16, 22, 28..... **(d)** 100, 96, 92, 88 .....

(e) 1, 5, 9, 13, ... **(f)** 30, 25, 20, ...

2. Find the next two terms in each of these number patterns:

(a) 1, 2, 4, 8, 16 ..... **(b)** 243, 81, 27, ...

(c) 1, 2, 4, 7, 11 ..... **(d)** 20, 19, 17, 14.....

(e) 2, 4, 8, 14, 22 ..... **(f)** 400, 200, 100 .....

3. Find the next three terms in each of these patterns:

(a) 1, 4, 9, 16 ..... What special numbers are these?

(b) 1, 3, 6, 10 ..... What special numbers are these?

(c) 1, 1, 2, 3, 5, 8..... What is the special name given to this sequence?

4. Find the next two terms in each of these patterns:

(a) 1, 2, 6, 24 ..... **(b)** 32, 24, 16 .....

(c) 15, 10, 5, 0 ..... **(d)** 16, 8, 4, 2.....

(e) 30, 20, 11, 3 ..... **(f)** 2, 8, 18, 32.....

Extending a straightforward number or diagrammatic pattern and determining its formula.

One step patterns

1.

1 bunch 4 bananas

2 bunches 8 bananas

3 bunches 12 bananas

(a) Copy this table and complete it using the information above.

Number of bunches	1	2	3	4	5	6
Number of bananas						

(b) For every extra bunch of bananas, how many bananas are added?

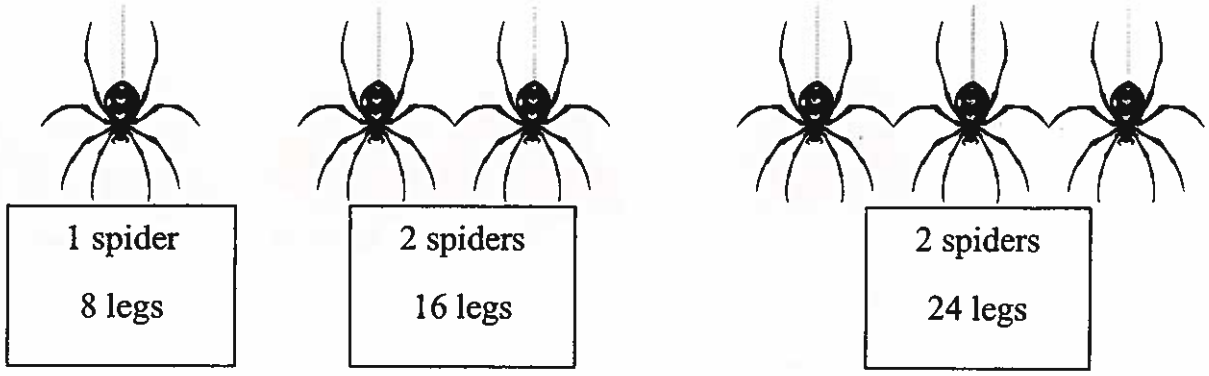
(c) Write down a formula (rule) for finding the total number of bananas (N) if you know the number of bunches (B) :-

Number of bananas = × number of bunches

(d) Write this rule in symbols.

(e) How many bunches of bananas would I have if I had 48 bananas altogether?

2.



(a) Copy this table and complete it using the information above:

Number of spiders	1	2	3	4	5	6
Number of legs						

(b) For every extra spider, how many legs are added?

(c) Write down a formula (rule) for finding the total number of legs (L) if we know the number of spiders (S) :-

Number of legs = × number of spiders

(d) Write this formula in symbols.

(e) How many spiders would there be if there were 80 legs?

3.

1 handful 6 sweets

2 handfuls 12 sweets

3 handfuls 18 sweets

(a) Copy this table and complete it using the information above.

Number of handfuls	1	2	3	4	5	6
Number of sweets						

(b) For every extra handful, how many sweets are added?

(c) Write down a formula for finding the total number of sweets (S) if we know the number of handfuls (H) :-

Number of jelly beans = × number of handfuls

(d) Write this formula in symbols.

(e) How many handfuls would there be if there were 42 sweets?

4. This shape is called a pentagon. It has 5 sides. 

1 pentagon 5 sides	2 pentagons 10 sides	3 pentagons 15sides

(a) Copy and complete this table from the diagrams above.

Number of pentagons	1	2	3	4	5	6
Number of sides						

(b) Complete: the number of sides = × number of pentagons

(c) How many sides would there be on 16 pentagons?

(d) How many pentagons could be formed from 100 sides?

5.

1 star 16 points	2 stars 32 points	3 stars 48 points

(a) Complete: the number of points = × number of stars

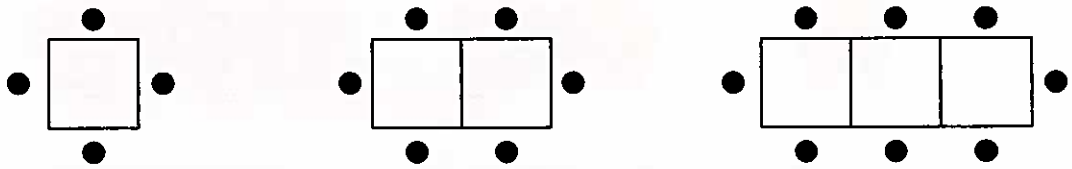
(b) How many points would there be for 10 stars?

(c) How many stars could be formed from 128 points?

Extending a straightforward number or diagrammatic pattern and determining its formula.

Two step patterns

1. The squares in the diagram represent tables and the dots represent people sitting at them.



(a) Draw diagrams to show the number of people who could sit at 4 tables and 5 tables.

(b) Copy and complete this table for the number of tables and the number of people.

Number of tables	1	2	3	4	5		10	14
Number of people								

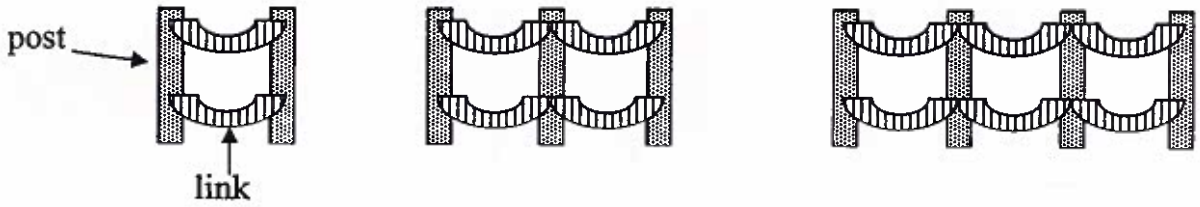
(c) Write down a rule in words for the finding the number of people if you know how many tables there are.

(d) Write the formula in symbols using T for the number of tables and P for the number of people.

(d) Use your formula to find how many people would be able to sit at 20 tables.

(e) There are 44 people at a gathering. How many tables would be needed to seat them?

2. Mr Wright wants to build a fence round his garden and draws some diagrams so that he can work out how many posts and how many link pieces he will need.



(a) Draw diagrams with 5 and 6 posts.

(b) Copy and complete this table to show the number of posts and the number of links required for different lengths of fencing.

Number of posts	1	2	3	4	5		20	25
Number of links								

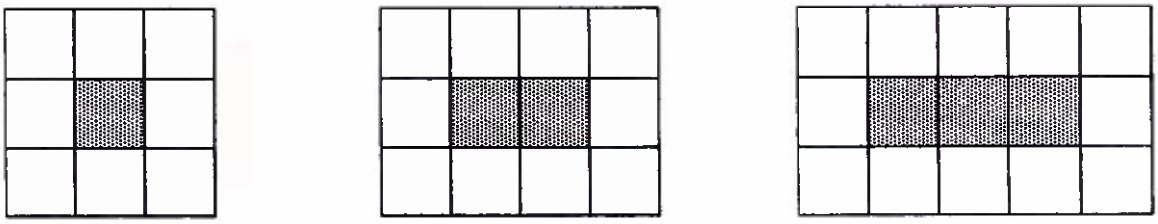
(c) Write down a rule in words for the finding the number of links needed if you know how many posts there are.

(d) Write the formula in symbols using L for the number of links and P for the number of posts.

(e) Use your formula to find how many links would be needed for 50 posts.

(f) Mr Wright has 100 links. How many posts would he need to use them all up?

3. Plain and patterned tiles are laid in a strip.



(a) Draw the next two patterns of tiles.

(b) How many plain tiles would there be in a strip with 7 patterned tiles?

(c) If there are 9 patterned tiles, how many plain tiles will these be?

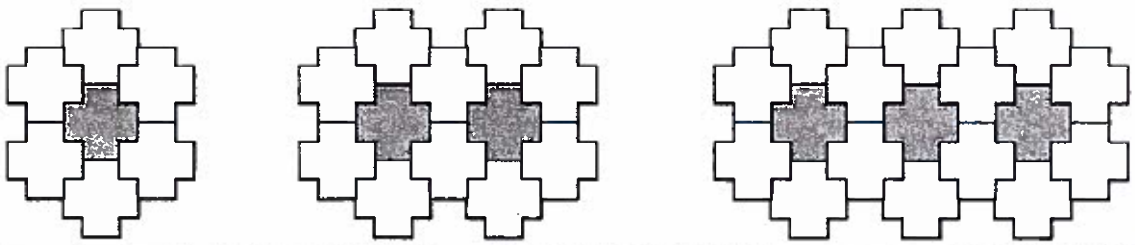
(d) Copy and complete the following table:

Number of patterned tiles	4	5	6	7	8	9	10		20
Number of plain tiles									

(e) Write down a formula for finding the number of plain tiles (P) when you know the number of patterned tiles (R).

(f) If there are 152 plain tiles, how many patterned tiles would there be?

4. **(a)** Complete the table below for this tile pattern made from coloured and white tiles.



Number of coloured tiles	1	2	3	4		10	20		50
Number of white tiles									

(b) Write down a formula for finding the number of white tiles (W) when you know the number of coloured tiles (C).

(c) If there are 86 white tiles, how many coloured tiles would there be?

5. For their barbeque Mr and Mrs Goldie allowed 3 burgers for each person attending and an extra 10 to be on the safe side.

(a) Complete this table for the numbers of burgers they would need:

Number of people	1	2	3	4	5	6
Number of burgers						

(b) Find a formula for the number of burgers needed when you know the number of people.

(c) Use your formula to find out how many burgers would be needed for 18 people.

(d) If you have 100 burgers how many people could you invite to the barbeque?

6. These patterns are made up from a number of rhombuses.

(a) Complete the table to show the number of rhombuses used in each.

Pattern number	1	2	3	4	5	6
Number of rhombuses						

(b) How many rhombuses would be needed for the 10^{th} pattern?

(c) How many rhombuses would be in the 24^{th} pattern?

(d) Write down a rule for finding the number of rhombuses (R) in any pattern number (P).

(e) What pattern number would have 34 rhombuses in it?

(f) What pattern number would have 46 rhombuses in it?

7. **(i)** Find a formula for each of the following.

(a)

P	1	2	3	4	5	6		12		
Q	3	6	9	12	15	18			48	90

(b)

M	1	2	3	4	5	6		11		
N	3	5	7	9	11	13			33	57

(c)

R	1	2	3	4	5	6		14		
T	2	5	8	11	14	17			26	47

(d)

D	5	6	7	8	9	10		20		
K	4	5	6	7	8	9			31	68

(e)

V	2	3	4	5	6	7		15		
A	3	6	9	12	15	18			57	72

(ii) Use your formulae to complete the missing entries in the tables.

EXAM QUESTIONS

1. A plumber uses this table to calculate the charges for carrying out work. He charges a call out charge plus a charge for every hour the work takes.

(a) Complete the table:

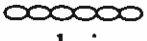
Number of hours worked (n)	2	3	4	5		10
Cost (£C)	49	61	73			

(b) Find a formula for calculating the cost when you know the number of hours a piece of work will take.

2. Art students at college were asked to design a bracelet.

Julie made up this design from bars and chains.

bar



chain

(a) Complete this table for the above pattern.

Number of bars (b)	2	3	4		8
Number of chains (c)					

(b) Write down a formula for calculating the number of chains (c) when you know the number of bars (b).

(c) Julie has 57 pieces of chain. How many bars will she need if she wants to use all the pieces of chain?

3.

The 'Shoe Tidy' shown opposite is made up from wall brackets and pouches.

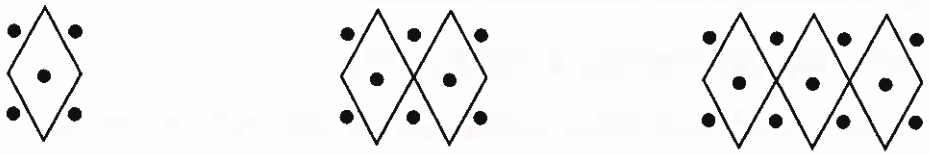
Number of wall brackets (w)	2	3	4	5		12
Number of pouches (p)	4	8				

(a) Complete the table above.

(b) Write down a formula for calculating the number of pouches (p) when you know the number of wall brackets (w).

(c) How many wall brackets would be needed if 76 pouches are required?

4. Milly bought a new top which has some coloured glass diamonds and beads round the neck. Here is how the pattern is built up.



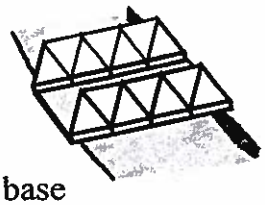
Pattern 1	Pattern 2	Pattern 3
1 Diamond	2 Diamonds	3 Diamonds
5 Beads	8 Beads	11 Beads

(a) Complete the table for the number of diamonds and number of beads in other patterns.

Number of Diamonds (N)	1	2	3	4	5		10
Number of Beads (B)	5	8	11				

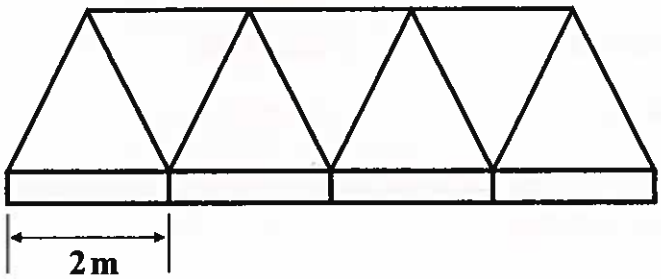
(b) Write down the formula for finding the number of beads needed for any number of diamonds.

5. A company makes bridge sides to any length. Each side is made up of triangular and rectangular sections.



Each rectangular section is 2 metres long.

The diagram below shows a single bridge side with four rectangular base plates.



(a) Complete the table below for different lengths of single bridge side.

Number of rectangles (r)	2	3	4	5	6		12
Number of triangles (T)			7				

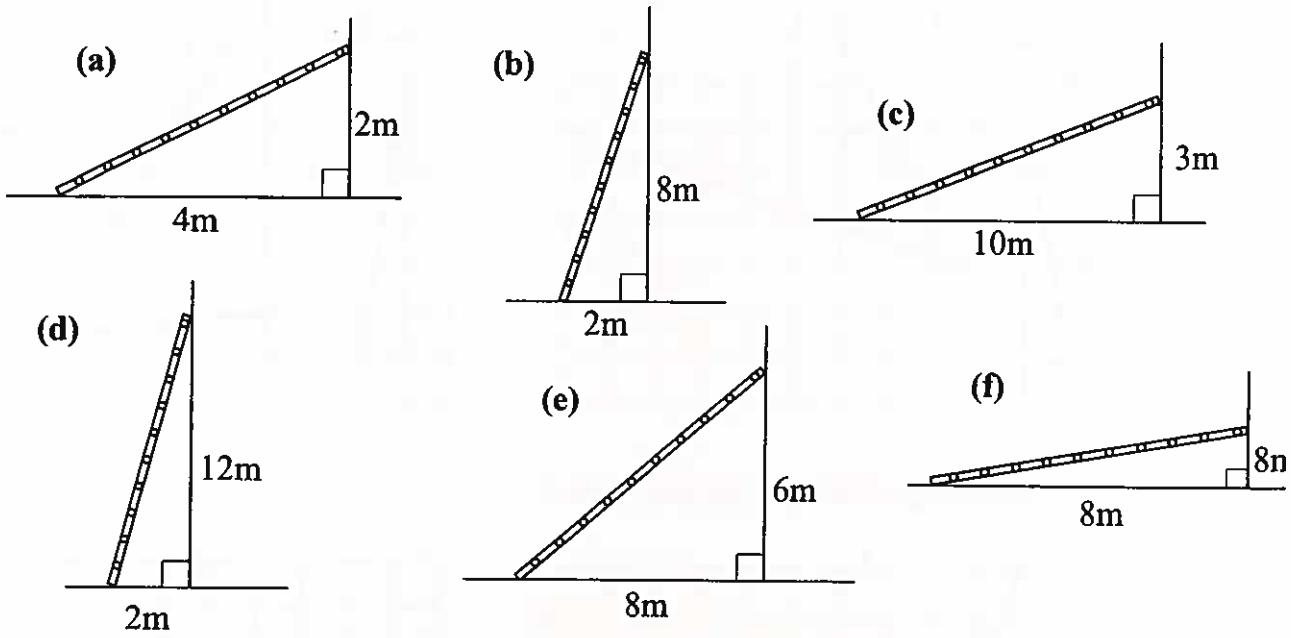
(b) Write down a formula for calculating the number of triangles (T), when you know the number of rectangles (r) for a single bridge side.

(c) A bridge **with two sides** has a total of 78 triangular sections.

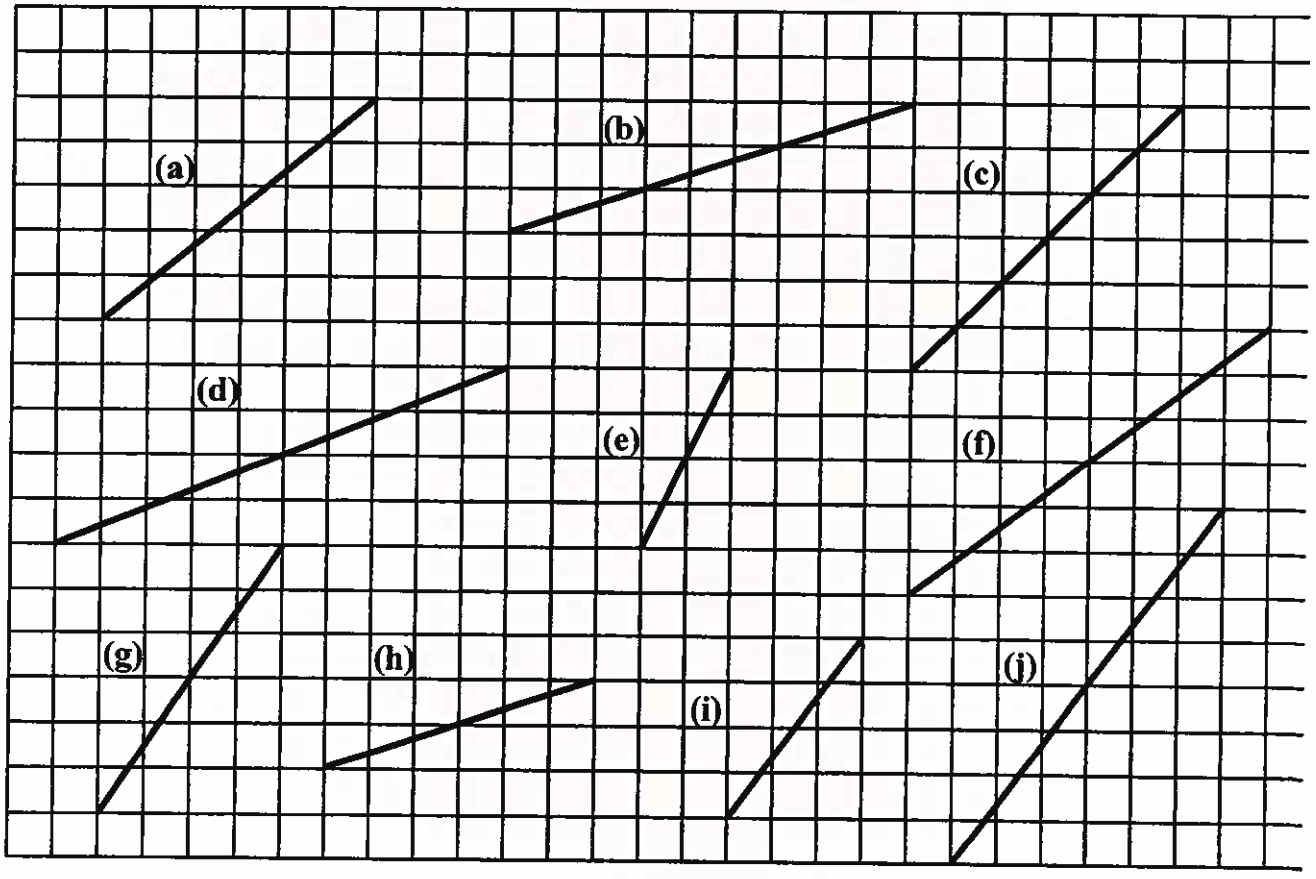
What is the total length of this bridge?

Calculating the gradient of a straight line from horizontal and vertical distances

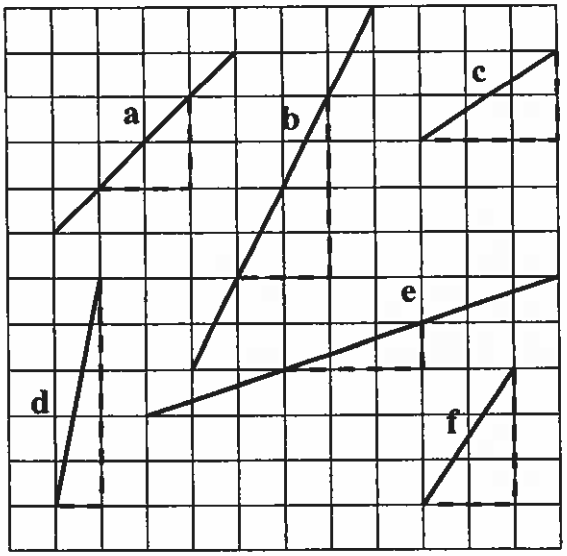
1. Calculate the gradient of each ladder below:

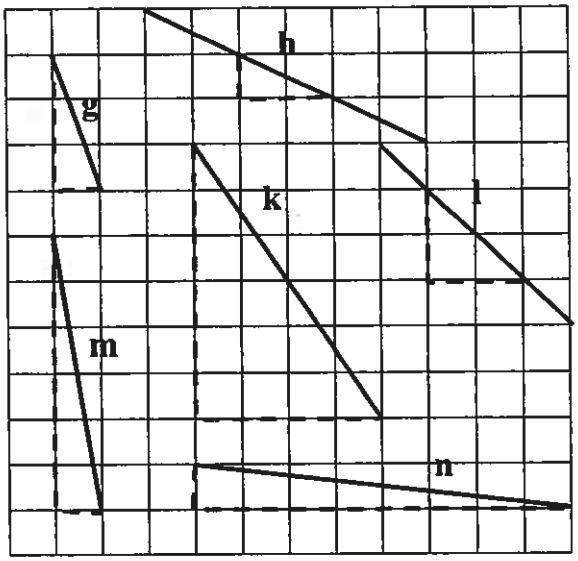


2. Calculate the gradient of each line below, leaving your answer as a fraction in its simplest form where necessary.

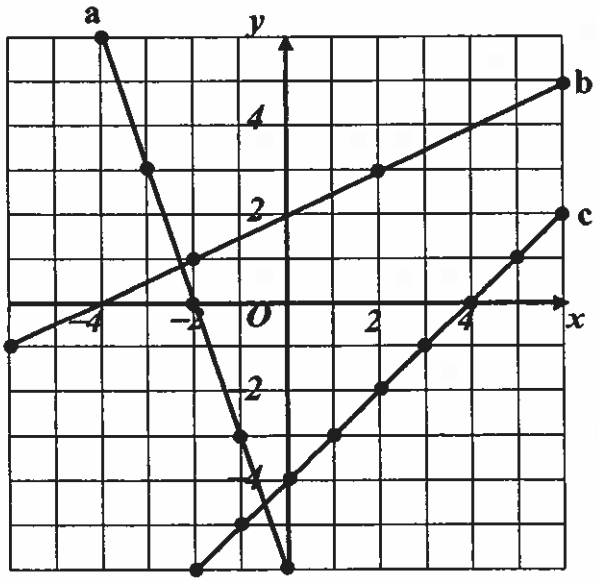


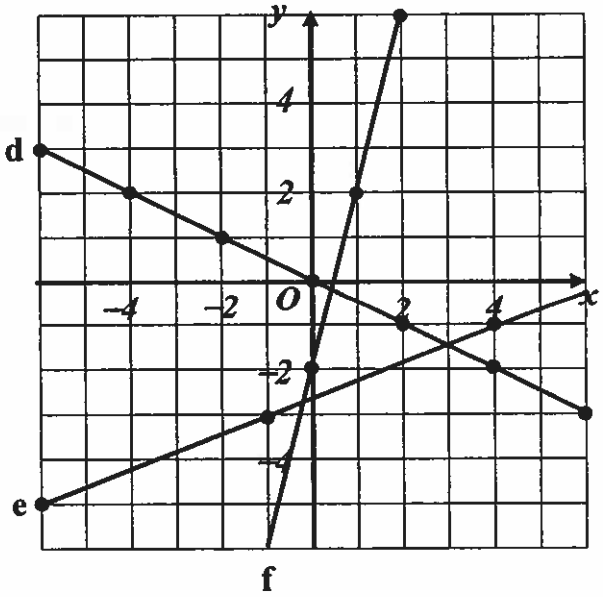
3. Find the **gradients** of the lines shown in each of the diagrams below





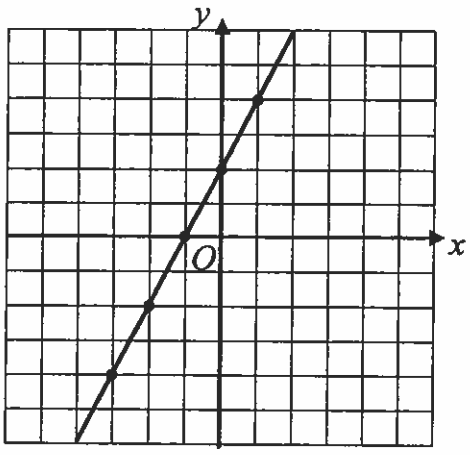
4. Find the **gradients** of the lines below



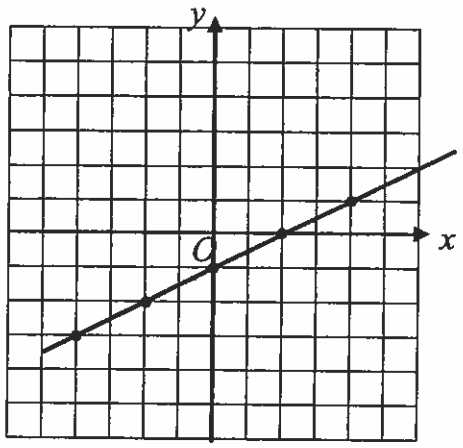


5. Write down the gradient of the lines drawn in the diagrams below.

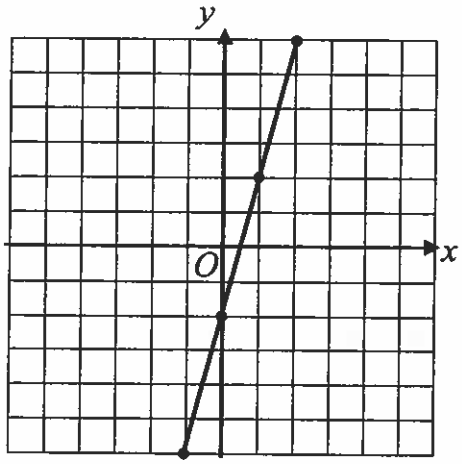
(a)



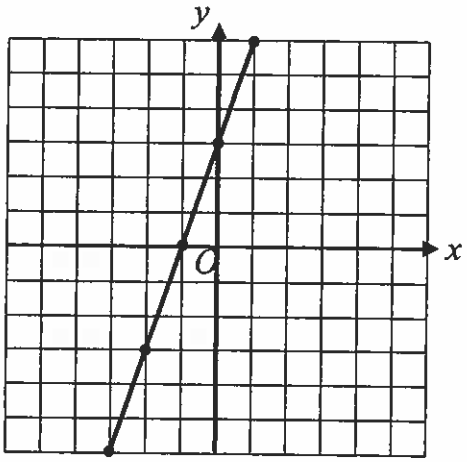
(b)



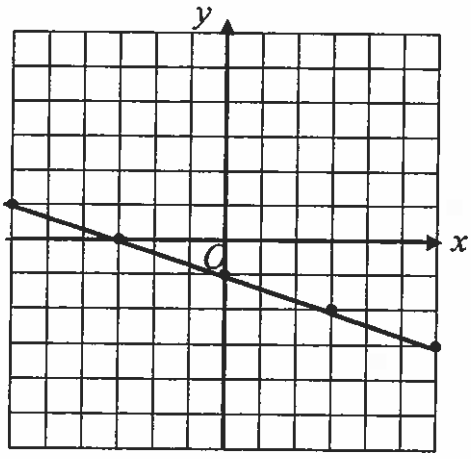
(c)



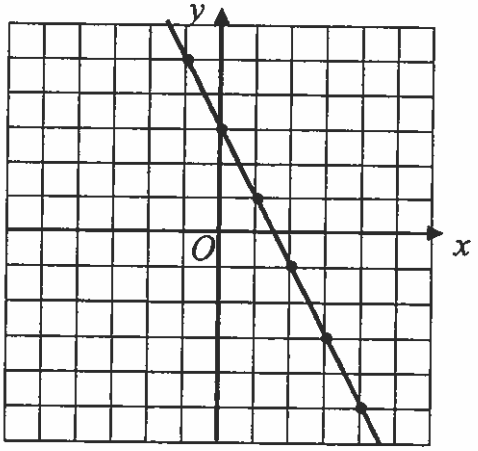
(d)



(e)

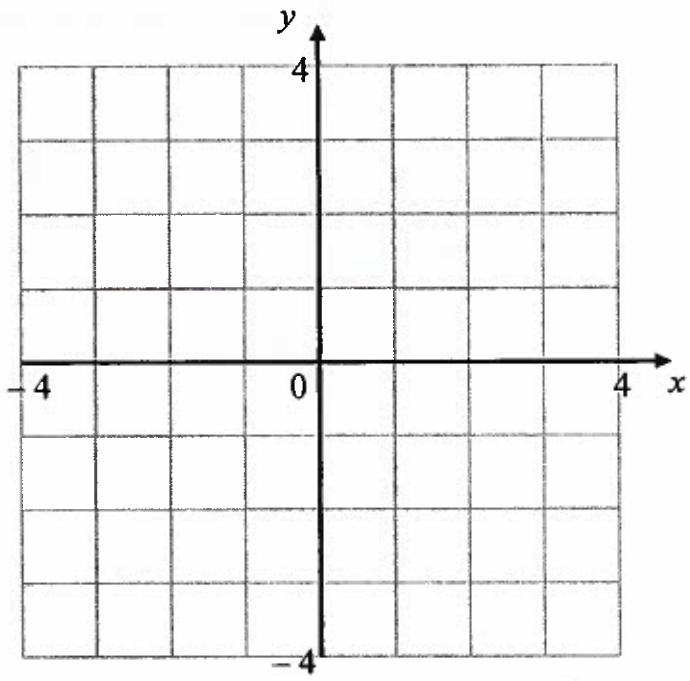


(f)



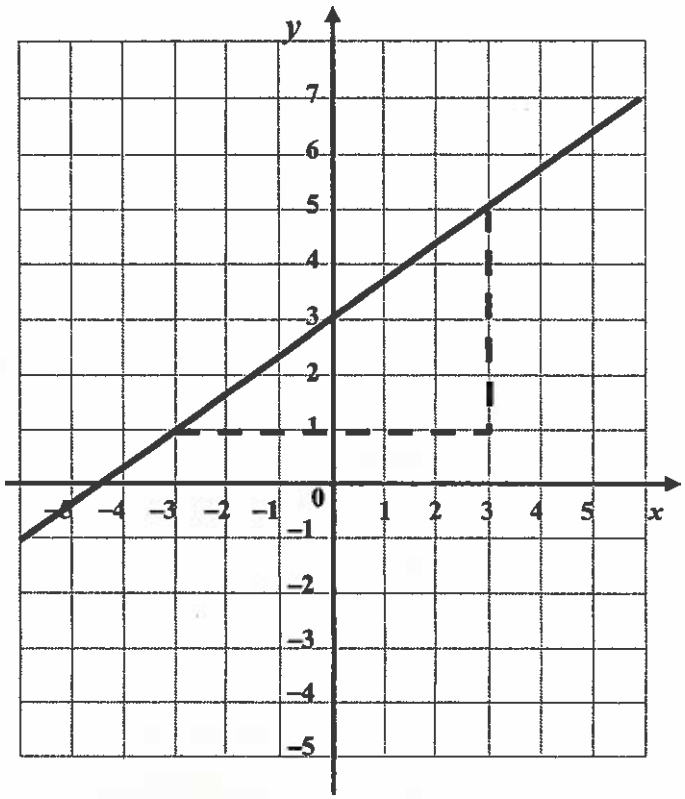
EXAM QUESTIONS

1. **(a)** Copy the grid shown below plot the points A(– 1, 0) and B(3, – 3).

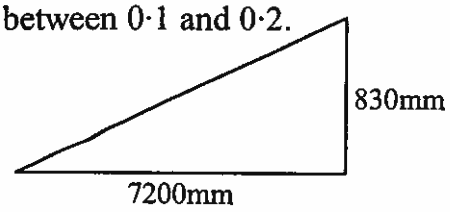


(b) Find the gradient of the line AB

2. Find the gradient of the line shown in the diagram below.



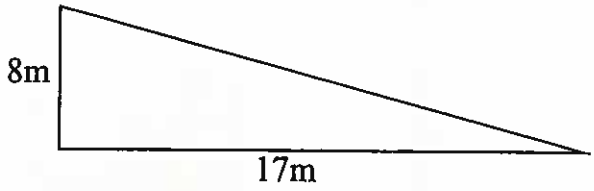
3. The manufacturer of a ramp for a shop entrance states that to be suitable for a wheelchair user the gradient of the ramp must be between 0·1 and 0·2.



Is this ramp suitable for wheelchair users?

You must show working and give a reason for your answer.

4. A skateboard ramp has been designed to have the dimensions shown in the diagram.



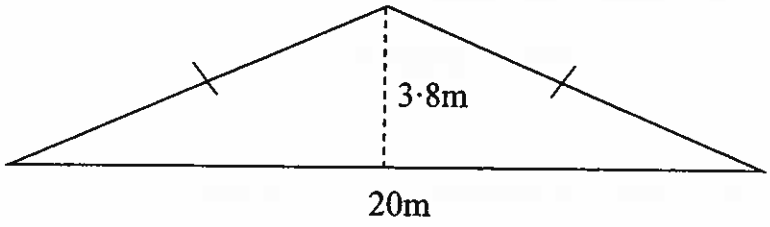
Safety regulations state that the gradient of the ramp should be a **maximum** of 0·5.

Does this ramp meet safety regulations? **You must show working and give a reason for your answer.**

5. A builder wants to find the gradient of the slope of a roof.

The length of the attic floor is 20 metres long and the height at the centre is 3·8m.

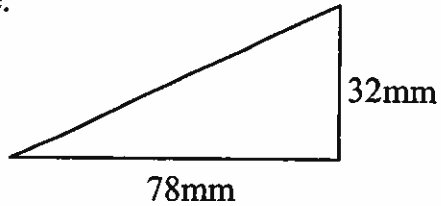
Calculate the gradient of the slope of the roof



6. A door wedge is in the shape of a triangle.

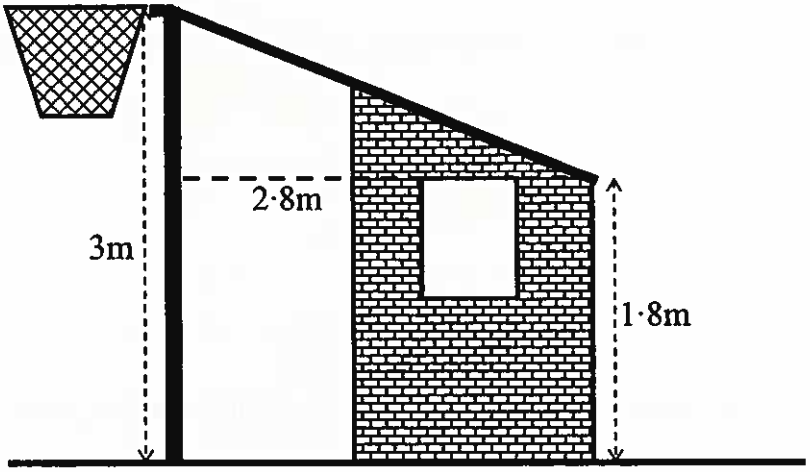
It has a height of 32mm and a base of 78mm.

Calculate the gradient of the sloping edge.



7. Colin has put a basketball net on a pole in his garden. He has fixed it to his garden shed using a baton which he has nailed over the roof of the shed.

The horizontal distance is 2·8 metres and the basketball pole is 3 metres high.



Calculate the gradient of the slope of the roof.

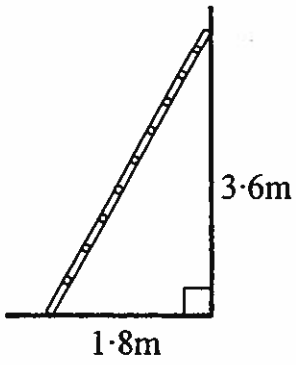
8. A ladder resting against a wall reaches 3·6 metres up a wall.

The foot of the ladder is 1·8 metres from the wall.

For the ladder to be used safely the gradient of the ladder must lie between 1·8 and 2.

Is this ladder being used safely?

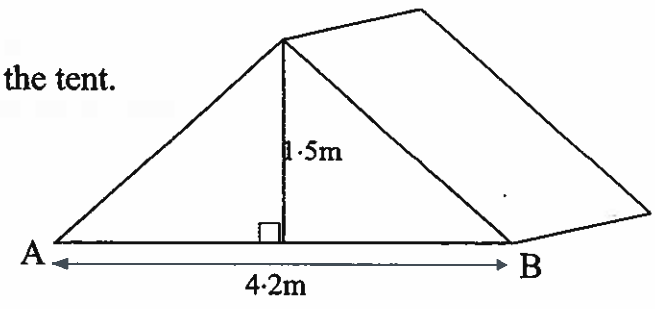
You must show working and give a reason for your answer.



9. The distance between the tent pegs at A and B is 4·2m and the height at the centre is.1·5m.

The sloping sides are the same length.

Calculate the gradient of the sloping side of the tent.



Drawing the graph of a linear equation

1. A straight line has as its equation $y = 2x$.

(a) **Copy** and complete the table for this line.

x	0	1	2	3	4	5
y		2				10

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

2. A straight line has as its equation $y = 3x$.

(a) **Copy** and complete the table for this line.

x	0	1	2	3	4	5
y		3				

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

3. A straight line has as its equation $y = \frac{1}{2}x$.

(a) **Copy** and complete the table for this line.

x	0	2	4	6	8	10
y		1			4	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

4. A straight line has as its equation $y = \frac{1}{3}x$.

(a) **Copy** and complete the table for this line.

x	0	3	6	9	12
y	0			3	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

5. A straight line has as its equation $y = x$.

(a) **Copy** and complete the table for this line.

x	1	2	3	4	5	6
y	1				5	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

6. A straight line has as its equation $y = x + 2$.

(a) **Copy** and complete the table for this line.

x	0	1	2	3	4	5
y	2			5		

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

7. A straight line has as its equation $y = 2x + 1$.

(a) **Copy** and complete the table for this line.

x	0	1	2	3	4	5
y		3			9	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

8. A straight line has as its equation $y = \frac{1}{2}x + 4$.

(a) **Copy** and complete the table for this line.

x	0	2	4	6	8	10
y	4				8	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

9. A straight line has as its equation $y = \frac{1}{4}x + 5$.

(a) **Copy** and complete the table for this line.

x	0	4	8	12
y		6		

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

10. A straight line has as its equation $y = 3x - 2$.

(a) **Copy** and complete the table for this line.

x	1	2	3	4	5
y	1			10	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

11. **(a)** Plot the points (1, –1), (1, 0), (1, 1), (1, 2), (1, 3), (1, 4), (1, 5)

(b) Draw a line through these points

(c) You have drawn the line $x = 1$. Label your line.

12. Use a similar method to draw the lines

(a) $x = 5$ **(b)** $x = 3$ **(c)** $x = -2$ **(d)** $x = -4$

13. **(a)** Plot the points (–1, 2), (0, 2), (1, 2), (2, 2), (3, 2), (4, 2), (5, 2)

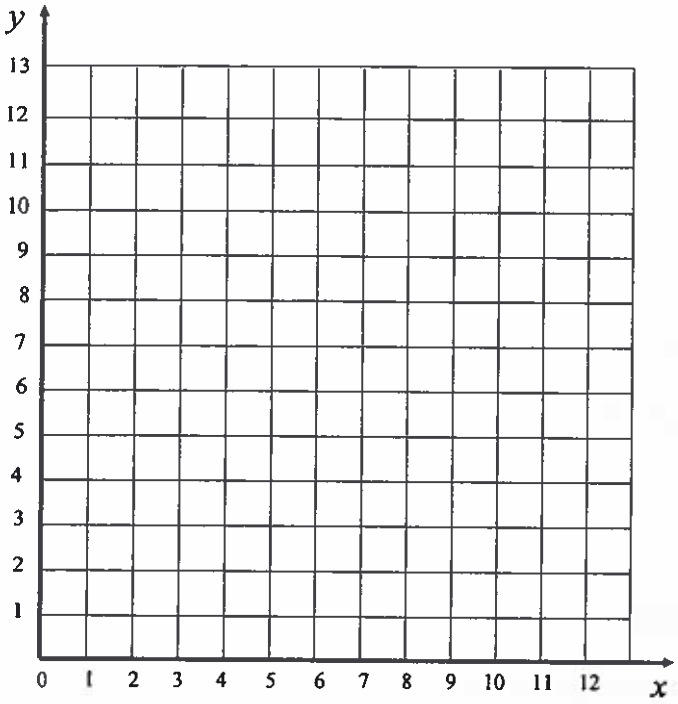
(b) Draw a line through these points

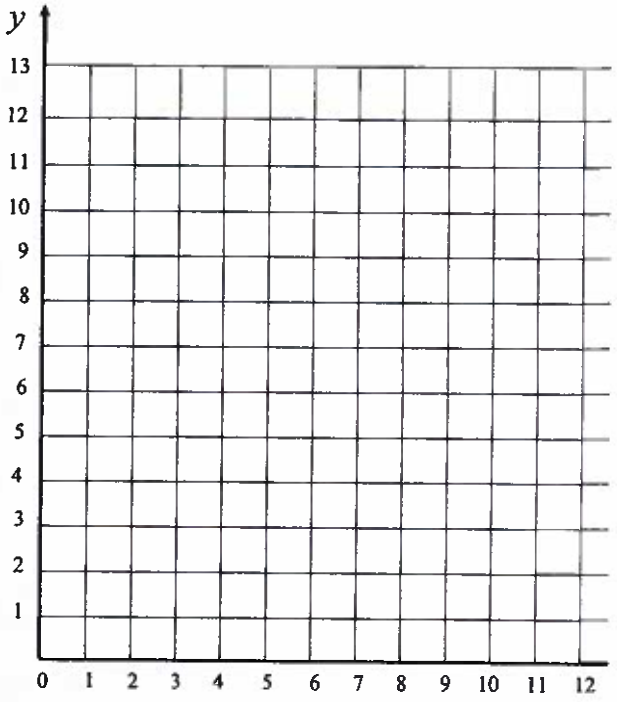
(c) You have drawn the line $y = 2$. Label your line.

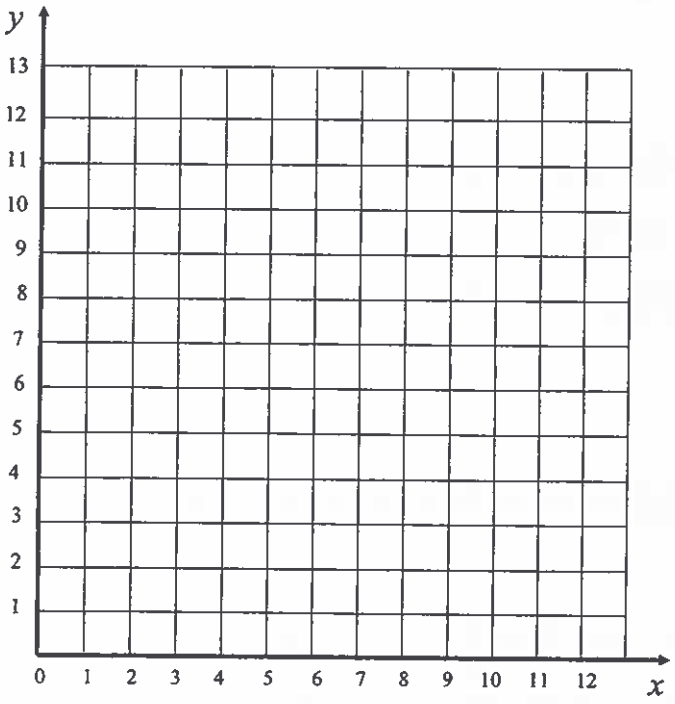
14. Use a similar method to draw the lines

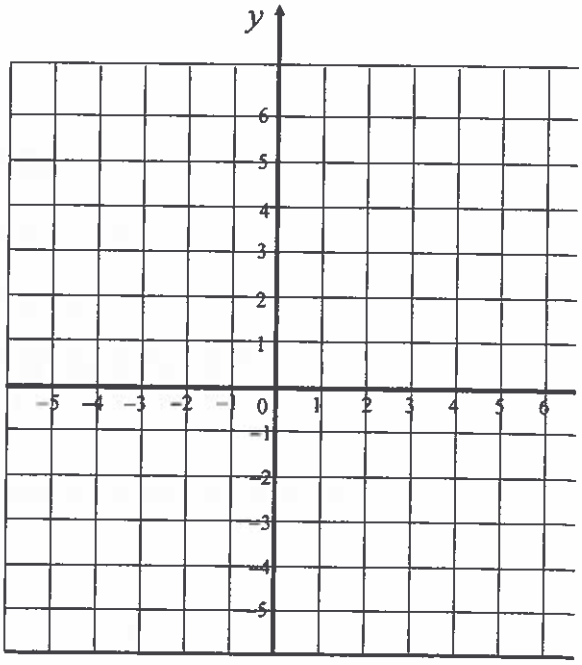
(a) $y = 4$ **(b)** $y = 5$ **(c)** $y = -3$ **(d)** $y = -1$

Worksheet Name : _____









Drawing the graph of a linear equation (More practice)

1. **(a)** Copy and complete the table below for the line with equation $y = 2x - 1$.

x	−2	−1	0	1	2	3
y	−5		−1			

(b) Copy and complete the list of points to be plotted.

(−2, −5), (−1,), (0, −1), (1,), (2,), (3,)

(c) Draw a suitable grid and plot the points.

(d) Draw the straight line.

2. **(a)** Copy and complete the table below for the line with equation $y = 3x + 4$.

x	−2	−1	0	1	2	3
y		1	4			

(b) Copy and complete the list of points to be plotted.

(−2,), (−1, 1), (0, 4), (1,), (2,), (3,)

(c) Draw a suitable grid and plot the points.

(d) Draw the straight line.

3. Repeat the method shown in above to draw the straight lines with equations:

(a) $y = x - 3$ **(b)** $y = 2x + 2$ **(c)** $y = 3x + 1$

(d) $y = 4x - 2$ **(e)** $y = 2x + 3$ **(f)** $y = \frac{1}{2}x - 4$

Recognising the graph of a linear equation

1. Write down the gradient and y-intercept for each of these lines

(a) $y = x + 3$ **(b)** $y = 2x + 2$ **(c)** $y = 3x + 1$

(d) $y = 4x + 2$ **(e)** $y = 2x + 3$ **(f)** $y = \frac{1}{2}x + 4$

2. For each line, write down the gradient and the coordinates of the point where it crosses the y – axis.

(a) $y = 3x + 1$ **(b)** $y = \frac{1}{2}x - 5$ **(c)** $y = -2x + 3$

(d) $y = -\frac{1}{4}x - 2$ **(e)** $y = 8x - \frac{1}{2}$ **(f)** $y = -x + 4$

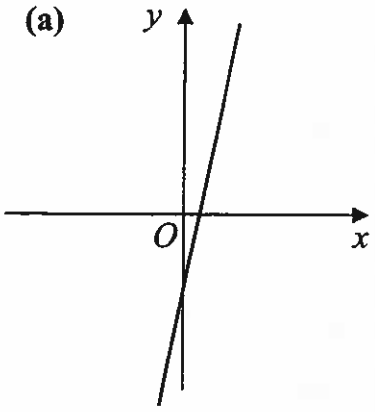
3. Match these equations with the graphs shown below.

(1) $y = x + 1$ **(2)** $y = -2x - 3$ **(3)** $y = \frac{1}{2}x +$

4

(4) $y = -\frac{1}{4}x + 2$ **(5)** $y = 6x - 2$ **(6)** $y = 3x - 5$

(a)



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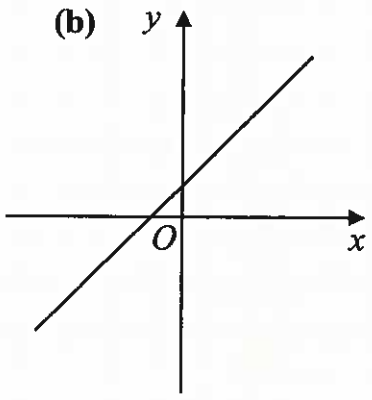

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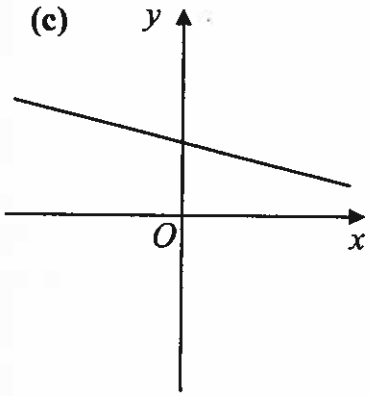
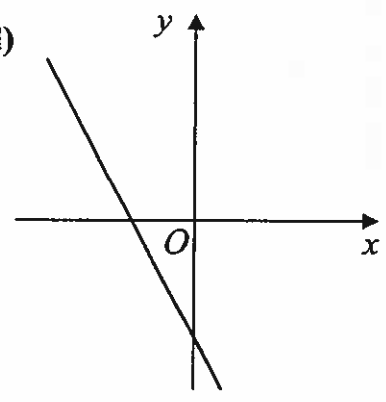
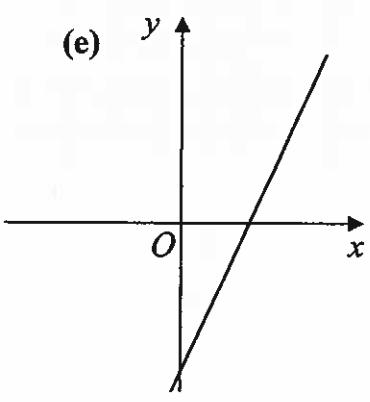


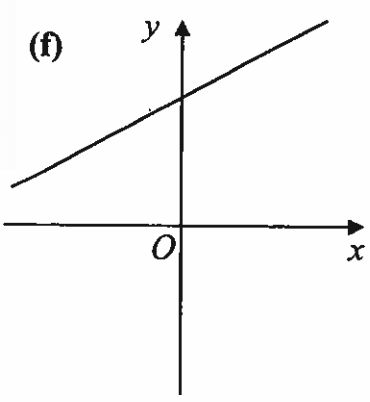
(d)



(e)



(f)



4. Write down the equations of these lines:

(a) $m = 4$ passing through the point (0, 5)

(b) $m = 3$ passing through the point (0, 1)

(c) $m = 2$ passing through the point (0, –1)

(d) $m = ¼$ passing through the point (0, 2)

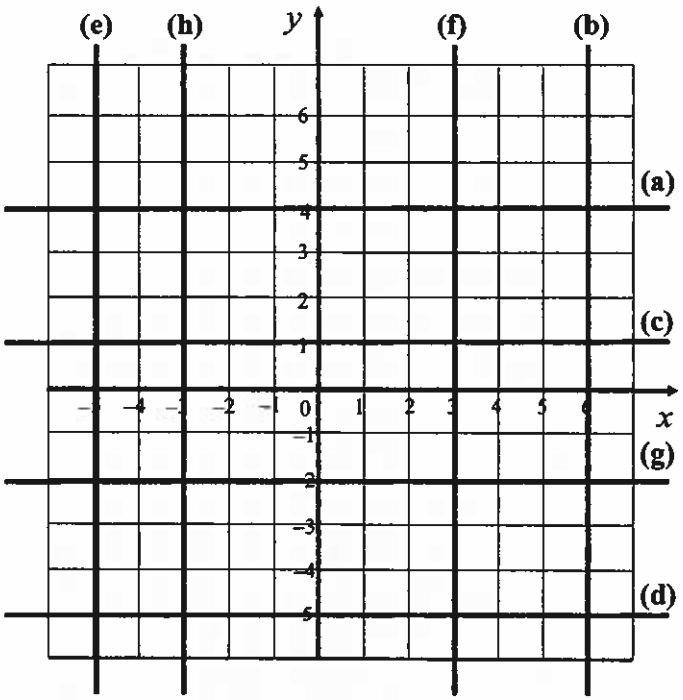
(e) $m = ½$ passing through the point (0, –2)

(f) $m = -2$ passing through the point (0, –4)

(g) $m = -3$ passing through the point (0, 3)

(h) $m = -¾$ passing through the point (0, –2)

5. Write down the equation of the lines shown in this diagram.

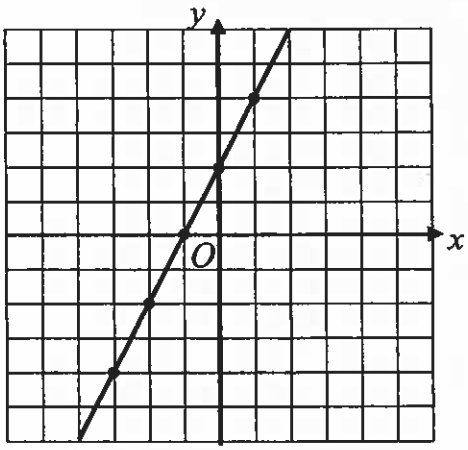


6. **Sketch**, on plain paper, the graphs of lines with equations:

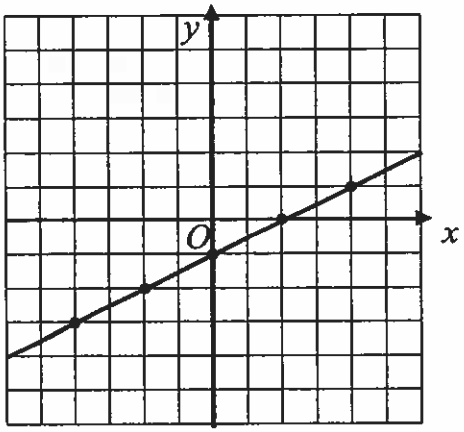
(a)	$y = -x + 3$	**(b)**	$y = 2x + 3$	**(c)**	$y = 4x + 1$
(d)	$y = \frac{1}{2}x - 2$	**(e)**	$y = -2x - 1$	**(f)**	$y = -3x + 2$

7. Write down the equation of the lines drawn in the diagrams below.

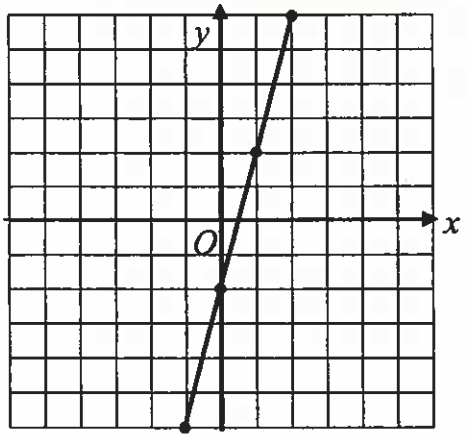
(a)



(b)



(c)



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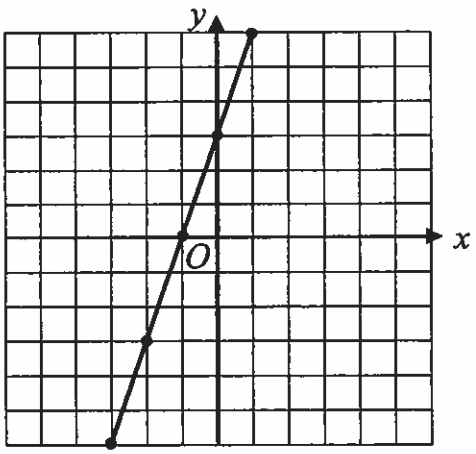

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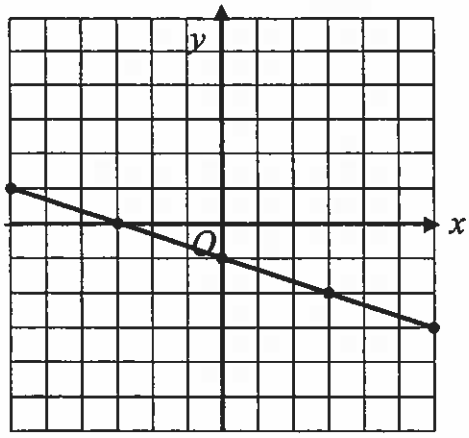
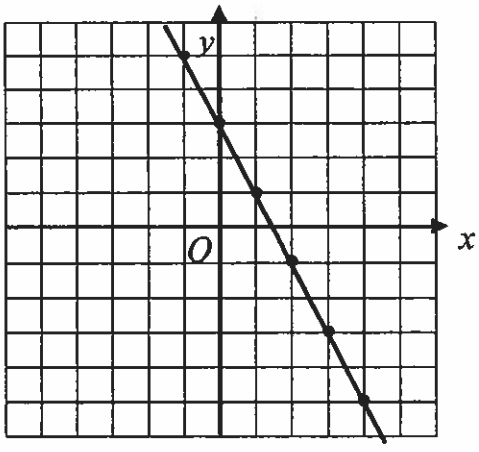
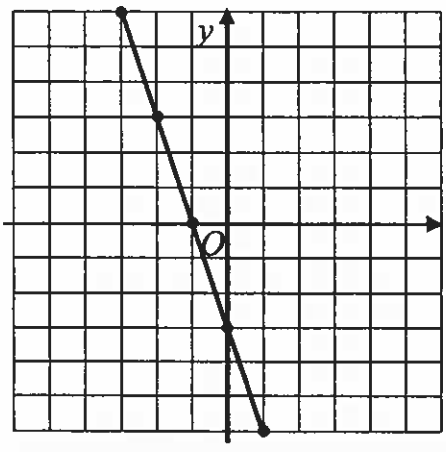


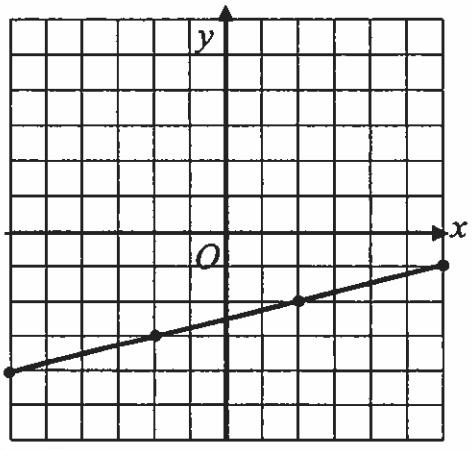
(f)



(g)



(h)



Drawing and recognising the graph of a linear equations

EXAM QUESTIONS

1. **(a)** Copy and complete this table of values for $y = 3x - 1$.

x	–2	2	4
y			

(b) Draw the graph of $y = 3x - 1$ onto a coordinate grid.

(c) Onto the same grid draw the graph of the line $y = 8$.

(d) Write down the coordinates of the point of intersection of the two lines.

2. **(a)** Copy and complete this table of values for $y = -\frac{1}{2}x + 2$.

x	–6	2	8
y			

(b) Draw the graph of $y = -\frac{1}{2}x + 2$ onto a coordinate grid.

(c) Onto the same grid draw the graph of the line $x = 3$.

(d) Write down the coordinates of the point of intersection of the two lines.

3. **(a)** Copy and complete this table of values for $y = -3x - 1$.

x	–4	0	3
y			

(b) Draw the graph of $y = -3x - 1$ onto a coordinate grid.

(c) Onto the same grid draw the graph of the line $y = 2$.

(d) Write down the coordinates of the point of intersection of the two lines.

4. **(a)** Copy and complete the table of values for $y = \frac{1}{2}x - 3$.

x	−2	2	6
y			

(b) Draw the graph of $y = \frac{1}{2}x - 3$ onto a coordinate grid.

(c) Write down the coordinates of the point where the line crosses the y-axis.

5. **(a)** Copy and complete this table of values for $y = 2x + 1$.

x	−3	−1	0		3
y		−1		3	7

(b) Use your table to draw the graph of $y = 2x + 1$ onto a coordinate grid.

1.1 DETERMINING the EQUATION of a STRAIGHT LINE

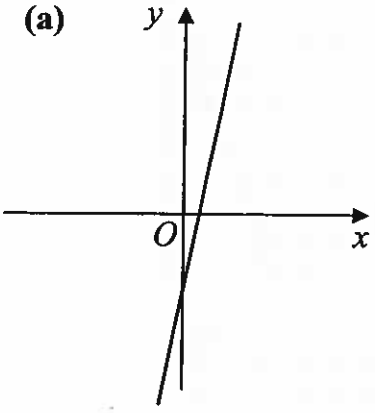
1. For each line, write down the gradient and the coordinates of the point where it crosses the y – axis.

(a)	$y = 3x + 1$	**(b)**	$y = \frac{1}{2}x - 5$	**(c)**	$y = -2x + 3$
(d)	$y = -\frac{1}{4}x - 2$	**(e)**	$y = 8x - \frac{1}{2}$	**(f)**	$y = -x + 4$

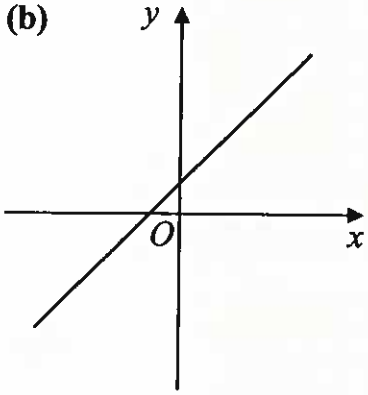
2. Match these equations with the graphs shown below.

1.	$y = x + 1$	**2.**	$y = -2x - 3$	**3.**	$y = \frac{1}{2}x + 4$
4.	$y = -\frac{1}{4}x + 2$	**5.**	$y = 6x - 2$	**6.**	$y = 3x - 5$

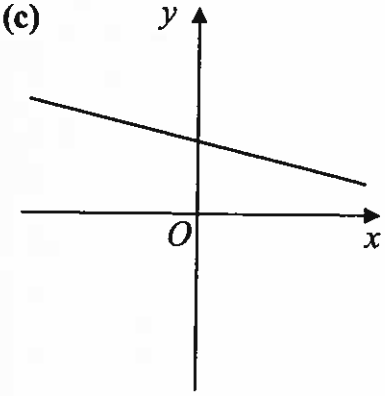
(a)



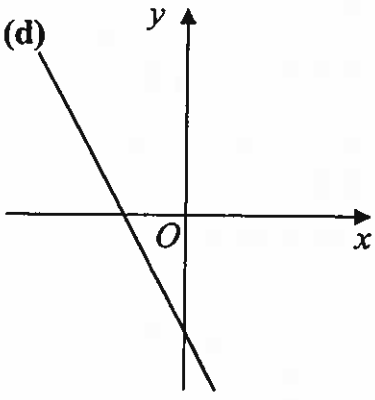
(b)



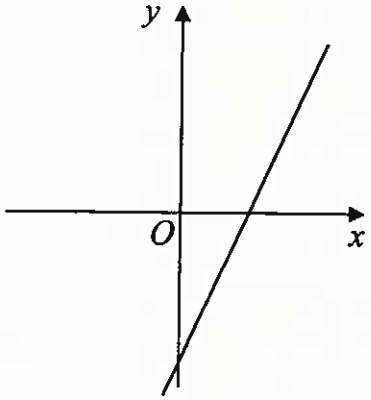
(c)



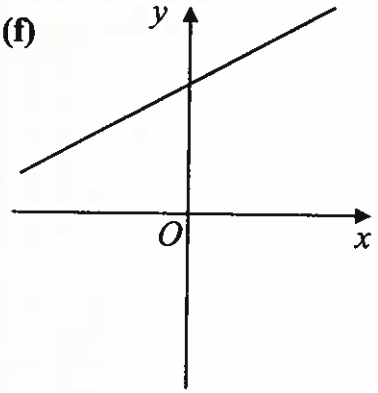
(d)



(e)



(f)

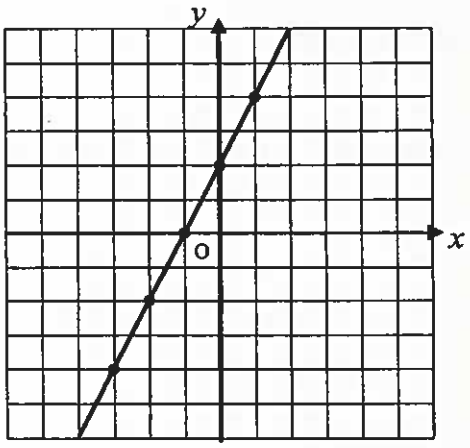


3. Sketch the graphs of lines with equations:

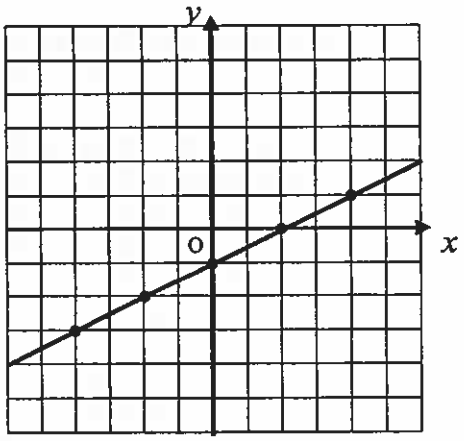
(a)	$y = \frac{1}{2}x - 2$	**(b)**	$y = -2x - 1$	**(c)**	$y = -3x + 2$
(d)	$y = -x + 3$	**(e)**	$y = 2x + 3$	**(f)**	$y = 4x + 1$

4. Write down the equation of the lines drawn in the diagrams below.

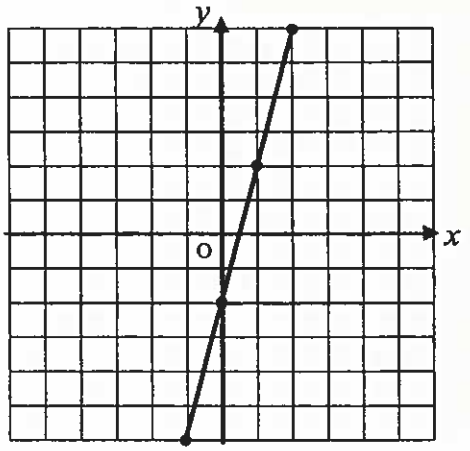
(a)



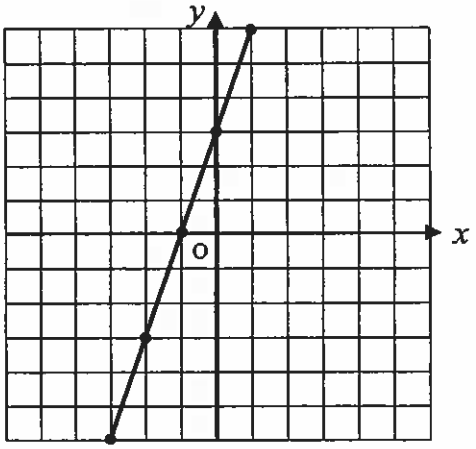
(b)



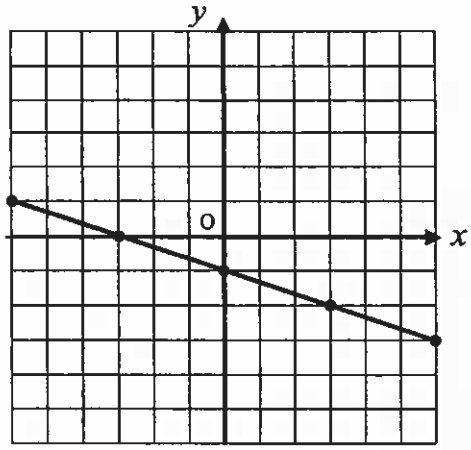
(c)



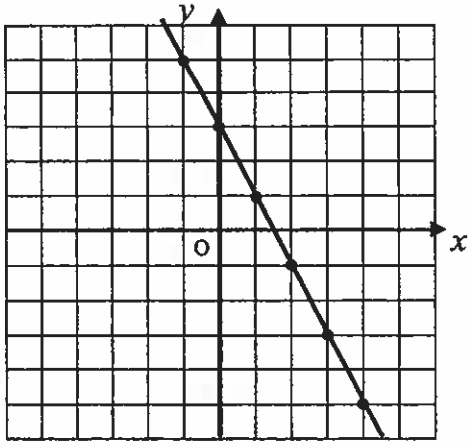
(d)



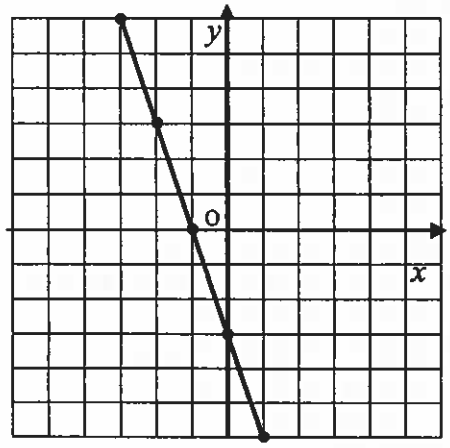
(e)



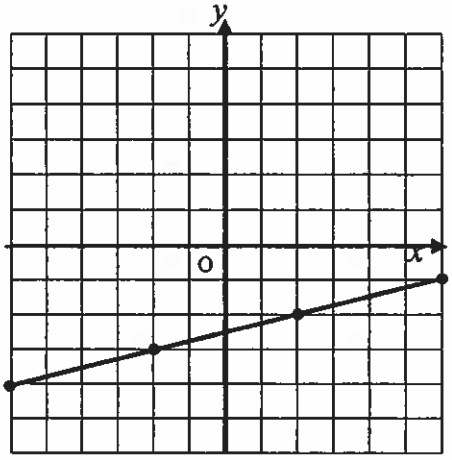
(f)



(g)



(h)



5. Identify the gradient and y – intercept of these lines.

(a) $y = x + 3$ **(b)** $y = -2x - 1$ **(c)** $y = \frac{1}{2}x$

(d) $y = -\frac{1}{2}x + 2$ **(e)** $x + y = 6$ **(f)** $2y = x - 4$

(g) $3y = x + 12$ **(h)** $4x + 5y = 20$ **(i)** $3x - 2y = 12$

6. State the gradient and the y – intercept for each line below.

(a) $y = x - 7$ **(b)** $y = -5x + 3$ **(c)** $5y = 3x - 10$

(d) $y = -4x$ **(e)** $2x + y = 11$ **(f)** $2y = x - 5$

(g) $3y - x = 18$ **(h)** $3x + 7y - 21 = 0$ **(i)** $4x - 5y = 20$

7. Write down the equation of the lines described below:

(a) with gradient 4, passing through the point (0, 5)

(b) with gradient –2, passing through the point (0, 1)

(c) with gradient $\frac{3}{4}$, passing through the point (0, –3)

(d) with gradient 4, passing through the point (3, 1)

(e) with gradient –5, passing through the point (–3, 1)

(f) with gradient $\frac{1}{2}$, passing through the point (–5, –2)

(g) with gradient $\frac{4}{3}$, passing through the point (2, 7)

(h) with gradient $-\frac{3}{4}$, passing through the point (–2, –2)

(i) with gradient $-\frac{3}{2}$, passing through the point (–5, 3)

8. Find the equation of the line joining each pair of points below.

(a) A(4, 3) and B(8, 11) **(b)** C(1, 9) and D(3, 1) **(c)** E(–2, 6) and F(8, 8)

(d) G(5, –9) and H(8, –15) **(e)** I(0, 6) and J(5, 11) **(f)** K(–1, –3) and L(7, –9)

(g) M(–4, 0) and N(–1, 5) **(h)** P(2, 2) and Q(–3, 4) **(i)** R(5, –1) and S(–2, 10)

9. Find the equations of the lines joining the following pairs of points:

(a) (2, 1) and (6, 3) **(b)** (1, 5) and (3, 1) **(c)** (2, 0) and (4, 6)

(d) (–2, –3) and (2, 3) **(e)** (–1, 2) and (5, –1) **(f)** (–4, 2) and (4, –4)

(g) (–6, –2) and (–5, 3) **(h)** (4, –3) and (6, 5) **(i)** (–2, 3) and (0, –2)

10. Establish the equation of the line passing through each pair of points below.

(a) A(2, 1) and B(6, 13) **(b)** C(3, 4) and D(5, –4) **(c)** E(–2, –1) and F(6, 3)

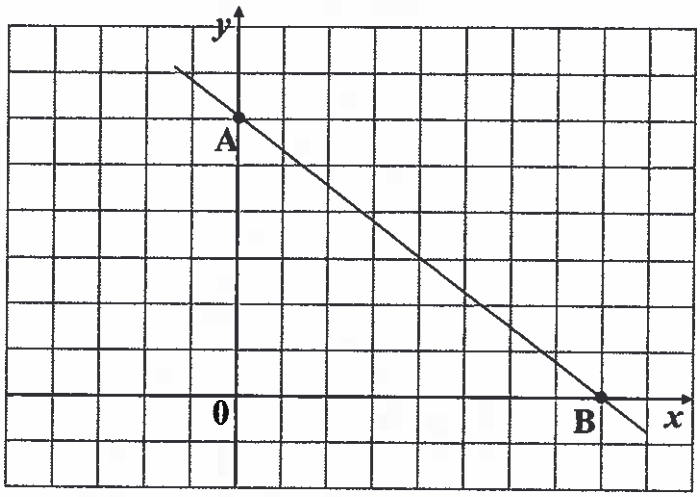
(d) G(4, –13) and H(–2, –1) **(e)** I(2, 8) and J(10, 12) **(f)** K(–3, 2) and L(9, –2)

##

1. A straight line has the equation $3x - 2y = -4$.

Find the gradient and y-intercept of the line.

2. The line AB passes through the points (0, 6) and (8, 0) as shown in the diagram.



Find the equation of the line AB.

3. A straight line has equation $2y + 3x = 8$. Which line of these gives its gradient and y – intercept? Show working to explain your answer.

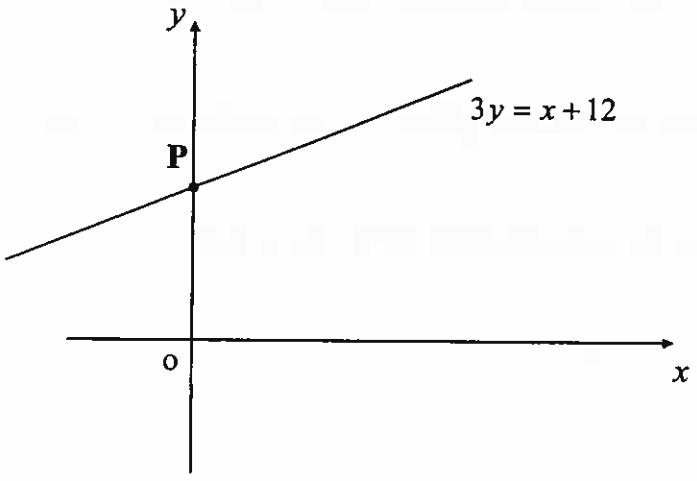
A. 3 and (0, 8) **B.** – 3 and (0. 8)

C. $\frac{3}{2}$ and (0, 4) **D.** $-\frac{3}{2}$ and (0, 4)

4. Find the gradient and y – intercept of the straight line with equation

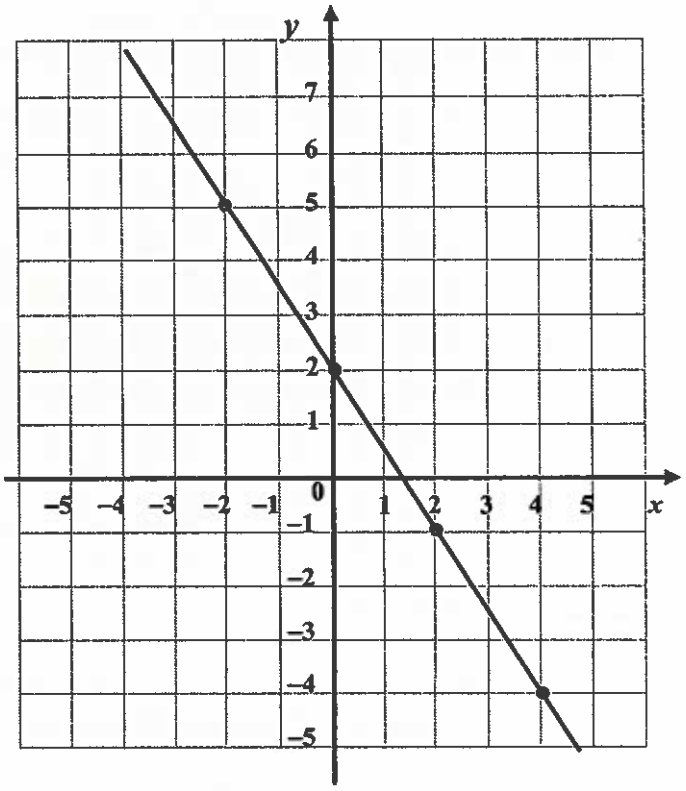
$$3x - 4y = 12 .$$

5. The diagram below shows the line with equation $3y = x + 12$.



Find the coordinates of **P**, the point where the line cuts the y-axis.

6. Find the equation of the line shown in the diagram below.

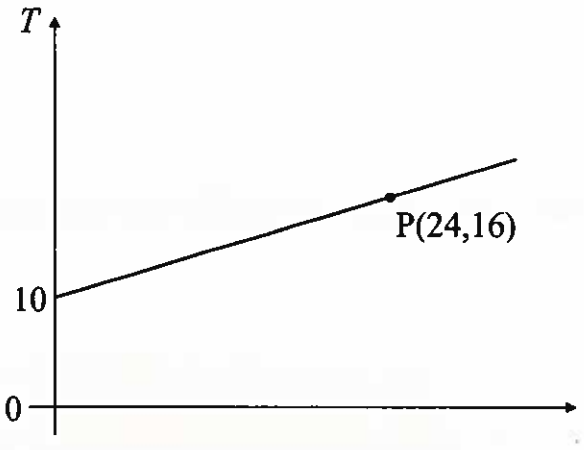


7. A line has equation $2y + 6x = 9$. Find its gradient and y - intercept.

8. A line has equation $3y + 4x = 15$. Make a sketch of this line on plain paper showing clearly where it crosses the y - axis.

9. The relationship between variables v and T produces a straight line graph as shown below.

The line passes through the point P(24,16) as shown.



(a) Find the gradient of the line.

(b) Hence, write down the equation of the line in terms of v and T.

10. A straight line has equation $3y - 2x = 6$. Find the gradient and y-intercept of the line.

11. A straight line has equation $3x - 2y = 8$. Find the gradient and y-intercept of the line.

12. Find the equation of the straight line which passes through the point A(3, –2) and is parallel to the line $3y - 2x = 5$

13. **(a)** A straight line has equation $4y - 3x = 6$.

State the gradient and the y-intercept point for this line.

(b) Write down the equation of the line with gradient $-\frac{1}{2}$ which has the same y – intercept point as the line above.

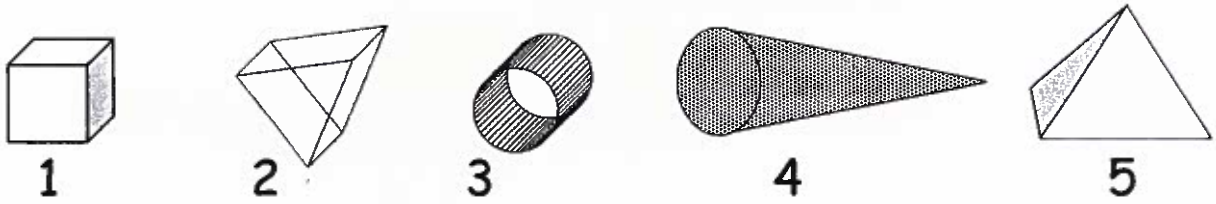
14. **(a)** A straight line has equation $3y - 4x = 12$.

State the gradient and the y-intercept point for this line.

(b) Write down the equation of the line with gradient $-\frac{3}{4}$ which has the same y – intercept point as the line above.

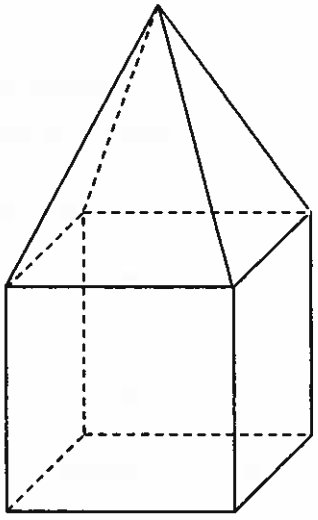
Investigating the surface of a prism

1. Debbie is buying some perfume for her Mum. The perfume bottles are different shapes like the ones below:



Write down the name of each of the shapes above and state how many faces, edges and vertices they have.

2. The diagram shows a 3D-shape made up from two different solid shapes.



(a) What two shapes have been used?

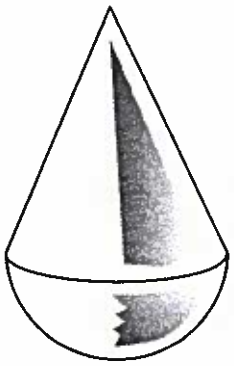
(b) How many faces are there?

(c) How many edges are there?

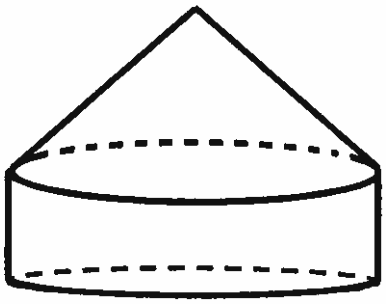
(d) How many vertices are there?

3. Repeat question 2 for these shapes.

(a)

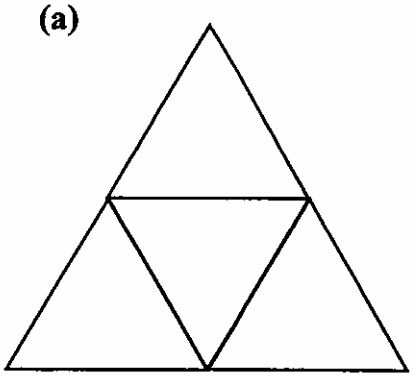


(b)

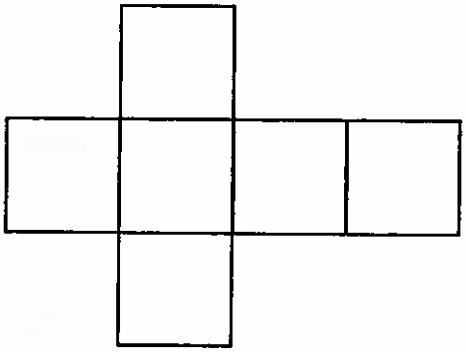


4. Write down the name of each shape shown in the nets below.

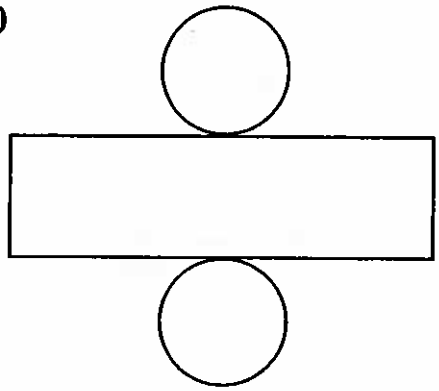
(a)



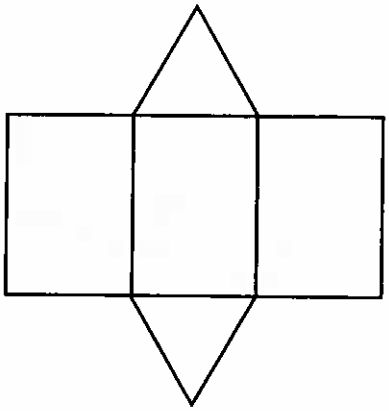
(b)



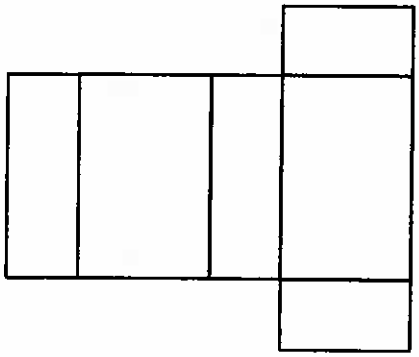
(c)



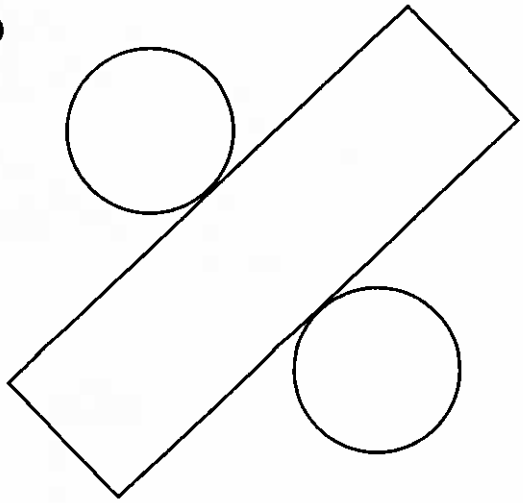
(d)



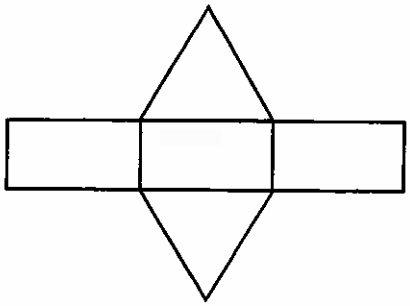
(e)



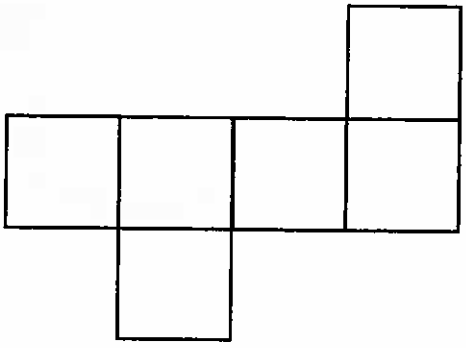
(f)



(g)

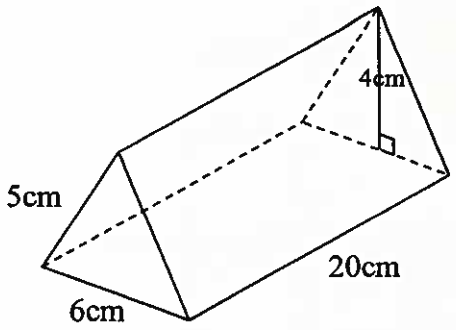


(h)

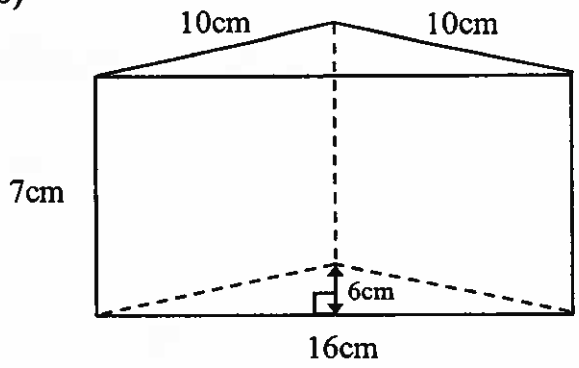


5. For each shape below, sketch the net and calculate the surface area.

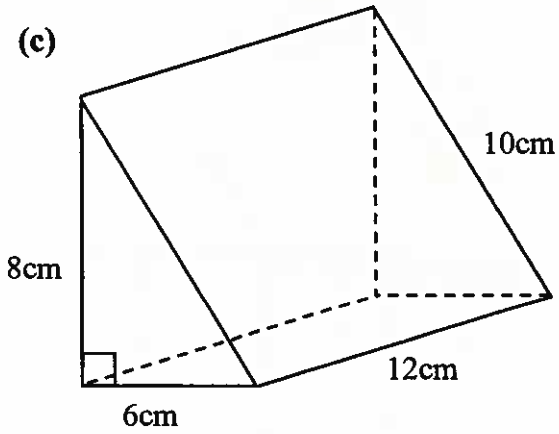
(a)



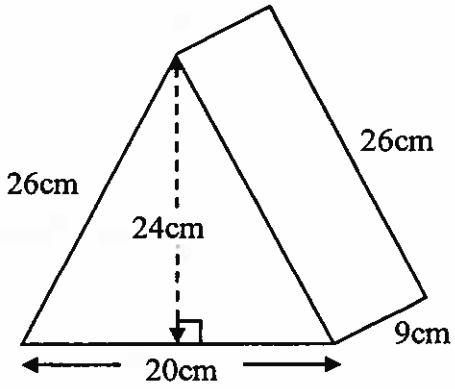
(b)



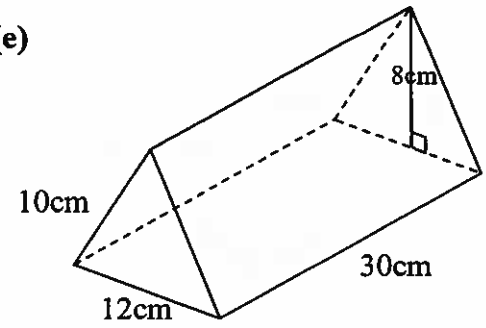
(c)



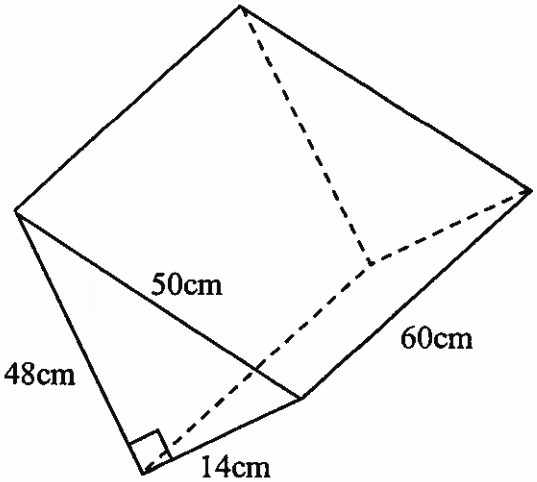
(d)



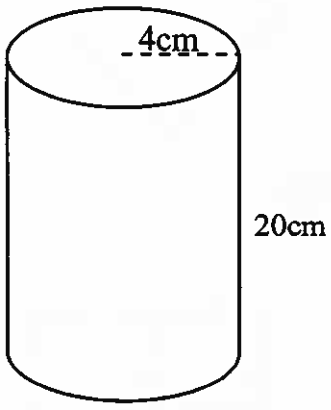
(e)



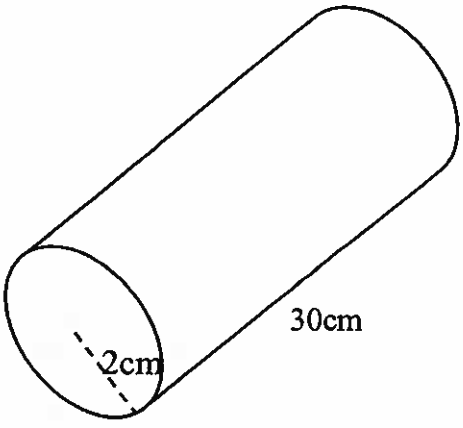
(f)



(g)

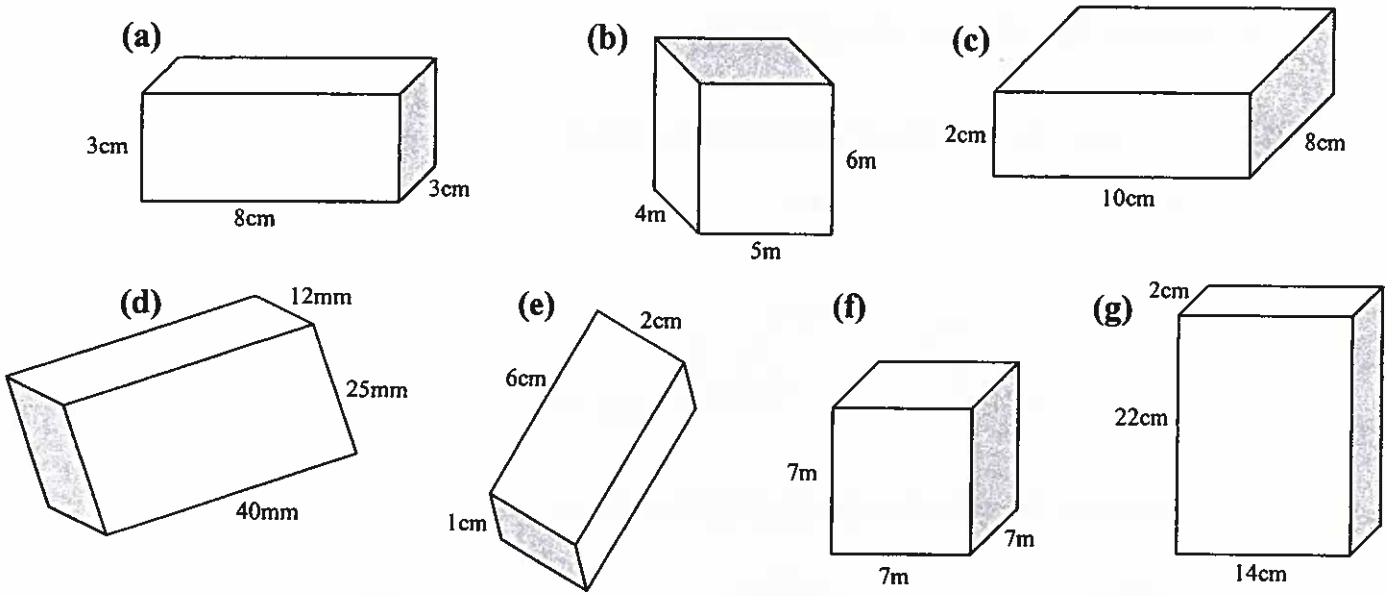


(h)



Calculating the volume of a prism

1. Calculate the volume of each of the cuboids below:



2. Calculate the volumes of the cuboids measuring:

(a) 12cm by 8cm by 9cm **(b)** 18mm by 12mm by 3mm

(c) 50cm by 20cm by 5cm **(d)** 15m by 7m by 8m

(e) 11mm by 9mm by 2mm **(f)** 4·3cm by 2·2cm by 10cm

3. Calculate the volumes of the cubes of side:

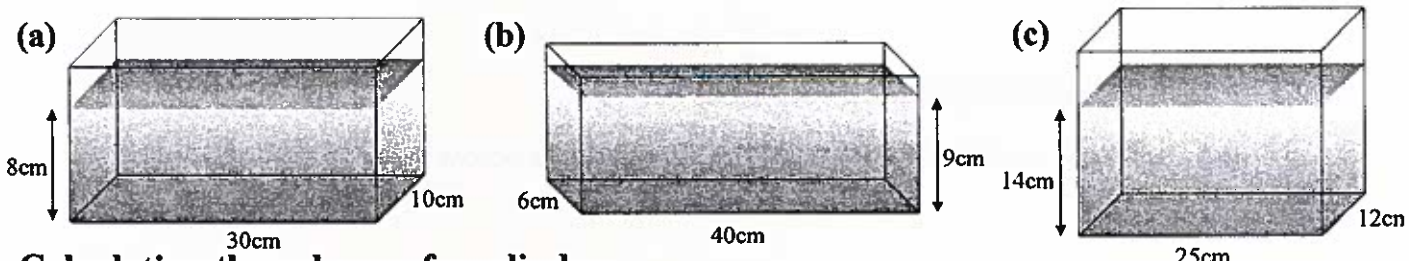
(a) 6cm **(b)** 4mm **(c)** 14cm **(d)** 23mm

4. Convert each of the following volumes in *cubic centimetres* into *litres*:

(a) $3000cm^3$ **(b)** $2400cm^3$ **(c)** $12600cm^3$ **(d)** $600cm^3$

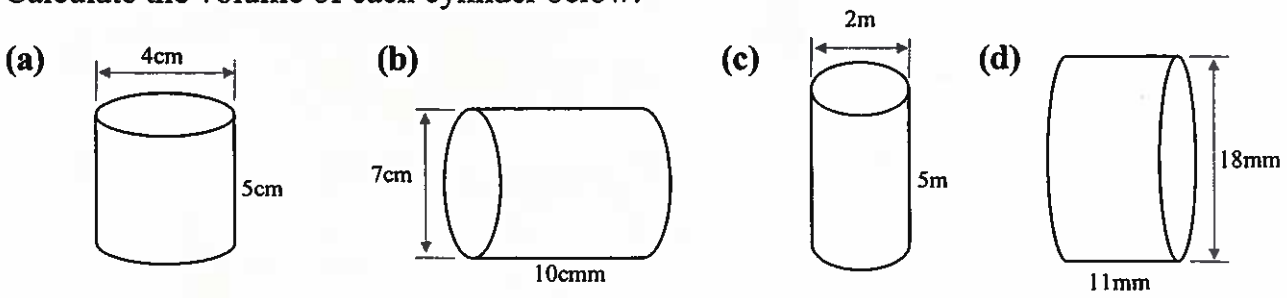
(e) $1460cm^3$ **(f)** $480cm^3$ **(g)** $320000cm^3$ **(h)** $2565cm^3$

5. Calculate the volume of water in each fish tank below, giving your answer in *litres* :



Calculating the volume of a cylinder

1. Calculate the volume of each cylinder below:



2. Calculate the volume of each cylinder below :

3. The drinks can opposite is cylindrical in shape.

Calculate its volume (in ml) if it has a diameter of 6cm and a length of 11·68cm . Give your answer to the nearest millilitre.

4. Six cola-cans each with a diameter of 6·8cm and a height of 9·183cm are sold together in an economy pack.

Calculate the total volume of cola in the six-pack.

Answer to the nearest millilitre.

5. A container for holding coffee is cylindrical in shape.

Given that it has a diameter of 8cm and a height of 15cm calculate its volume in cubic centimetres.

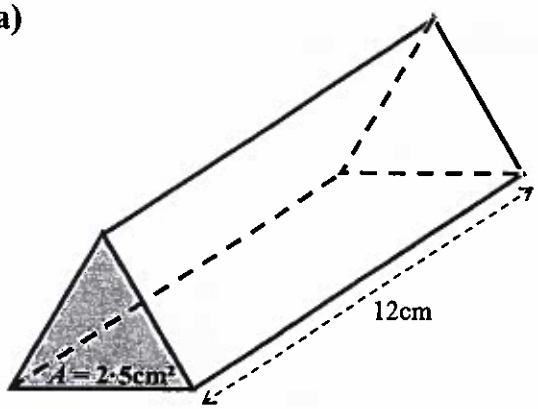
6. An oil drum has a diameter of 66cm and a height of 105.3cm.

Calculate the capacity of the drum to the nearest litre.

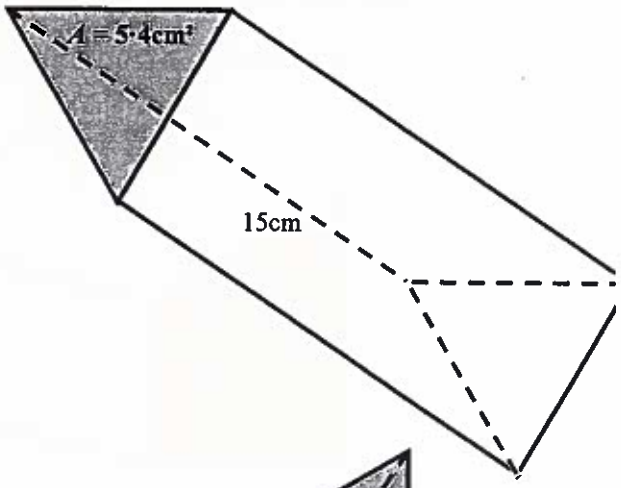
Calculating the volume of a triangular prism

1. Calculate the volumes of these triangular prisms

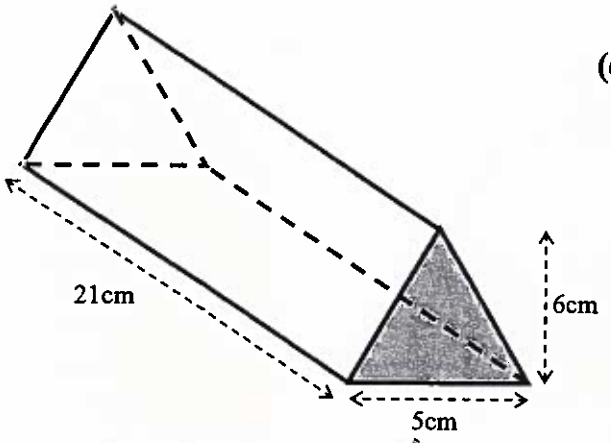
(a)



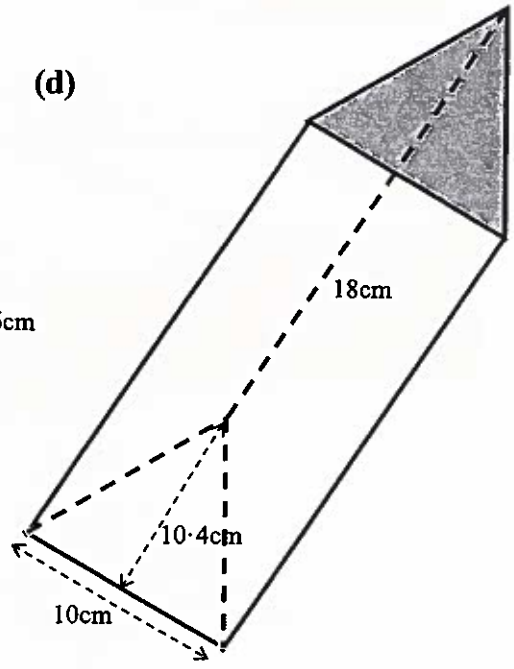
(b)



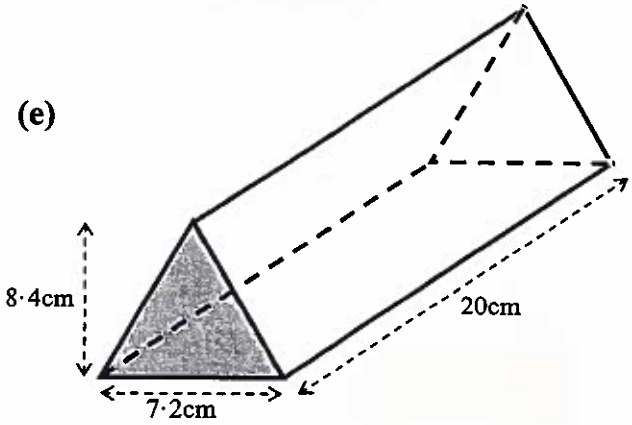
(c)



(d)

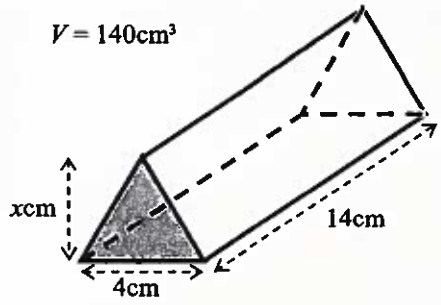


(e)

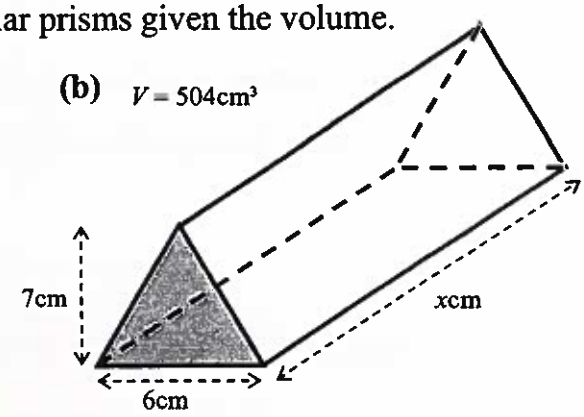


2. Calculate the side marked x in these triangular prisms given the volume.

(a) $V = 140cm^3$



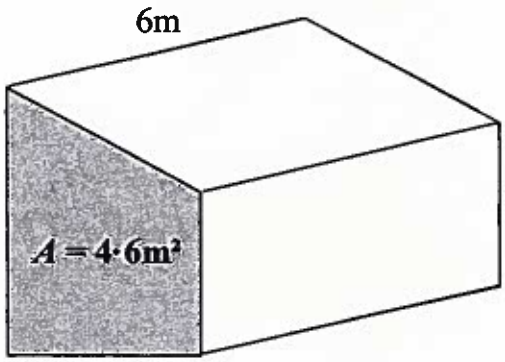
(b) $V = 504cm^3$



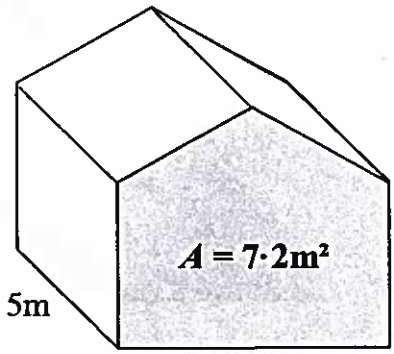
Calculating the volume of other prisms

The area of the base of these prisms is given. Calculate the volume of the prisms.

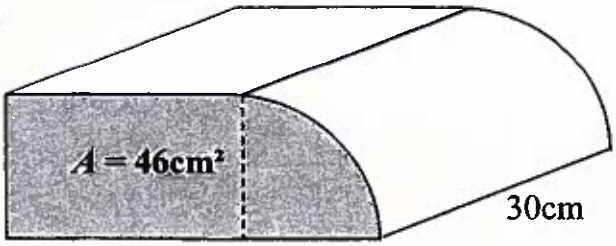
(a)



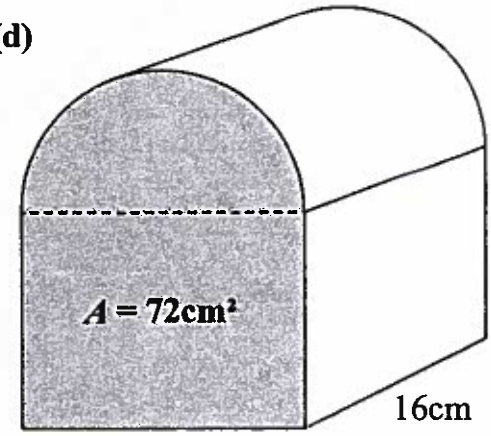
(b)



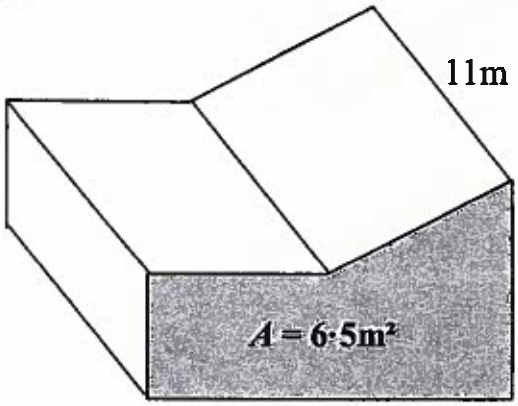
(c)



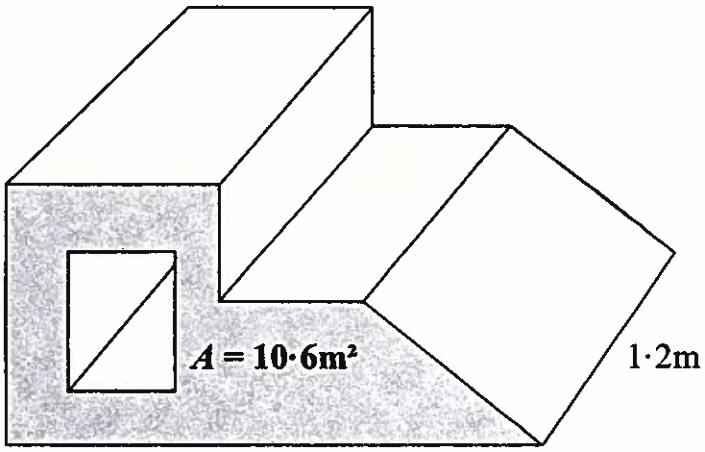
(d)



(e)



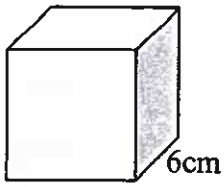
(f)



Applying geometric skills to circumference, area and volume

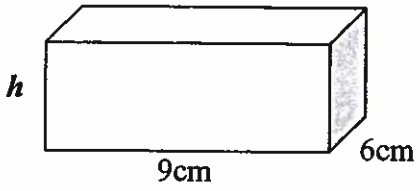
EXAM QUESTIONS

1. A solid metal cube of side 6cm is to be melted down and re-formed to make a cuboid.



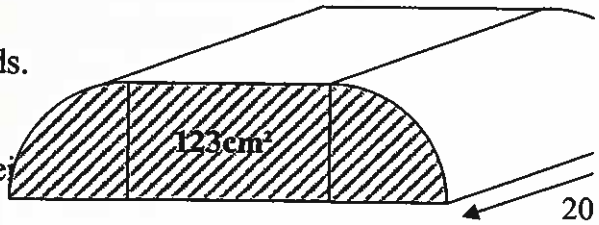
The base of the cuboid has dimensions 9cm by 6cm.

What height, h, should the cuboid be so that the volume is the same as that of the cube?

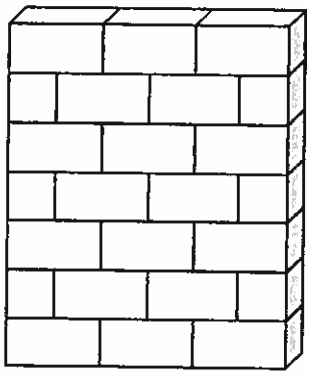


2. The side of a box of chocolates is in the shape of a rectangle with two quarter-circle ends.

Calculate the volume of the box if the area of the end of the box is 123cm² and its hei is 20cm.



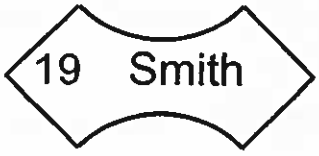
3. A climbing wall is part of an outdoor fitness training course. The wall is made up of cuboids and cubes as shown in the diagram.



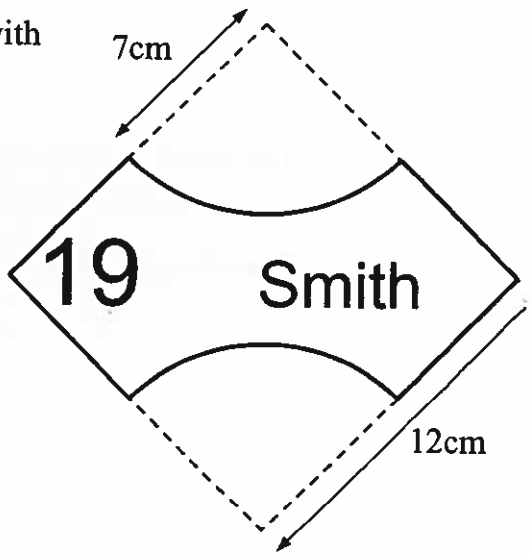
The cuboids measure 60cm by 30cm by 30cm and the cubes are half the length of the cuboids.

Find the total volume of the wall.

4. The Portal Door Company makes nameplates for doors which are in the shape of a square with 2 identical quarter circles cut out.



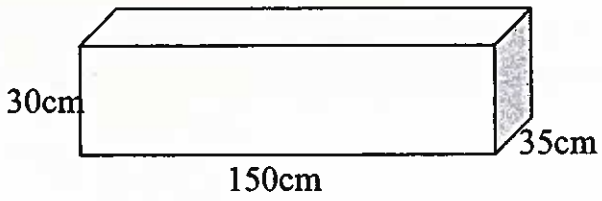
Calculate the area of the nameplate shown here.



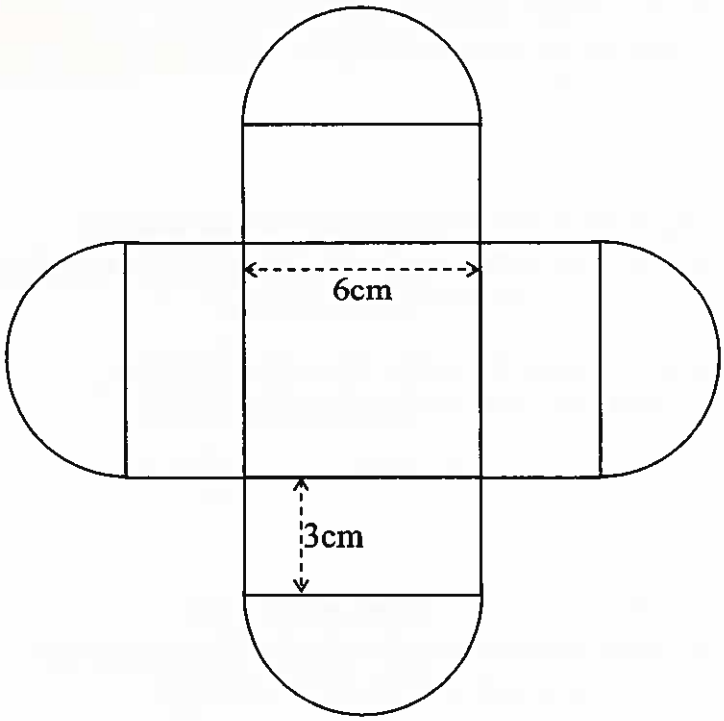
5. Peter wants to make a tank to collect rainwater to use in his garden.

He would like it to be able to hold at least 150 litres of water when full.

Is the tank, shown below, big enough? Show your working and give a reason for your answer.



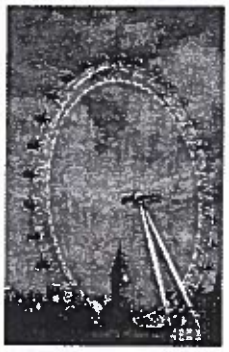
6. In a fast food café, cakes are prepared in advance and displayed in cardboard boxes which have the net shown in the diagram below.



The boxes consist of a square base of side 6cm, rectangular sides with depth 3cm and a semicircular fringe on each side.

Find the total area of card needed to make each box. (Ignore any overlaps)

7. Josh and Jamie were having an argument. Josh said that the perimeter of a full-sized football pitch was longer than the circumference of the London Eye but Jamie disagreed.



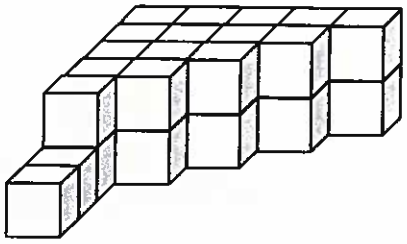
The diameter of the London eye is 135m and a full-sized football pitch has perimeter 420 metres.

Was Josh correct? **You must show all working and give a reason for your answer.**

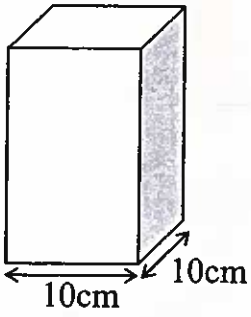
[3]

8. This solid is made from building bricks which are in the shape of a cube with side 5cm.

(a) What is the total volume of the solid?

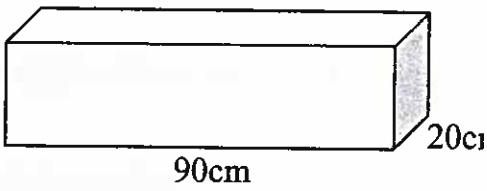


(b) The bricks have to be packed into a cuboid-shaped box with a square base of side10cm.



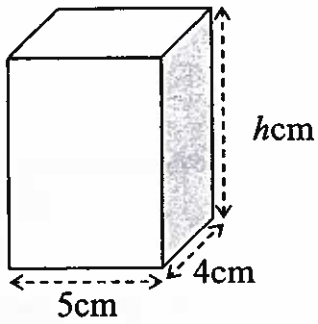
How far up the cuboid will the bricks reach?

9. A garden water trough is in the shape of a cuboid which measures 90cm by 30cm by 20cm.



(a) Calculate the number of litres that the trough holds when it is completely full. ($1000cm^3 = 1$ litre)

(b) The water is used to fill 300 small cuboid shaped vases like the one shown in the diagram.

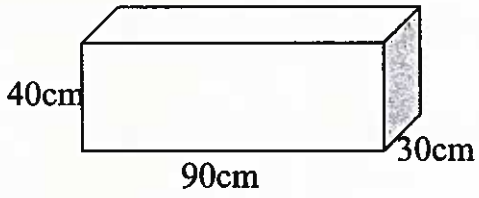


Calculate the height, *h*cm, of the vases.

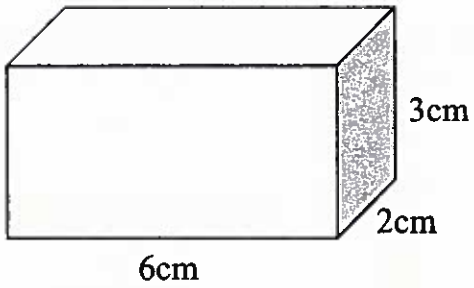
10. A fish tank is in the shape of a cuboid with dimensions as shown in the diagram.

John wants to fill it up from bottles of water which each hold 1litre of water.

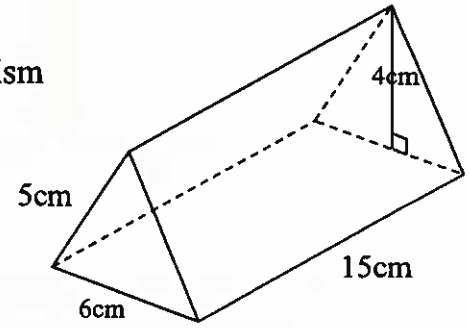
How many bottles will it take to fill the tank half full? ($1000cm^3 = 1$ litre)



11. Draw the net for this carton which is in the shape of a cuboid.



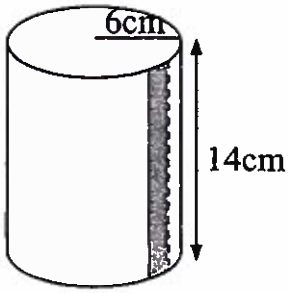
12 Calculate the surface area of the triangular prism shown in the diagram.



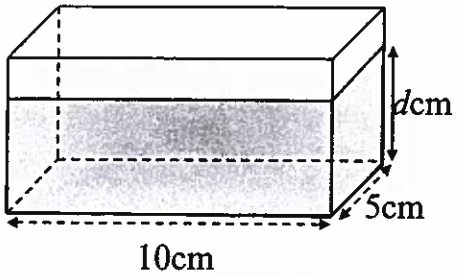
13. The label on a can of beans has to have a 1 cm overlap for joining.

The can has a radius of 6cm and a height of 14cm.

Calculate the area of the label.

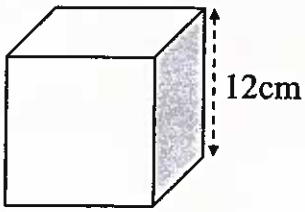


14. Anna makes **3 litres** of jelly and pours it into 10 containers like the one in the diagram



Calculate the depth ($d$cm) of the jelly in each container.

15. An ornament is packaged in a cardboard box which is a cube of side 12cm.



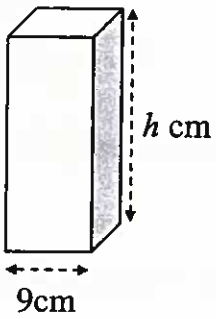
(a) Find the volume of the box.

(b) Calculate the area of card which would be needed to make the box.

[Ignore any overlaps]

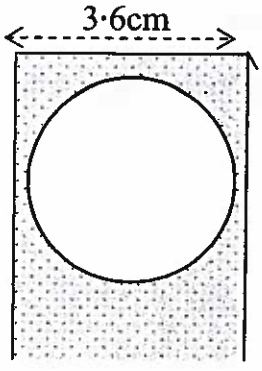
Another ornament is to be packed in a box which is a cuboid with **half** the volume of the cube.

This box is to have a square base of side 9cm.

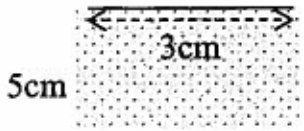


(c) Calculate the height, $h$cm, of this new box giving your answer correct to 1 decimal place.

16.



A bottle opener is formed from a rectangle of metal with a semi-circle cut out.



The rectangle measures 3·6cm by 5cm and the semicircle has diameter 3cm.

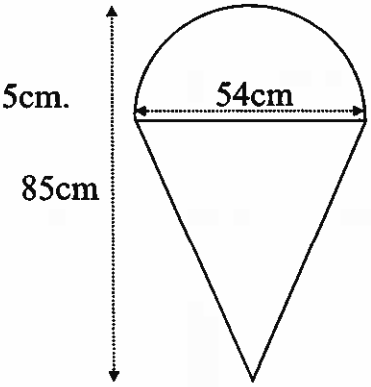
(a) Calculate the area of metal required to make the opener. [i.e. the shaded area in the diagram]
[Use $\pi = 3{\cdot}14$]

(b) To find the volume of the opener we use the formula:

Volume = area × thickness

Calculate the weight of the opener if 1 cm^3 of the metal weighs 70g and the opener has a depth of 0·3cm.

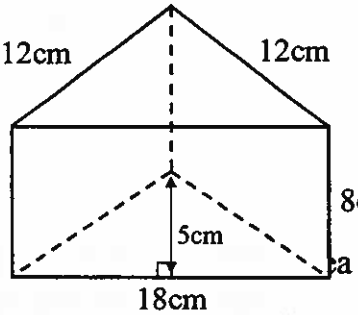
17. The sign outside the Yummy Ice Cream shop is formed from a triangle and a semi-circle.



The diameter of the semicircle is 54cm and the overall height of the sign is 85cm.

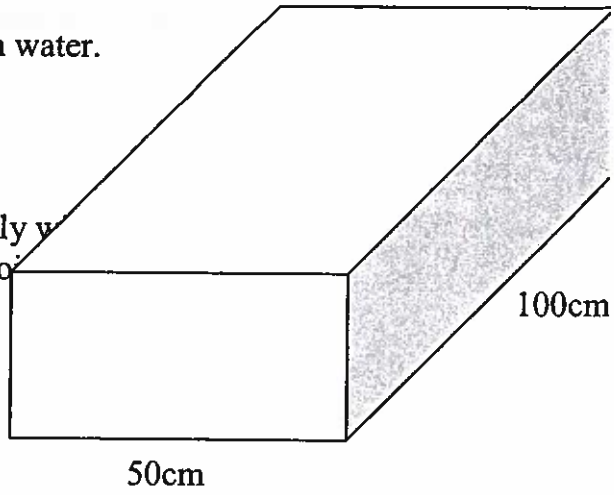
Calculate the area of the sign.

18. A display case in a museum is in the shape of a triangular prism without a base.

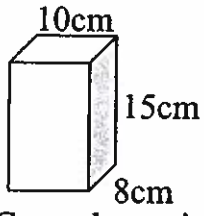


a of glass required to make the display case.

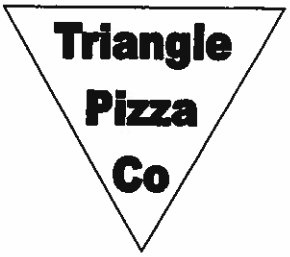
19. A large cuboid which measures 100cm by 50cm by 20cm is filled completely with water.



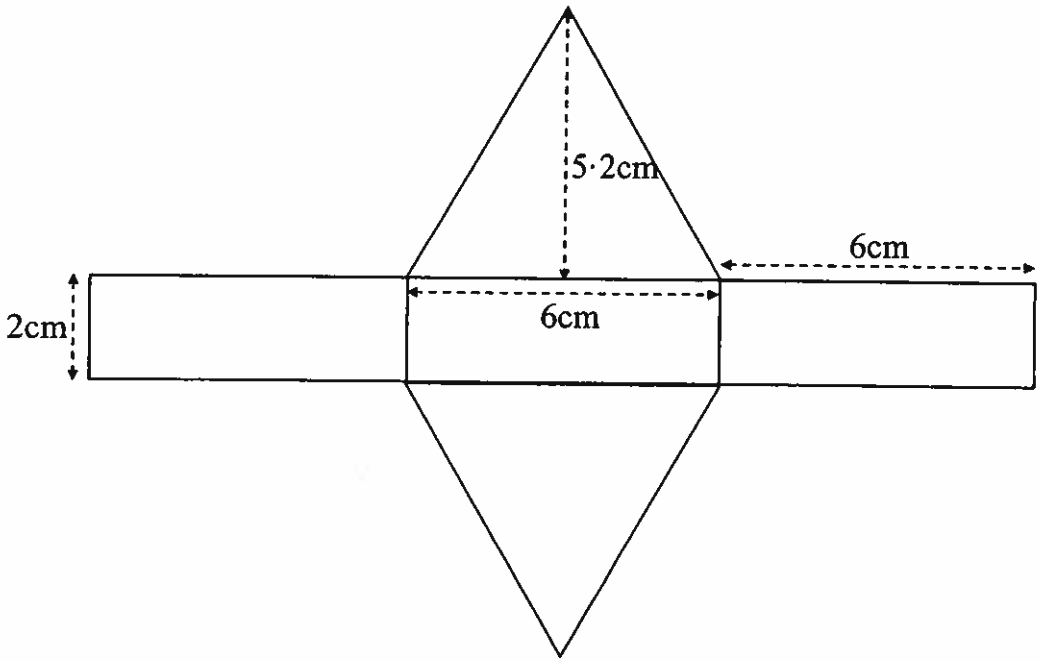
How many small cuboids, measuring 8 cm by 10 cm by 15 cm, can be filled completely with water from the larger cuboid?



20. The Triangle Pizza Co packages its pizzas in boxes made from this net.



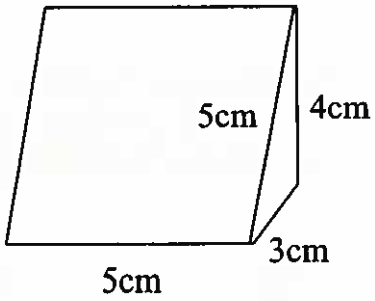
Measurements are given correct to 1 decimal place where necessary.



(a) What is the mathematical name for the 3D shape which can be made from this net?

(b) Use the diagram to calculate the area of card needed to make this box. [Ignore any overlaps]

21. Draw the net for this carton which is in the shape of a triangular prism.

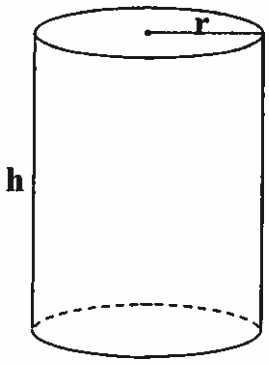


WORKING with VOLUME of a CYLINDER

This topic is not mentioned in National 5 arrangements but worth covering at this stage

1. Circular – based prism (cylinder)

Find the volume of a circular-based prism for the values of r and h given.

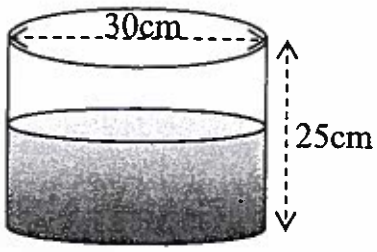


(a)	$r = 6$ cm	$h = 15$ cm
(b)	$r = 8$ cm	$h = 24$ cm
(c)	$r = 4$ cm	$h = 12$ cm
(d)	$r = 10$ cm	$h = 8$ cm
(e)	$r = 20$ cm	$h = 60$ cm
(f)	$r = 7$ cm	$h = 20$ cm
(g)	$r = 15$ cm	$h = 40$ cm
(h)	$r = 11$ cm	$h = 35$ cm
(i)	$r = 44$ cm	$h = 125$ cm
(j)	$r = 8.8$ cm	$h = 30$ cm

2. A milk dispenser is cylindrical in shape with diameter 30cm.

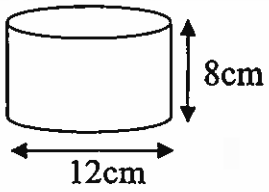
(a) If 14 litres of milk are poured into it, calculate the depth of the milk in the cylinder.

(b) The height of the cylinder is 25cm.



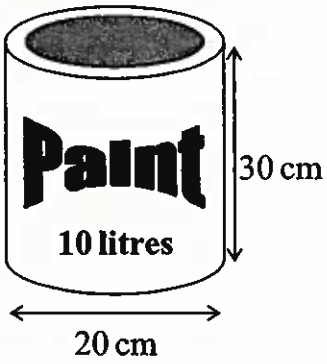
How many **more** litres of milk are needed to completely fill it?

3.



Calculate the volume of a cylinder with diameter 12cm and height 8cm.

4. This paint tin has diameter 20 cm and height 30 cm as shown in the diagram.

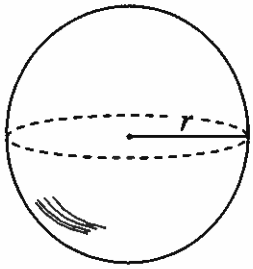


It is claimed that it can hold 10 litres of paint. Is this claim correct?

You must show all working and give a reason for your answer.

3.3 WORKING with the VOLUME of a SOLID SPHERE, CONE, PYRAMID

1. Calculate the volume of each sphere described below, rounding your answer to 1 decimal place.



(a) $r = 6\text{cm}$

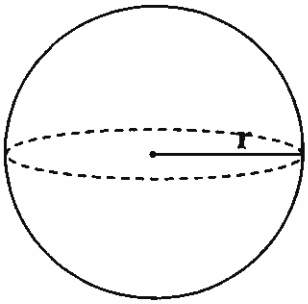
(b) $r = 2\text{m}$

(c) $r = 9\text{mm}$

(d) $r = 3\text{cm}$

2. Find the volume of a sphere for the following values of r and d.

(give your answers correct to 3 significant figures)



(a) $r = 10\text{cm}$

(b) $r = 25\text{cm}$

(c) $d = 2\text{m}$

(d) $r = 200\text{mm}$

(e) $d = 11\text{cm}$

(f) $d = 18\text{cm}$

(g) $r = 80\text{mm}$

(h) $d = 55\text{cm}$

(i) $r = 3{\cdot}5\text{m}$

(j) $d = 48\text{cm}$

3. A sphere has a diameter of 8cm.

Calculate its volume giving your answer correct to 3 significant figures.

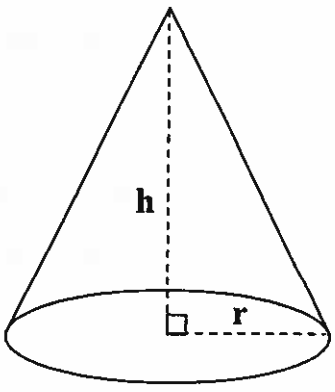
4. Find the volume of a cone for the following values of r and h.

(give your answers correct to 3 significant figures)

(a) $r = 5\text{cm}$ $h = 14\text{cm}$

(b) $r = 7\text{cm}$ $h = 25\text{cm}$

(c) $r = 3\text{cm}$ $h = 22\text{cm}$



(d) $r = 12\text{cm}$ $h = 7\text{cm}$

5. Find the volume of a cone for the following values of d and h.

(give your answers correct to 3 significant figures)

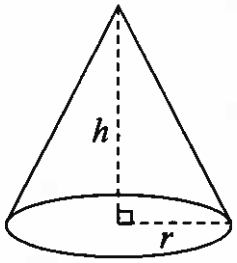
(a) $d = 15\text{cm}$ $h = 40\text{cm}$

(b) $d = 11\text{cm}$ $h = 37\text{cm}$

(c) $d = 22\text{cm}$ $h = 125\text{cm}$

(d) $d = 8{\cdot}8\text{cm}$ $h = 30\text{cm}$

6. Calculate the volume of each cone described below, rounding your answers to 1 decimal place.



(a) $r = 3\text{cm}$ and $h = 6\text{cm}$

(b) $r = 8\text{mm}$ and $h = 12\text{mm}$

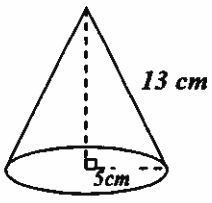
(c) $r = 3\text{cm}$ and $h = 5\text{cm}$

(d) $r = 2\text{m}$ and $h = 6\text{m}$

7. A cone has a base diameter of 8cm and a height of 5cm. Calculate the volume of this cone.

8. A cone has a base diameter of 10cm and a **slant height** of 13cm.

Calculate the volume of the cone.



9. A cone has a base radius of 9cm and a **slant height** of 15cm.

Calculate the volume of the cone.

10. A pyramid has a square base of side 4cm and a vertical height of 7cm.

Calculate the volume of the pyramid correct to 2 significant figures.

11. A pyramid has a rectangular base measuring 16mm by 12mm and a vertical height of 10mm.

Calculate the volume of the pyramid.

WORKING with the VOLUME of a SOLID SPHERE, CONE, PYRAMID & CYLINDER

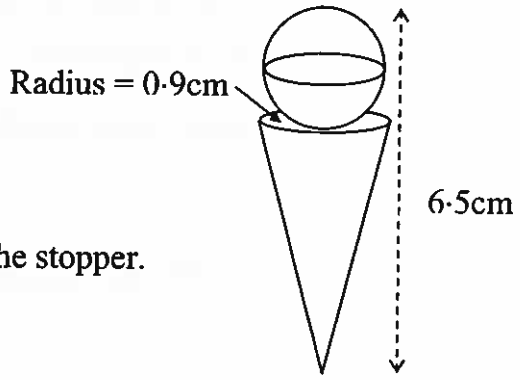
EXAM QUESTIONS

1. The Stockholm Globe Arena is the largest hemispherical building in the world.

The radius of the building is 110 m.

Calculate the volume of the building in cubic metres, giving your answer in scientific notation correct to 3 significant figures.

2. A metal bottle stopper is made up from a cone topped with a sphere.



The sphere has diameter 1·5cm.

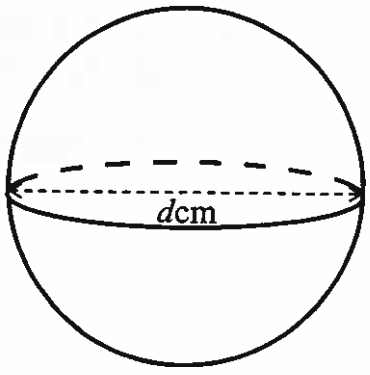
The cone has radius 0·9cm.

The overall length of the stopper is 6·5cm.

Calculate the volume of metal required to make the stopper.
Give your answer correct to 3 significant figures.

3. The volume of this sphere is 524cm^3.

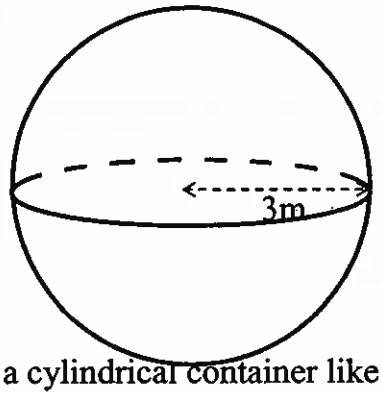
Calculate the diameter, d cm.



4. **Non Calculator!**

Calculate the volume of this sphere which has radius 3m.

[Take $\pi = 3 \cdot 14$]



5. Sherbet in a sweet shop is stored in a cylindrical container like the one shown in *diagram 1*.

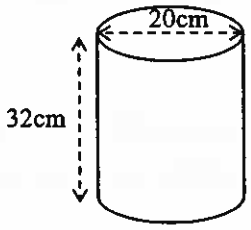


Diagram 1

The volume of the cylinder, correct to the nearest 1000cm^3, is $10\,000\ \text{cm}^3$.

The sherbet is sold in conical containers with diameter 5 cm as shown in *diagram 2*.

250 of these cones can be filled from the contents of the cylinder.

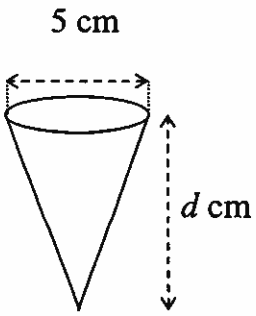


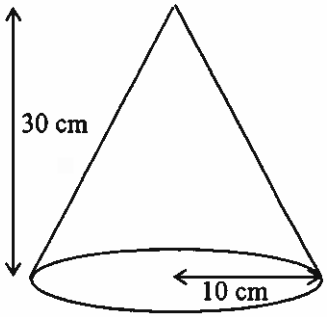
Diagram 2

Calculate the depth, d cm, of a sherbet cone.

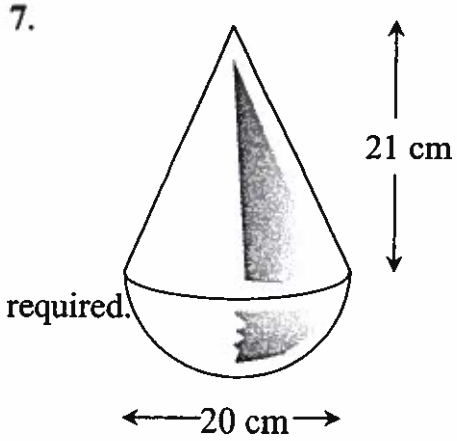
6. **Non Calculator!**

The diagram shows a cone with radius 10 centimetres and height 30 centimetres.

Taking $\pi = 3 \cdot 14$, calculate the volume of the cone.



7.

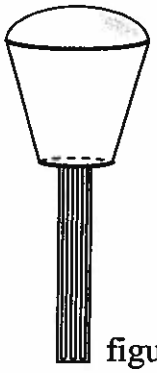


A children's wobbly toy is made from a cone, 21 cm high, on top of a hemispherical base of diameter 20 cm.

The toy has to be filled with liquid foam.

Calculate the volume of foam which will be required.

8.

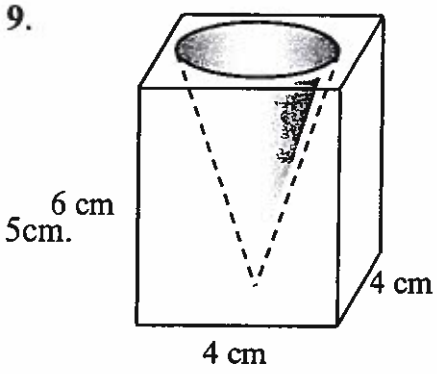


The lamp cover in a street lamp is in the shape of a cone with the bottom cut off.

The height of the cone is 50cm and its radius is 25cm. The height of the lamp is 30cm and the base of the lamp has a radius of 18cm

Calculate the volume of the lamp cover. [Answer to 3 significant figures.]

9.



A glass candle holder is in the shape of a cuboid with a cone removed. The cuboid measures 4cm by 4cm by 6cm.

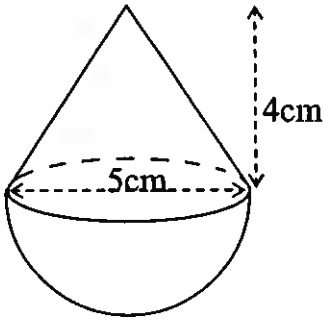
The cone has a diameter of 3cm and a height of

Calculate the volume of glass in the candle holder.

10. For the Christmas market a confectioner has created a chocolate Santa.

It consists of a solid hemisphere topped by a solid cone.

Both have diameter 5cm and the height of the cone is 4cm as shown in the diagram.



Calculate the volume of chocolate required to make one chocolate Santa, giving your answer correct to 3 significant figures.

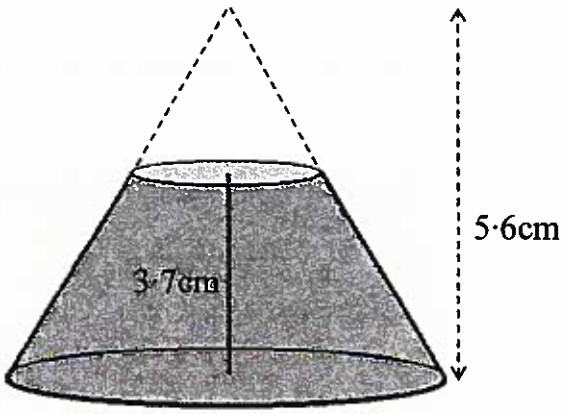
11. The diameter of an ordinary snooker ball is 5·25cm.

Calculate the volume of a snooker ball giving your answer correct to 3 significant figures.

12. A dessert is in the shape of a truncated cone [a cone with a 'slice' taken from the top].

The radius of the base is 4·1cm and is 1·6 cm at the top.

The other dimensions are shown in the diagram.



Calculate the volun

13. A young child was given a slab of moulding clay. It was a cuboid and measured 15·2cm by 4·8cm by 3·4cm.

(a) Calculate the volume of the cuboid rounding your answer to 2 significant figures.

The clay was made into 25 identical spheres.

(b) Using your answer from part (a), calculate the radius of one of the spheres.

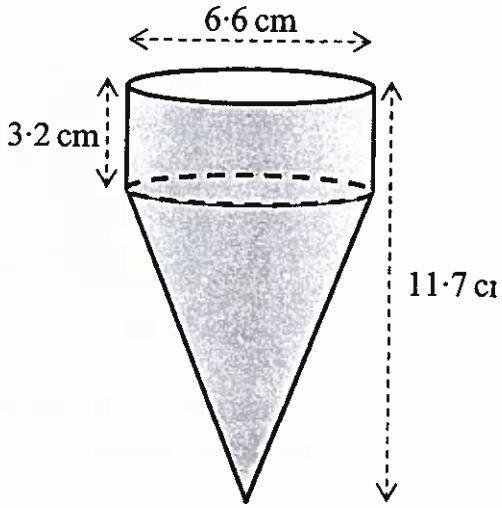
14. An ice cream is shaped like the one in the diagram.

The overall height of is 11·7 cm.

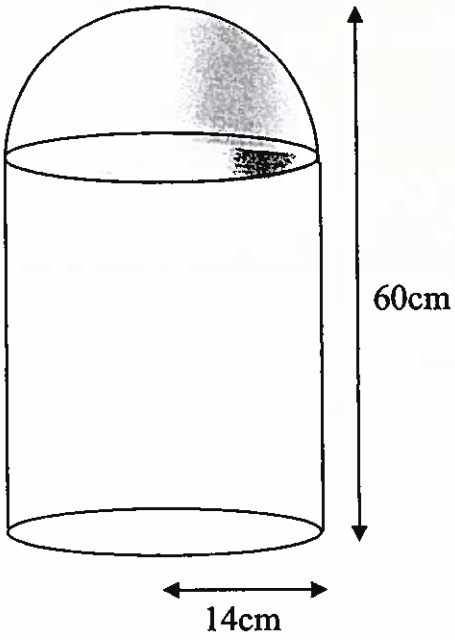
The height of the cylinder is 3·2 cm.

The diameter of the cone and cylinder is 6·6 cm.

Calculate the volume of ice cream.



15. A company that produces bins uses the design of a cylindrical base with a hemispherical lid.

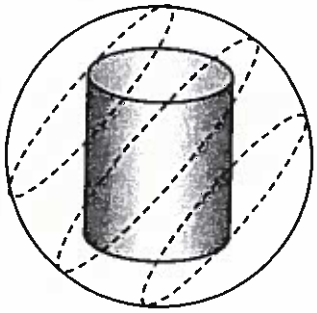


If the total height of the bin is 60cm and the radius of the bin is 14cm, calculate the total volume of the bin in litres correct to 3 significant figures.

(Volume of cylinder = $\pi r^2 h$;

Volume of sphere = $^4/_3\pi r^3$)

16.



A Christmas bauble is made from a sphere of perspex with a coloured cylinder in the middle. The volume round the cylinder is filled with a thick liquid.

The sphere has a diameter of 8 cm. The cylinder has a radius of 2·6 cm with a height of 6 cm.

Calculate the volume of liquid needed to fill the sphere, giving your answer correct to 2 significant figures.

Answers

Extending a straightforward number or diagrammatic pattern and determining its formula

1. **(a)** 11, 13, 15 **(b)** 15, 18, 21 **(c)** 34, 40, 46

(d) 84, 80, 76 **(e)** 17, 21, 25 **(f)** 15, 10, 5

2. **(a)** 32, 64 **(b)** 9, 3 **(c)** 16, 22

(d) 10, 5 **(e)** 32, 44 **(f)** 50, 25

3. **(a)** 25, 36, 49 square numbers

(b) 15, 21, 28 triangular numbers

(c) 13, 21, 34 Fibonacci

4. **(a)** 120, 720 **(b)** 8, 0 **(c)** $-5, -10$

(d) 1; ½ **(e)** $-4; -10$ **(f)** 50, 72

Extending a straightforward number or diagrammatic pattern and determining its formula

One step Patterns

1. **(a)** 4, 8, 12, 16, 20, 24 **(b)** 4 **(c)** 4

(d) B = 4N **(e)** 12

2. **(a)** 8, 16, 24, 32, 40, 48 **(b)** 8 **(c)** 8

(d) L = 8S **(e)** 10

3. **(a)** 6, 12, 18, 24, 30, 36 **(b)** 6 **(c)** 6

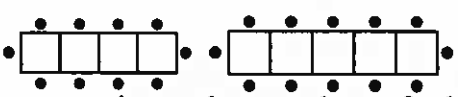
(d) S = 6H **(e)** 7

4. **(a)** 5, 10, 15, 20, 25, 30 **(b)** 5 **(c)** 80 **(d)** 20

5. **(a)** 16 **(b)** 160 **(c)** 8

Extending a straightforward number or diagrammatic pattern and determining its formula

Two step Patterns

1. **(a)**  **(b)** 4, 6, 8, 10, 12, 22, 30

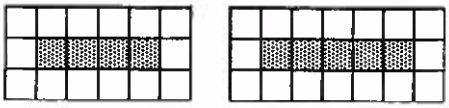
(c) two times the number of tables plus two

(d) $P = 2T + 2$ (e) 21

2. (a)  (b) 2, 4, 6, 8, 10, 38, 48

(c) Two times the number of posts subtract 2

(d) $L = 2P - 2$ (e) 98 (f) 51

3. (a)  (b) 20 (c) 24

(d) 14, 16, 18, 20, 22, 24, 26, 46 (e) $P = 2R + 6$ (f) 73

4. (a) 6, 10, 14, 18, 42, 82, 202 (b) $W = 4C + 2$ (c) 21

5. (a) 13, 16, 19, 22, 25, 28 (b) $B = 3P + 10$ (c) 64 (d) 30

6. (a) 4, 7, 10, 13, 16, 19 (b) 31 (c) 73

(d) $R = 3P + 1$ (e) 11 (f) 15

7. (a) $Q = 3P$; 36, 16, 30 (b) $N = 2M + 1$; 23, 16, 28

(c) $T = 3R - 1$; 41, 9, 16 (d) $K = D - 1$; 19, 32, 69

(e) $A = 3V - 3$; 42, 20, 25

Number patterns

EXAM QUESTIONS

1. (a) 85; 145 (b) $C = 12n + 25$

2. (a) 3, 6, 9, 21 (b) $c = 3b - 3$ (c) 20

3. (a) 12, 16, 44 (b) $p = 4w - 4$ (c) 20

4. (a) 14, 17, 32 (b) $B = 3N + 2$

5. (a) 3, 5, 9, 11, 23 (b) $T = 2r - 1$ (c) 20

Calculating the gradient of a straight line from horizontal and vertical distances

1. **(a)** $\frac{1}{2}$ **(b)** 4 **(c)** $\frac{3}{10}$ **(d)** 6 **(e)** $\frac{3}{4}$ **(f)** $\frac{1}{8}$

2. **(a)** $\frac{5}{6}$ **(b)** $\frac{1}{3}$ **(c)** 1 **(d)** $\frac{2}{5}$ **(e)** 2 **(f)** $\frac{3}{4}$

(g) $\frac{3}{2}$ **(h)** $\frac{1}{3}$ **(i)** $\frac{4}{3}$ **(j)** $\frac{4}{3}$

3. **(a)** 1 **(b)** 2 **(c)** $\frac{2}{3}$ **(d)** 5 **(e)** $\frac{1}{3}$ **(f)** $\frac{3}{2}$

(g) –3 **(h)** $-\frac{1}{2}$ **(k)** $-\frac{3}{2}$ **(l)** –1 **(m)** –6 **(n)** $-\frac{1}{8}$

4. **(a)** –3 **(b)** $\frac{1}{2}$ **(c)** 1 **(d)** $-\frac{1}{2}$ **(e)** $\frac{2}{5}$ **(f)** 4

5. **(a)** 2 **(b)** $\frac{1}{2}$ **(c)** 4 **(d)** 3 **(e)** $-\frac{1}{3}$ **(f)** -2

Gradients
EXAM QUESTIONS

1. $-\frac{3}{4}$ **2.** $\frac{2}{3}$ **3.** Suitable since 0·12 lies between 0·1 and 0·2

4. meets regulations since 0·47 < 0·5 **5.** $\frac{19}{50}$ or 0·38 **6.** $\frac{16}{39}$ or 0·41

7. $\frac{3}{7}$ or 0·43 **8.** Not safe since gradient is 2 which does not lies between 1·8 and 2

9. $\frac{5}{7}$ or 0·7

Applying Algebraic Skills to Linear Equations

Drawing the graph of a linear equation

1. **(a)**

x	0	1	2	3	4	5
y	0	2	4	6	8	10

(b) Graph drawn - see later

2. **(a)**

x	0	1	2	3	4	5
y	0	3	6	9	12	15

(b) Graph drawn - see later

3. **(a)**

x	0	2	4	6	8	10
y	0	1	2	3	4	5

(b) Graph drawn - see later

4. **(a)**

x	0	3	6	9	12
y	0	1	2	3	4

(b) Graph drawn - see later

5. A straight line has as its equation $y = x$.

(a) **Copy** and complete the table for this line.

x	1	2	3	4	5	6
y	1	2	3	4	5	6

(b) Graph drawn - see later

6. **(a)**

x	0	1	2	3	4	5
y	2	3	4	5	6	7

(b) Graph drawn - see later

7. **(a)**

x	0	1	2	3	4	5
y	1	3	5	7	9	11

(b) Graph drawn - see later

8. **(a)**

x	0	2	4	6	8	10
y	4	5	6	7	8	9

(b) Graph drawn - see later

9. **(a)**

x	0	4	8	12
y	5	6	7	8

(b) Graph drawn - see later

10. **(a)**

x	1	2	3	4	5
y	1	4	7	10	13

(b) Graph drawn - see later

11. **(a), (b) and (c)** Graph drawn - see later

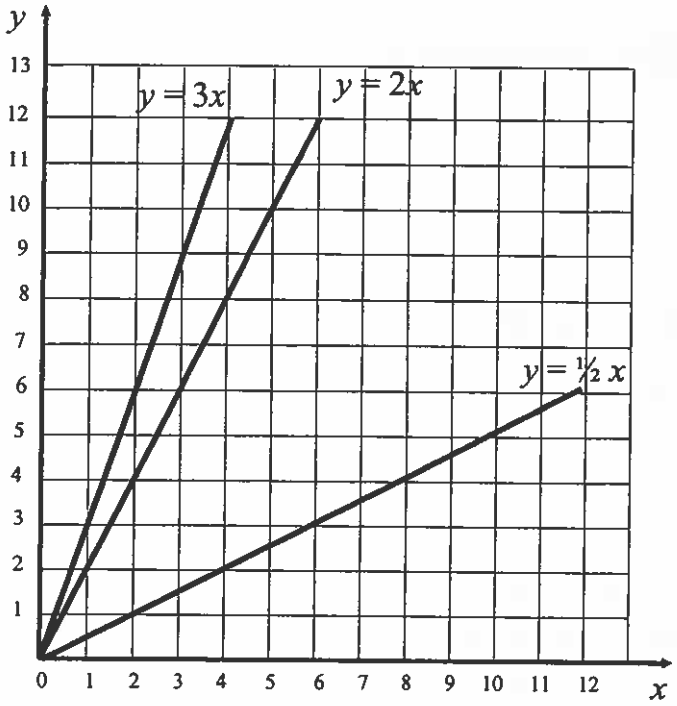
12. **all parts** Graphs drawn - see later

13. **(a), (b) and (c)** Graph drawn - see later

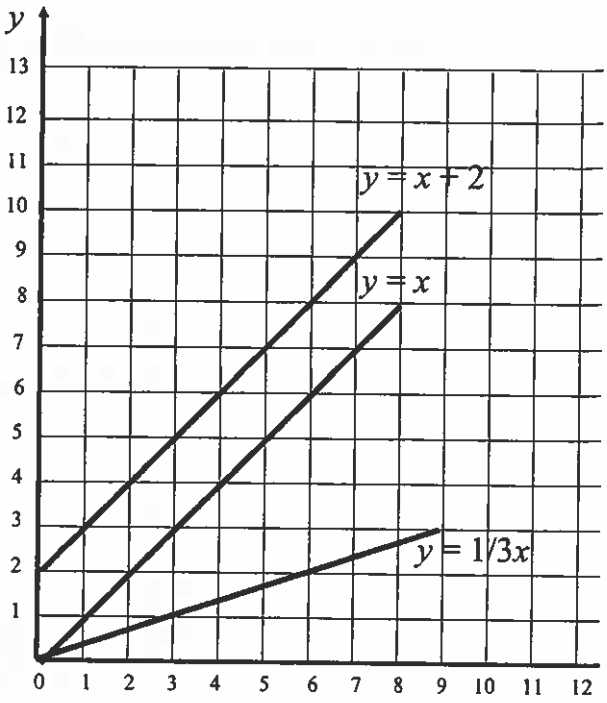
14. **all parts** Graphs drawn - see later

Drawing the graph of a linear equation

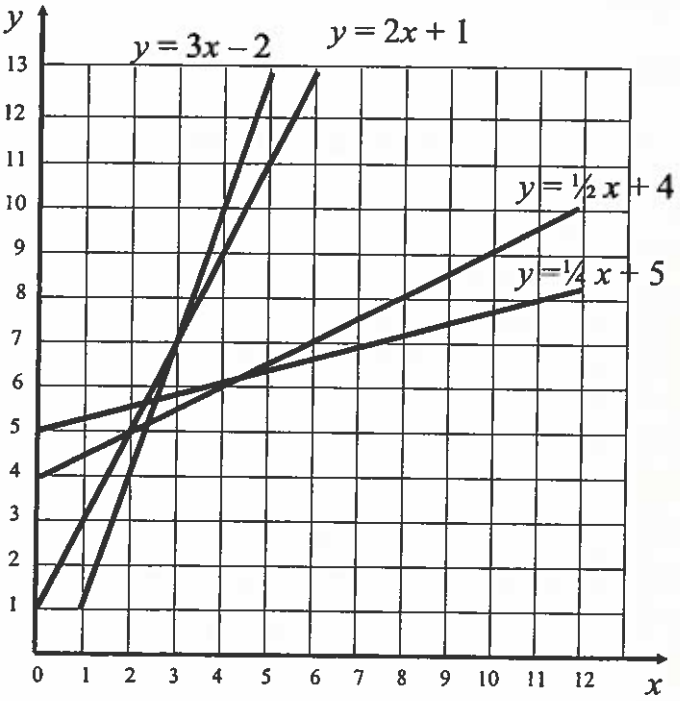
Questions 1, 2 and 3



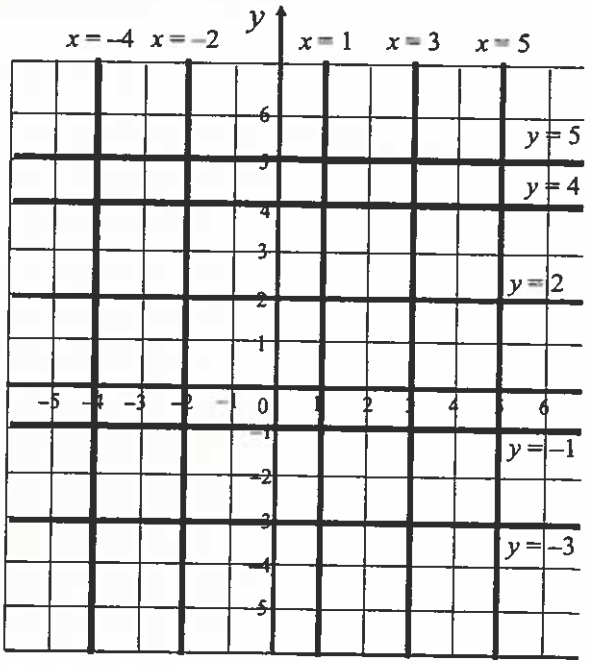
Questions 4, 5 and 6



Questions 7, 8, 9 and 10



Questions 11, 12, 13 and14



Drawing the graph of a linear equation (More practice)

1. **(a)**

x	–2	–1	0	1	2	3
y	–5	–3	–1	1	3	5

(b) (–2, –5), (–1, –3), (0, –1), (1, 1), (2, 3), (3, 5)

(c) and **(d)** Graph drawn – see later

2. **(a)**

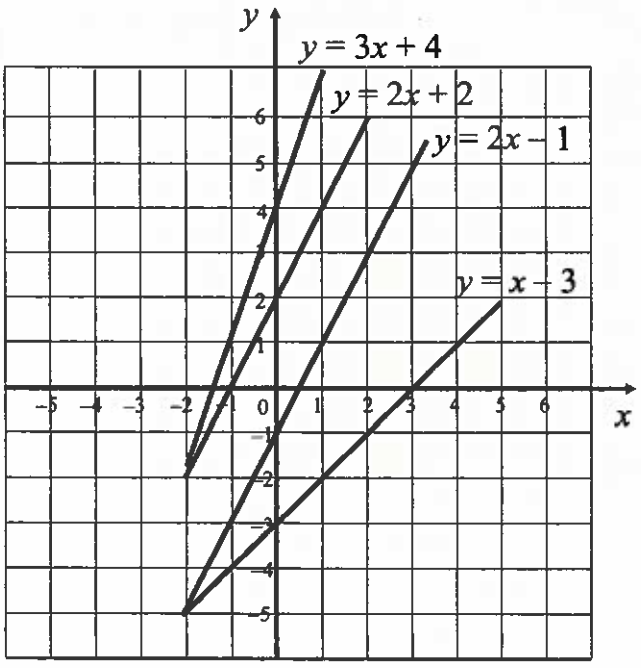
x	–2	–1	0	1	2	3
y	–2	1	4	7	10	13

(b) (–2, –2), (–1, 1), (0, 4), (1, 7), (2, 10), (3, 13)

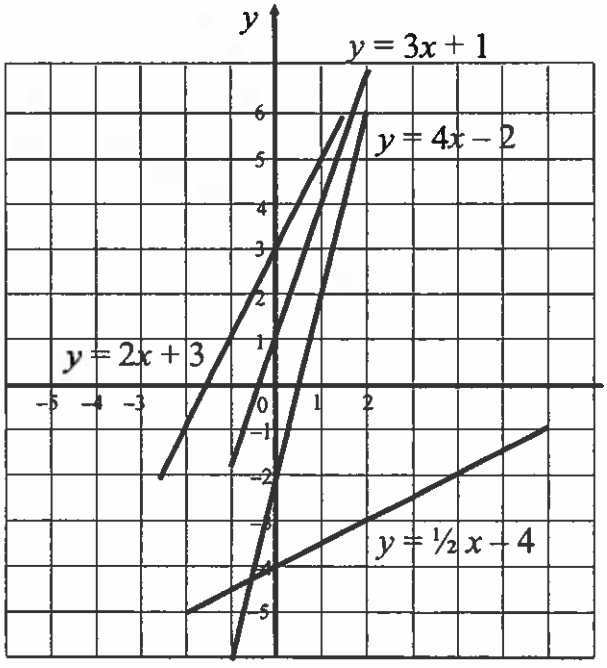
(c) and **(d)** Graph drawn – see later

3. All parts: Graph drawn – see later

Questions 1, 2, 3 (a) and (b)



Question 3 (c), (d), (e) and (f)



Recognising the graph of a linear equations

1. **(a)** $m = 1$; (0, 3) **(b)** $m = 2$; (0, 2) **(c)** $m = 3$; (0, 1)

(d) $m = 4$; (0, 2) **(e)** $m = 2$; (0, 3) **(f)** $m = ½$; (0, 4)

2. **(a)** $m = 3$; (0, 1) **(b)** $m = ½$; (0, –5) **(c)** $m = –2$; (0, 3)

(d) $m = – ¼$; (0, –2) **(e)** $m = 8$; (0, – ½) **(f)** $m = –1$; (0, 4)

3. (1) and (b); (2) and (d); (3) and (f); (4) and (c); (5) and (a); 6 and (e)

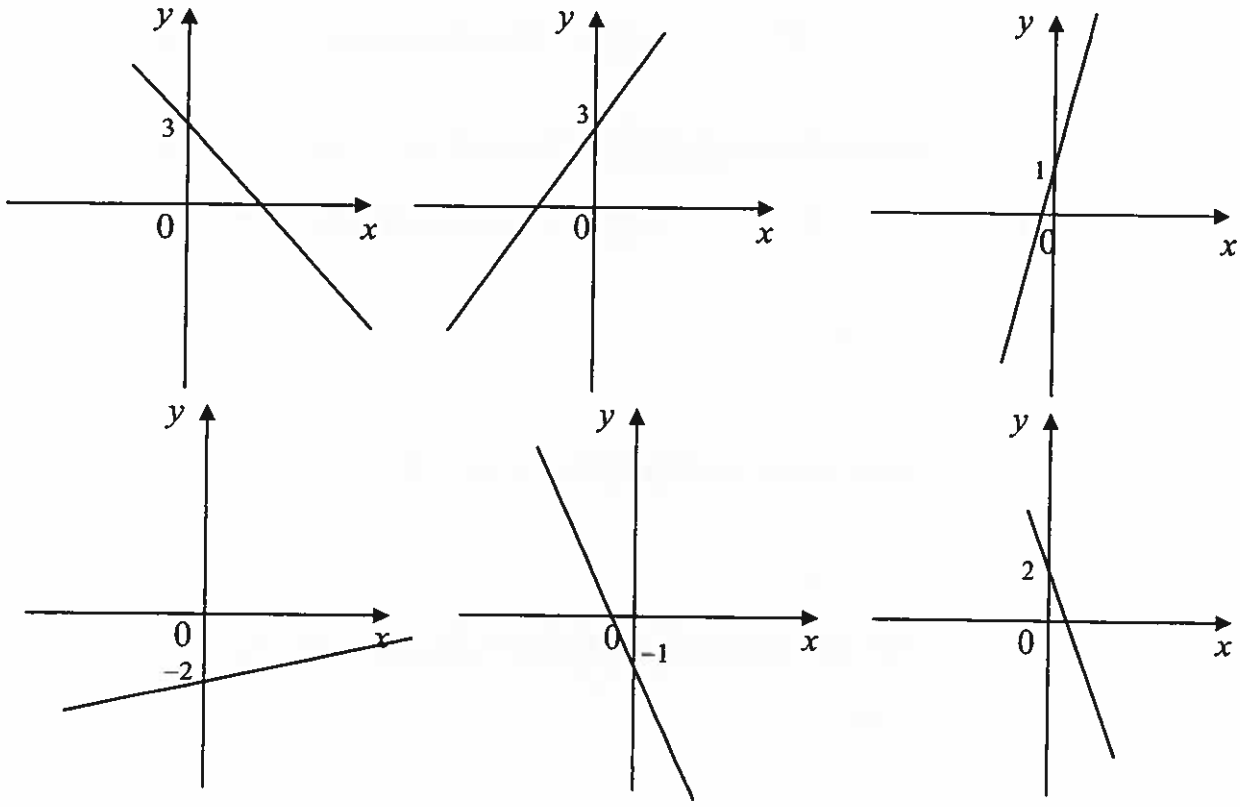
4. **(a)** $y = 4x + 5$ **(b)** $y = 3x + 1$ **(c)** $y = 2x – 1$ **(d)** $y = ¼ x + 2$

(e) $y = ½ x – 2$ **(f)** $y = –2x – 4$ **(g)** $y = –3x + 3$ **(h)** $y = –¾x – 2$

5. **(a)** $y = 4$ **(b)** $x = 6$ **(c)** $y = 1$ **(d)** $y = –5$

(e) $x = –5$ **(f)** $x = 3$ **(g)** $y = –2$ **(h)** $x = –3$

6.



7. **(a)** $y = 2x + 2$ **(b)** $y = \frac{1}{2}x - 1$ **(c)** $y = 4x - 2$ **(d)** $y = 3x + 3$

(e) $y = -1/3x - 2$ **(f)** $y = -2x + 3$ **(g)** $y = -3x - 3$ **(h)** $y = \frac{1}{4}x - 2{\cdot}5$

Drawing and recognising the graph of a linear equations.

EXAM QUESTIONS

1. **(a)** –7, 5, 11 **(b)** Line drawn passing through (–2, –7), (2, 5), (4, 1)

(c) Horizontal line passing through (0, 8) **(d)** (3, 8)

2. **(a)** 5, 1, –2 **(b)** Line drawn passing through (–6, 5), (2, 1), (8, –2)

(c) Vertical line passing through (3, 0) **(d)** (3, ½)

3. **(a)** 11, –1, –10 **(b)** Line drawn passing through (–4, 11), (0, –1), (3, –10)

(c) Horizontal line passing through (0, 2) **(d)** (–1, 2)

4. **(a)** –4, –2, 0 **(b)** Line drawn passing through (–2, –4), (2, –2), (6, 0)

(c) (0, –3)

5. **(a)** –5, 1, 1

(b) Graph dawn passing through (–3, –5), (–1, –1), (0, 1), (1, 3), (3, 7)

6. **(a)** 5, 4, 2, 1

(b) Line drawn passing through (–1, 5), (0, 4), (2, 2), (3, 1)

(c) (4, 0)

1.1 DETERMINING the EQUATION of a STRAIGHT LINE

1. **(a)** 3; (0, 1) **(b)** ½; (0, – 5) **(c)** –2; (0, 3)
(d) –¼; (0, – 2) **(e)** 8; (0, – ½) **(f)** –1; (0, 4)

2. **1** and **(b)** **2** and **(d)** **3** and **(f)** **4** and **(c)** **5** and **(a)** **6** and **(e)**

3. Lines sketched.

4. **(a)** $y = 2x + 2$ **(b)** $y = \frac{1}{2}x - 1$ **(c)** $y = 4x - 2$ **(d)** $y = 3x + 3$

(e) $y = -\frac{1}{3}x - 1$ **(f)** $y = -\frac{1}{2}x + 3$ **(g)** $y = -3x - 3$ **(h)**
$y = \frac{1}{4}x - 2 \cdot 5$

5. **(a)** 1; (0, 3) **(b)** $-2; (0, -1)$ **(c)** $\frac{1}{2}; (0,0)$

(d) $-\frac{1}{2}$; (0, 2) **(e)** $-1; (0,6)$ **(f)** $\frac{1}{2}; (0, -2)$

(g) $\frac{1}{3}; (0, 4)$ **(h)** $-\frac{4}{5}; (0, 4)$ **(i)** $\frac{3}{2}; (0, -6)$

6. **(a)** $1; (0, -7)$ **(b)** $-5; (0,3)$ **(c)** $\frac{3}{5}; (0, -2)$

(d) $-4; (0,0)$ **(e)** $-2; (0, 11)$ **(f)** $\frac{1}{2}; (0, -\frac{5}{2})$

(g) $\frac{1}{3}; (0, 6)$ **(h)** $-\frac{3}{7}; (0, 3)$ **(i)** $\frac{4}{5}; (0, -4)$

7. **(a)** $y = 4x + 5$ **(b)** $y = -2x + 1$ **(c)** $y = \frac{3}{4}x - 3$

(d) $y = 4x - 11$ **(e)** $y = -5x - 14$ **(f)** $2y - x = 1$

	(g)	$3y-4x=13$	**(h)**	$3x+4y=-14$	**(i)**	$2x+3y=-9$
8.	**(a)**	$y=2x-5$	**(b)**	$y+4x=13$	**(c)**	$5y=x+32$
	(d)	$y=2x-1$	**(e)**	$y=x+6$	**(f)**	$4x+3y=-15$
	(g)	$3y-5x=20$	**(h)**	$2x+5y=14$	**(i)**	$7y+11x=48$
9.	**(a)**	$2y-x=0$	**(b)**	$y+2x=7$	**(c)**	$y=3x-6$
	(d)	$2x-3y=0$	**(e)**	$2y+x=3$	**(f)**	$4y+3x=-4$
	(g)	$y=5x+28$	**(h)**	$y=4x-19$	**(i)**	$2y+5x=-4$
10.	**(a)**	$y=3x-5$	**(b)**	$y+4x=16$	**(c)**	$2y-x=0$
	(d)	$y+2x=-5$	**(e)**	$2y-x=14$	**(f)**	$3y+x=3$

STRAIGHT LINE

EXAM QUESTIONS

1. $\frac{3}{2}$; (0,2) **2.** $y=-\frac{3}{4}x+6$ **3.** D **4.** $\frac{3}{4}$; (0,3)

5. P(0, 4) **6.** $y=-\frac{3}{2}x+2$ **7.** -3; $(0,4\cdot5)$

8. Line crossing at (0, 5) with gradient $-\frac{4}{3}$ **9.** **(a)** $\frac{1}{4}$ **(b)** $T=\frac{1}{4}v+10$

10. $\frac{2}{3}$; (0,2) **11.** $\frac{3}{2}$; $(0,-4)$ **12.** $3y-2x=-12$

13. **(a)** $\frac{3}{4}$; $(0,1\cdot5)$ **(b)** $2y+x=3$ **14.** **(a)** $\frac{4}{3}$; (0,4) **(b)** $4y+3x=16$

Investigating the surface of a prism

1. cube, 6, 12, 8; triangular prism, 5, 9, 6; cylinder, 3, 2, 0; cone, 2, 1, 1 pyramid, 5, 8, 5

2. **(a)** cube and pyramid **(b)** 9 **(c)** 12 **(d)** 9

3. **(a)** hemisphere and cone, 2, 1, 1 **(b)** cylinder and cone, 3, 2, 1

4. **(a)** tetrahedron **(b)** cube **(c)** cylinder **(d)** triangular prism

(e) cuboid **(f)** cylinder **(g)** triangular prism **(h)** cube

5 Nets sketched

. **(a)** 344 cm^3 **(b)** 348 cm^3 **(c)** 336 cm^3 **(d)** 1128 cm^3

(e) 1056 cm^3 **(f)** 7392 cm^3 **(g)** 602·88 cm^3 **(h)** 401·92 cm^3

Calculating the volume of a prism

1. **(a)** 72 cm^3 **(b)** 120 m^3 **(c)** 160 cm^3 **(d)** 12000 mm^3

(e) 12 cm^3 **(f)** 343 m^3 **(g)** 616 cm^3

2. **(a)** 864 cm^3 **(b)** 648 mm^3 **(c)** 5000 cm^3

(d) 840 m^3 **(e)** 198 mm^3 **(f)** 94·6 cm^3

3. **(a)** 216 cm^3 **(b)** 64 mm^3 **(c)** 2744 cm^3 **(d)** 12167 mm^3

4. **(a)** 3 litres **(b)** 2·4 litres **(c)** 12·6 litres **(d)** 0·6 litre

(e) 1·46 litres **(f)** 0·48 litre **(g)** 320 litres **(h)** 2·565 litres

5. **(a)** 2·4 litres **(b)** 2·16 litres **(c)** 4·2 litres

Calculating the volume of a cylinder

1. **(a)** 62·8cm^3 **(b)** 384·65cm^3 **(c)** 15·7cm^3

(d) 2797·74mm^3

2. 117·8cm^3, 3391·2mm^3, 769·3cm^3, 17·8m^3

3. 330ml

4. 2000ml (2 litres)

5. 753·6cm^3 **6.** 360litres

Calculating the volume of a triangular prism

1. **(a)** $30cm^3$ **(b)** $81cm^3$ **(c)** $315cm^3$
(d) $936cm^3$ **(e)** $604{\cdot}8cm^3$

2. **(a)** 5 **(b)** 24

Calculating the volume of other prisms

(a) $27{\cdot}6m^3$ **(b)** $36m^3$ **(c)** $1380cm^3$

(d) $1152cm^3$ **(f)** $71{\cdot}5m^3$ **(g)** $12{\cdot}72m^3$

Applying geometric skills to circumference, area and volume

EXAM QUESTIONS

1. 4cm **2.** $2460cm^3$ **3.** $1134000\ cm^3$

4. $67\ cm^2$ **5.** yes; since $157{\cdot}5 > 150$ **6.** $164{\cdot}5cm^2$

7. Josh was wrong ($423{\cdot}9 > 420$) **8.** **(a)** $4000cm^3$ **(b)** 8 blocks / 40cm

9. **(a)** 54 litres **(b)** 9cm **10.** 54 bottles **11.** diagram of net

12. $264cm^2$ **13.** $541{\cdot}52cm^2$ **14.** 6cm

15. **(a)** $1728\ cm^3$ **(b)** $864cm^2$ **(c)** $10{\cdot}7cm$

16. **(a)** $14{\cdot}5cm^2$ **(b)** 304·5grams **17.** $2711\ cm^2$ **18.** $426cm^2$

19. 83 cuboids **20.** **(a)** triangular prism **(b)** $49{\cdot}2cm^2$

20. diagram of net

WORKING with VOLUME of a CYLINDER

1. **(a)** $1696{\cdot}5\ cm^3$ **(b)** $4825{\cdot}5\ cm^3$ **(c)** $603{\cdot}2\ cm^3$ **(d)** $2513{\cdot}3\ cm^3$ **(e)** $75398{\cdot}2\ cm^3$

(f) $3078{\cdot}8\ cm^3$ **(g)** $28274{\cdot}3\ cm^3$ **(h)** $13304{\cdot}6\ cm^3$ **(i)** $760265\ cm^3$ **(j)** $7298{\cdot}5\ cm^3$

2. **(a)** 19·8cm **(b)** 3·7 litres **3.** $904cm^3$

4. No; volume is 9·72 litres

3.3 WORKING with the VOLUME of a SOLID SPHERE, CONE, PYRAMID

1. **(a)** $904{\cdot}3cm^3$ $113{\cdot}0cm^3$ **(b)** $33{\cdot}5m^3$ **(c)** $3052{\cdot}1mm^3$ **(d)**

2. **(a)** $4190cm^3$ $33500000mm^3$ **(b)** $65400cm^3$ **(c)** $4{\cdot}19m^3$ **(d)**

(e) $697cm^3$ $87100cm^3$ **(f)** $3050cm^3$ **(g)** $2140000mm^3$ **(h)**

(i) $180m^3$ **(j)** $57900cm^3$

3. $268cm^3$

4. **(a)** $366cm^3$ $1060cm^3$ **(b)** $1280cm^3$ **(c)** $207cm^3$ **(d)**

5. **(a)** $2369cm^3$ $608cm^3$ **(b)** $1170cm^3$ **(c)** $15800cm^3$ **(d)**

6. **(a)** $56{\cdot}5cm^3$ $25{\cdot}1cm^3$ **(b)** $803{\cdot}8mm^3$ **(c)** $47{\cdot}1cm^3$ **(d)**

7. $83{\cdot}7cm^3$ $37cm^3$ **8.** $314cm^3$ **9.** $1020cm^3$ **10.**

11. $640mm^3$

WORKING with the VOLUME of a SOLID SPHERE, CONE, PYRAMID and CYLINDER

EXAM QUESTIONS

1. $2{\cdot}79 \times 10^6 m^3$ **2.** $6{\cdot}01cm^3$ **3.** 10cm **4.** $113{\cdot}04m^3$

5. 6·11cm **6.** $3140cm^3$ **7.** $4291cm^3$ **8.** $25900cm^3$

9. $84{\cdot}225cm^3$ **10.** $58{\cdot}9cm^3$ **11.** $75{\cdot}7cm^3$ **12.** $93{\cdot}4cm^3$

13. **(a)** $250cm^3$ **(b)** 1·3cm **14.** $206cm^3$

15. 34·1 litres **16.** $140\,cm^3$