White Rose Maths

1 Here is a coordinate grid showing the points A, B, C and D.
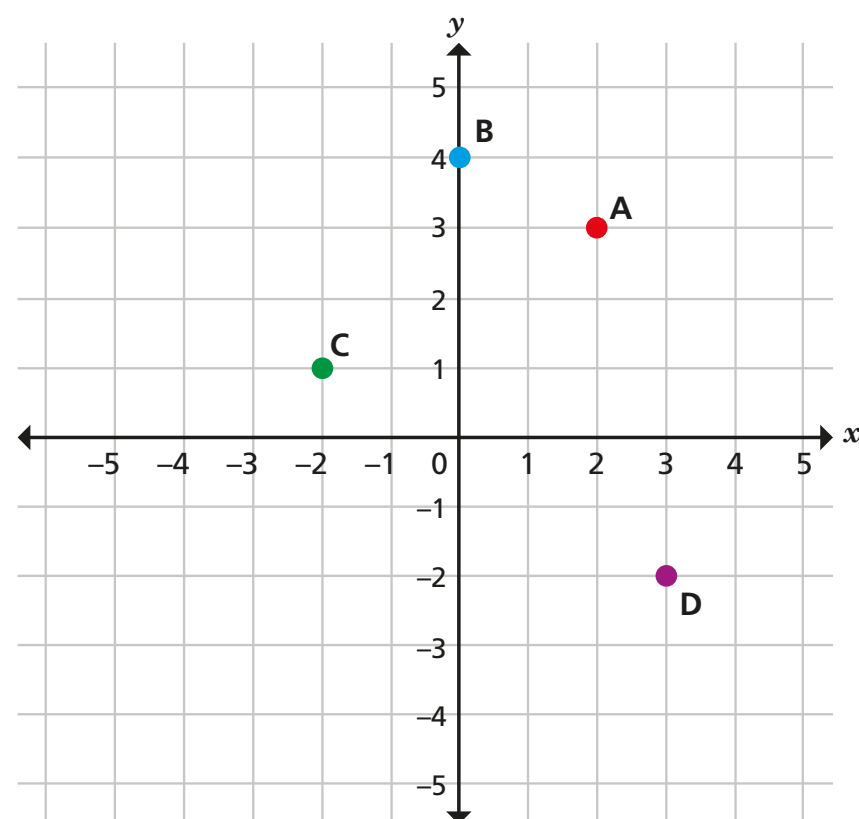
a) Write the coordinates of points A, B, C and D.

A (___ , ___)   C (___ , ___)

B (___ , ___)   D (___ , ___)

b) Which point is in the 2nd quadrant? _____

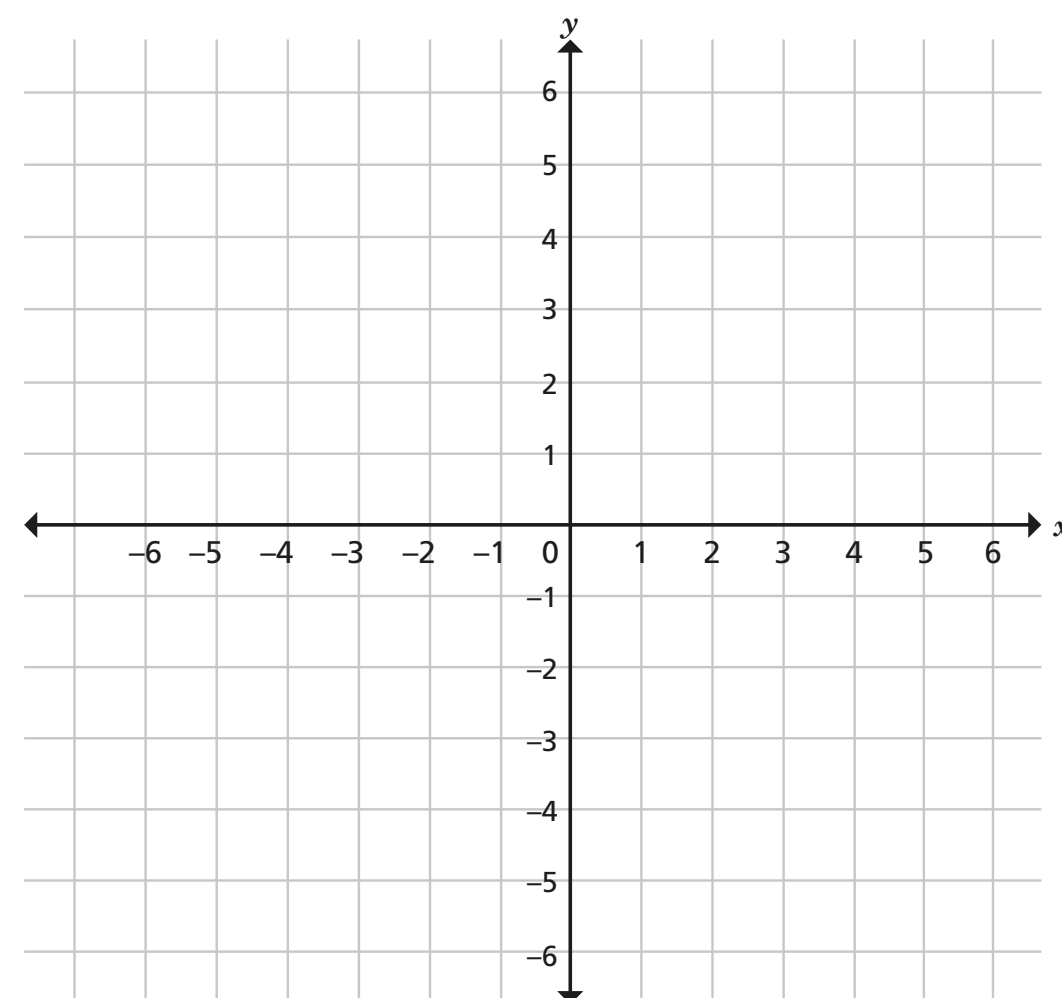c) Which point is closest to the origin? _____

2 Which of the following points is not in the same quadrant as the others?

Circle your answer.

(–3, 1)   (–2, 1)   (–4, –2)   (–7, 2)

Is the point (0, 0) in the same quadrant as the other three points?

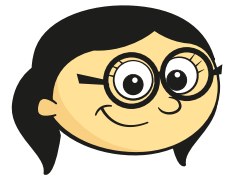**3** Here is a blank coordinate grid.
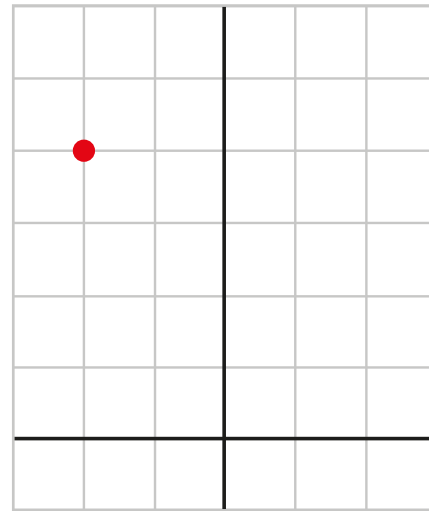

a) Plot these points on the grid.

J(2, 0)   L(–4, –6)   K(–4, 2)   M(2, –4)

b) What type of quadrilateral is the shape JKLM? _____

4

Point A is at (2, 4) because it is 2 across and 4 up.

Is Annie correct? _____

Explain your answer.

_____

_____

5 The points Q(6, 0), R(0, 0) and S form a right-angled triangle QRS.

Tick the coordinate(s) that could be the point S.
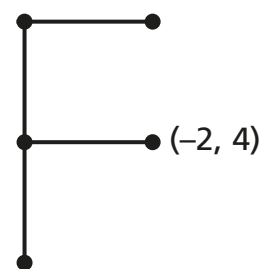
(6, 8) ☐   (0, −4) ☐   (9, −2) ☐   (−2, 0) ☐

6 Filip has drawn an F on a coordinate grid. One point is labelled.

Suggest possible values for the other points and label them on the diagram.

(−2, 4)

Compare answers with a partner.

Is there more than one possible set of answers?

7 The rectangle LMNP has an area of 700 square units.

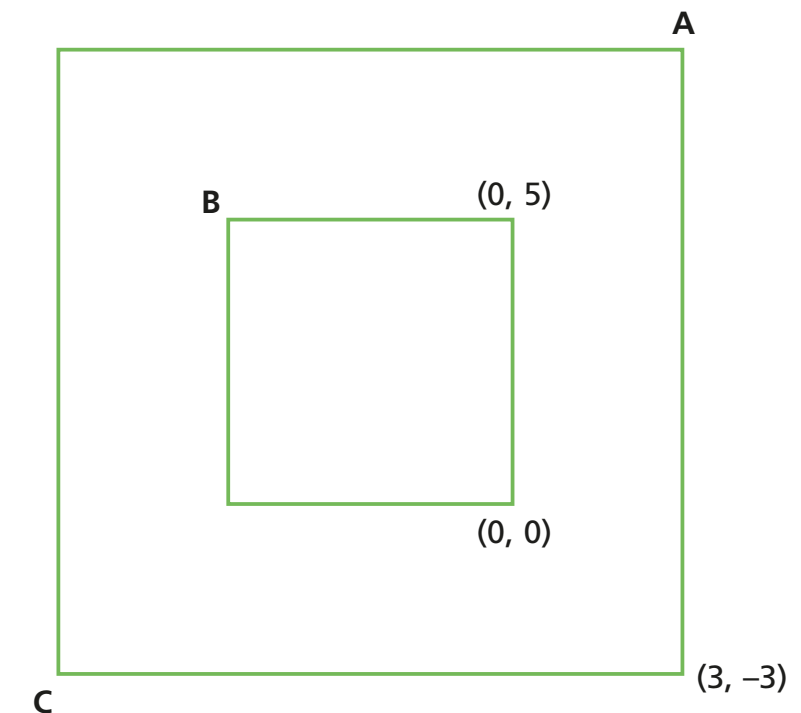The point L is (15, 15) and the point P is (−20, 15).

Find one possible pair of answers for M and N.

M(⬚ , ⬚) and N (⬚ , ⬚)

8 The diagram shows two concentric squares. (Concentric squares share the same centre.)

A

B   (0, 5)

(0, 0)

(3, −3)

C

a) Find the labelled coordinates.

A (⬚ , ⬚)   B (⬚ , ⬚)   C (⬚ , ⬚)

b) What are the coordinates of the centre point of both squares?

(⬚ , ⬚)

Identify and draw lines that are parallel to the axes

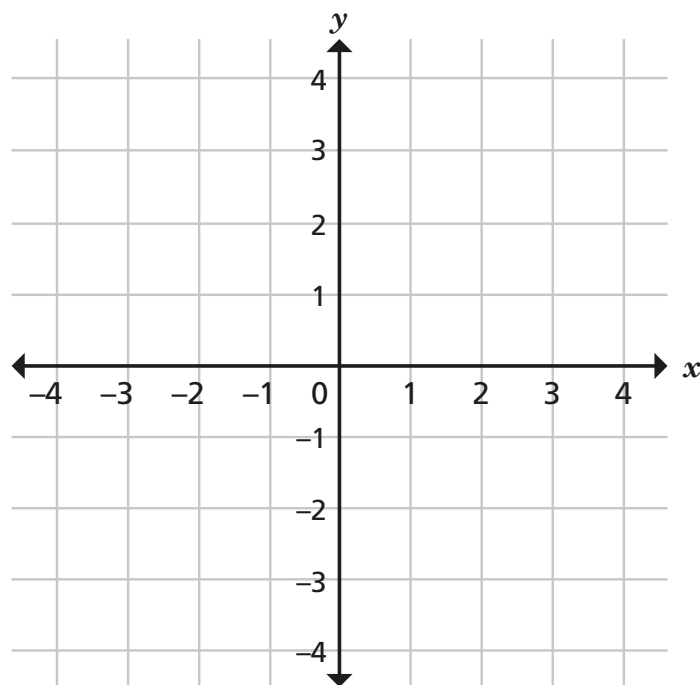**1** Which statement is correct? Tick your answer.

The x-axis and y-axis are perpendicular to each other. ☐

The x-axis and y-axis are parallel to each other. ☐

2 Here is a blank coordinate grid.

a) Plot these points and draw lines to join them.

(2, −3), (0, −3), (−1, −3), (−3.5, −3)

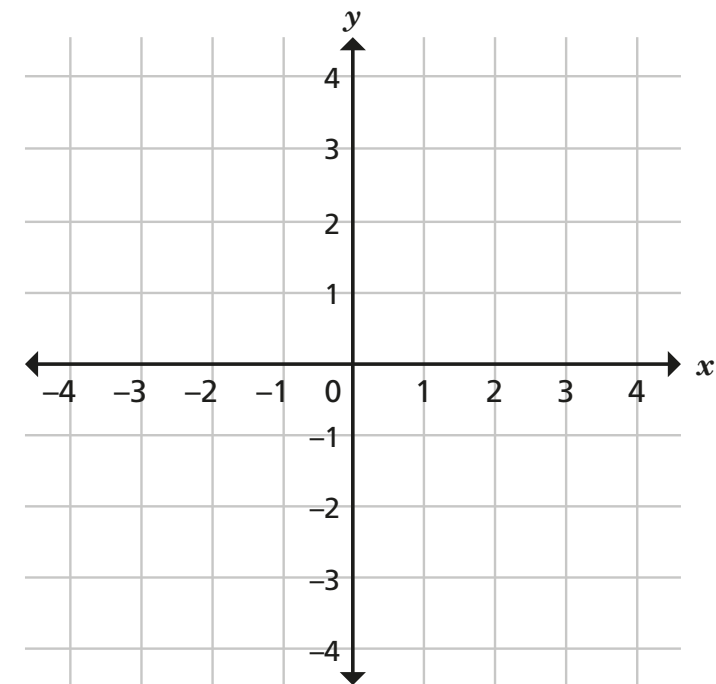**b)** Complete the sentences.

All of the y-coordinates are ☐

They join to make the line $y = $ ☐

c) Write the coordinates of three points that lie on the line $y = 8$

(☐ , ☐)   (☐ , ☐)   (☐ , ☐)

3 Here is a blank coordinate grid.

a) Draw the line $x = 2$ on the grid.

b) Write the coordinates of three points that lie on your line.

_____

How do these tell you that your line is correct?

_____

c) Write the coordinates of a point on the line $x = 2$ that you cannot see on the grid.   (☐ , ☐)

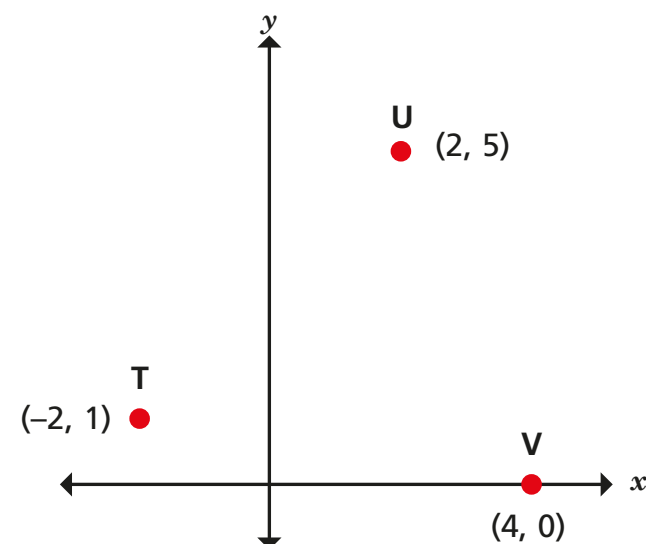**d)** Draw the line $y = 1$ on the same grid.

e) Write the coordinates of the point where the lines $x = 2$ and $y = 1$ intersect.   (☐ , ☐)

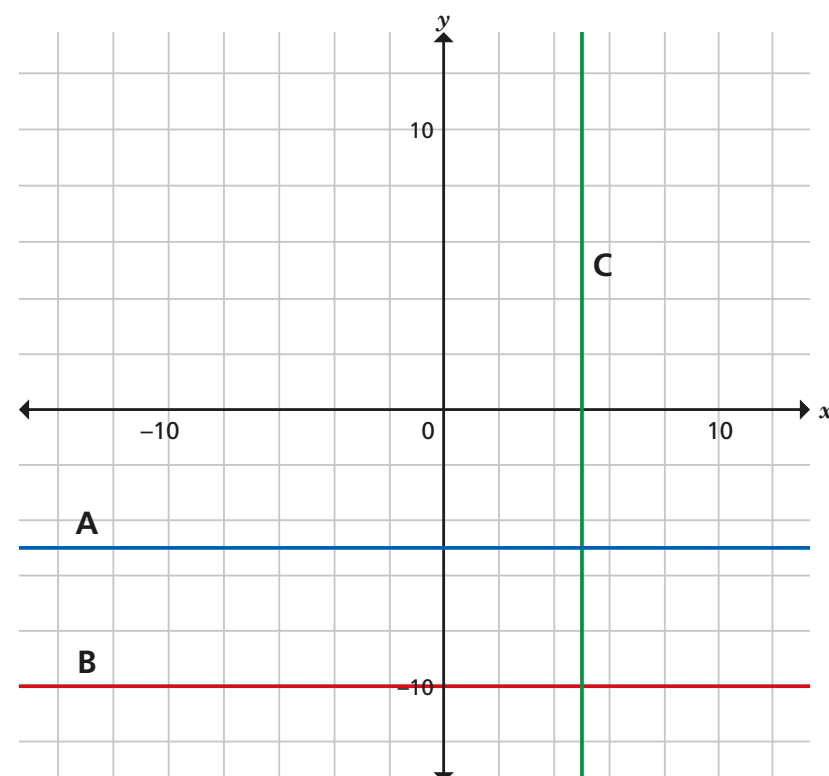**4** The point (−5, 9) lies on which of these lines?

$y = -5$ ☐ $x = -5$ ☐ $x = 9$ ☐ $y = 9$ ☐

5 The points T, U and V are shown.

Tick the points that satisfy the statements in the table.

Statement	T	U	V
Above $y = 4$			
Left of $x = -1$			
Below $y = 0.5$			

U ● (2, 5)

T
(−2, 1) ●

V ●
(4, 0)

6 The graph shows 3 straight lines: A, B and C.

a) Which two lines are parallel to each other? _____ and _____

b) Which line is parallel to the y-axis? _____

c) What is the equation of line A? _____

d) What is the equation of line C? _____

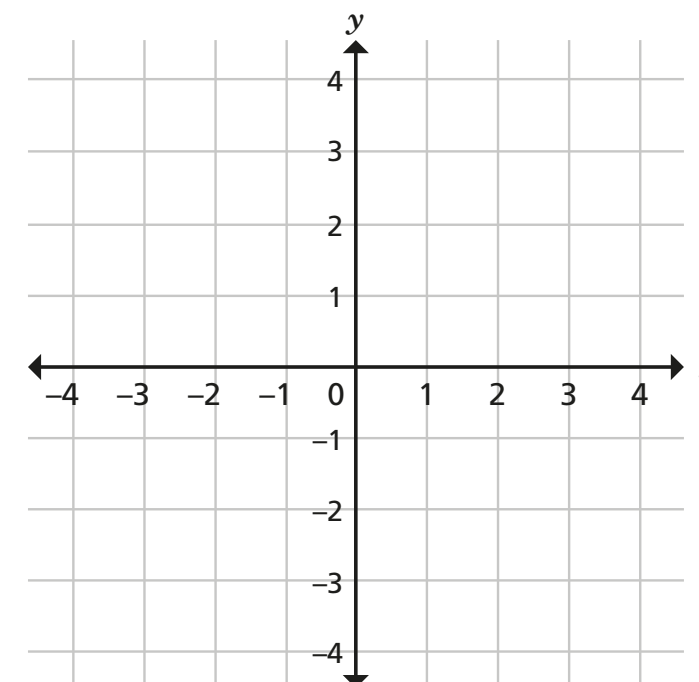**7** Which of these lines are parallel to the x-axis?

$x = 0$ ☐ $6 = y$ ☐ $6y = 2$ ☐ $3y + 8 = 0$ ☐

8 Here is a blank coordinate grid.

a) Plot the points (2, −3), (4, −3), (2, 1) and (4, 1).

Join them to make a rectangle.

b) Write the equations for the two lines of symmetry of the rectangle.

_____ and _____

c) What are the coordinates of the centre of the rectangle?

(☐ , ☐)

Recognise and use the line $y = x$

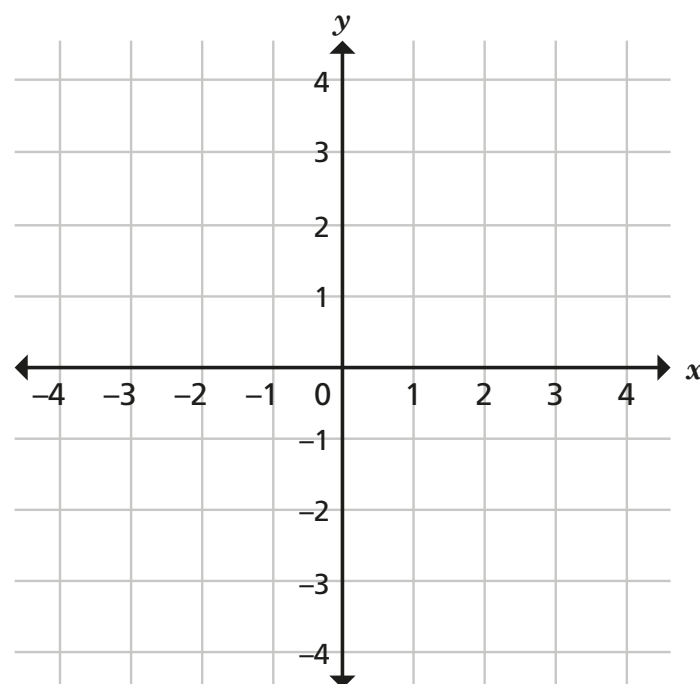**1** On the line $y = x$, the y-coordinate is equal to the x-coordinate.

a) Complete the table of values for $y = x$.

x	−1	0		2	
y		0	1		3

b) Write the values in the table as coordinates.

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

c) Plot the points.

d) Join the points to make the line $y = x$.

e) Is the point (3, 4) above or below the line $y = x$? _____

2 Are these statements always true, sometimes true or never true.

Give a reason for your answer.

a) The line $y = x$ is the same as the line $x = y$.

_____

_____

b) The line $y = x$ is at 45° to the x-axis.

_____

_____

c) The line $y = x$ passes through the 4th quadrant.

_____

_____

3 Tick the coordinates that lie on the line $y = x$.

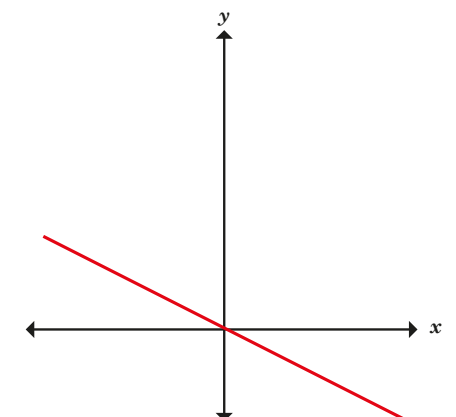(5.6, 5.6) ☐ $(3a, a + 2a)$ ☐

$(120, 60^2)$ ☐ $(0.3, \frac{1}{3})$ ☐

4 Give a reason why each graph is not the line $y = x$.

a)
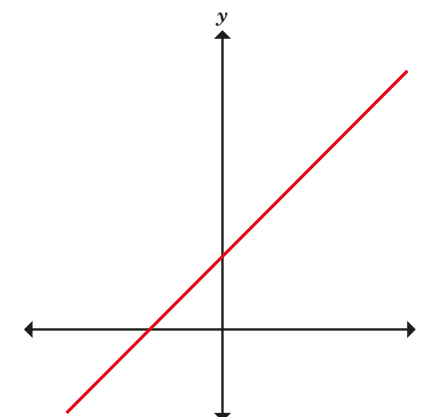
b)

_____   _____

_____   _____

5 The points D(0, 0), E(4, 0) and F(4, 4) join to make the triangle DEF.

a) What is the equation of the line that passes through these points?
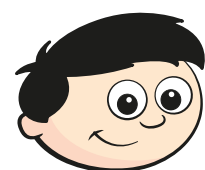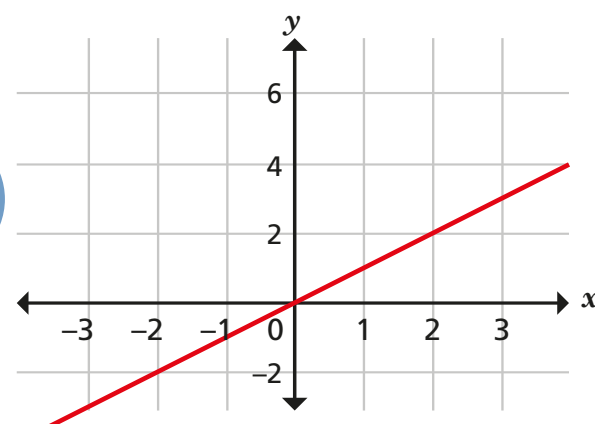
E and F _____

D and E _____

F and D _____

b) Find the area of the enclosed triangle.

_____

6

This graph of $y = x$ has been plotted wrong because it is not steep enough.

Explain why Dexter is wrong.

_____

_____

_____

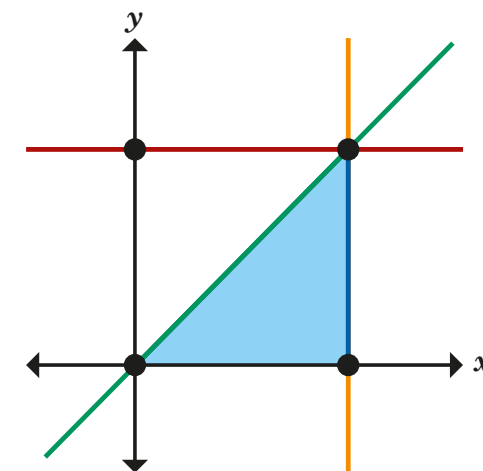**7** Which of these is not the line $y = x$?

$y - x = 0$ ☐ $3x = 3y$ ☐

$x + y = 0$ ☐ $y = x + 0$ ☐

8 The lines $y = x$ and $x = a$ enclose a triangle with the x- and y-axes.

a) Find the area of the triangle when $a = 5$

_____

b) If the area of the triangle is 50, what is the value of a?

_____

_____

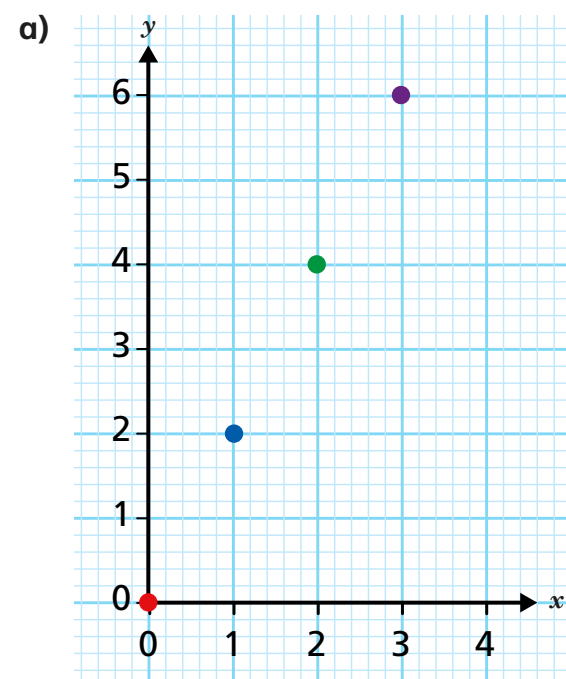**c)** Write a formula for the area of the triangle.

_____

Recognise and use lines of the form $y = kx$
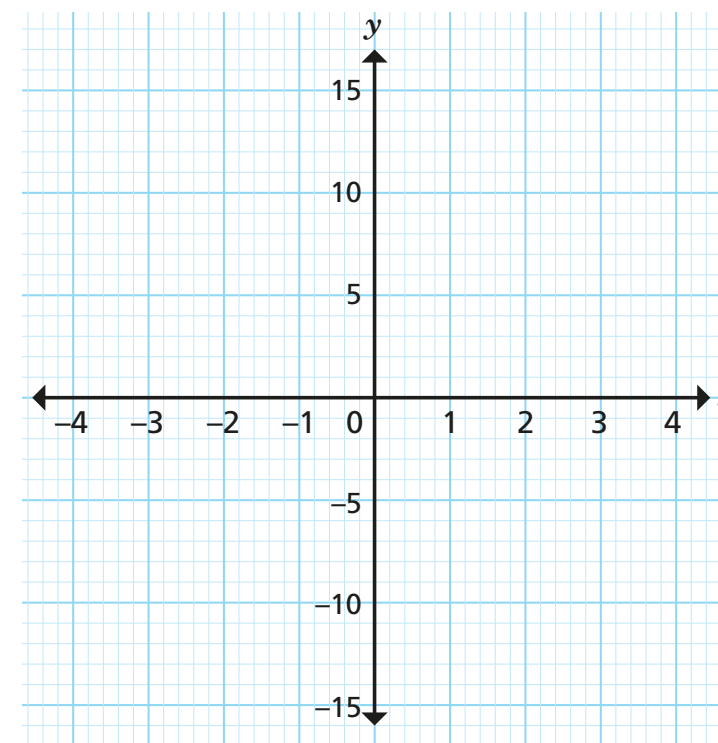
1 Which times-tables do the graphs show?

a)

b)
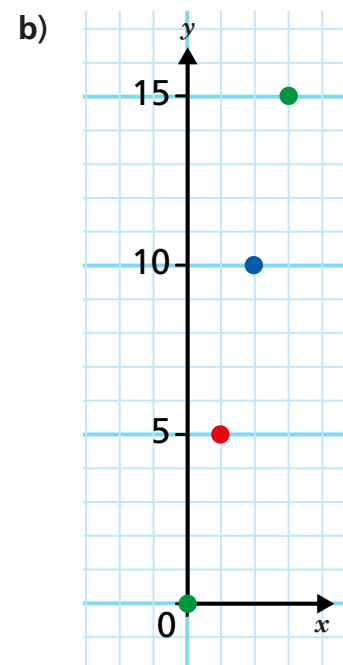
☐ times-table   ☐ times-table

2 **a)** Complete the table of values for $y = 4x$.

x	−2	−1	0		2	
y	−8			4		12

b) Write the values in the table as coordinates.

(−2, −8), (☐ , ☐), (☐ , ☐), (☐ , ☐),

(☐ , ☐), (☐ , ☐)

c) Plot the graph of $y = 4x$.

d) Complete the sentence.

On the graph $y = 4x$, the y-coordinate is always ☐ times the

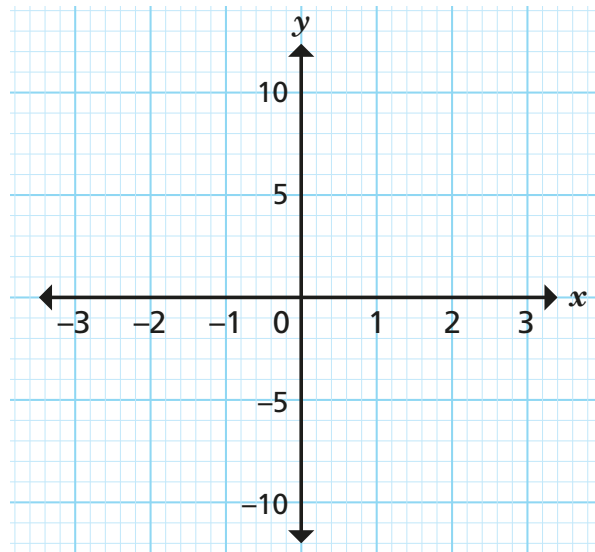_____-coordinate.

3 **a)** Complete the table of values for $y = 3x$.

Use values of x from −2 to 2

x					
y					

b) Write the values in the table as coordinates.

(☐ , ☐), (☐ , ☐), (☐ , ☐),

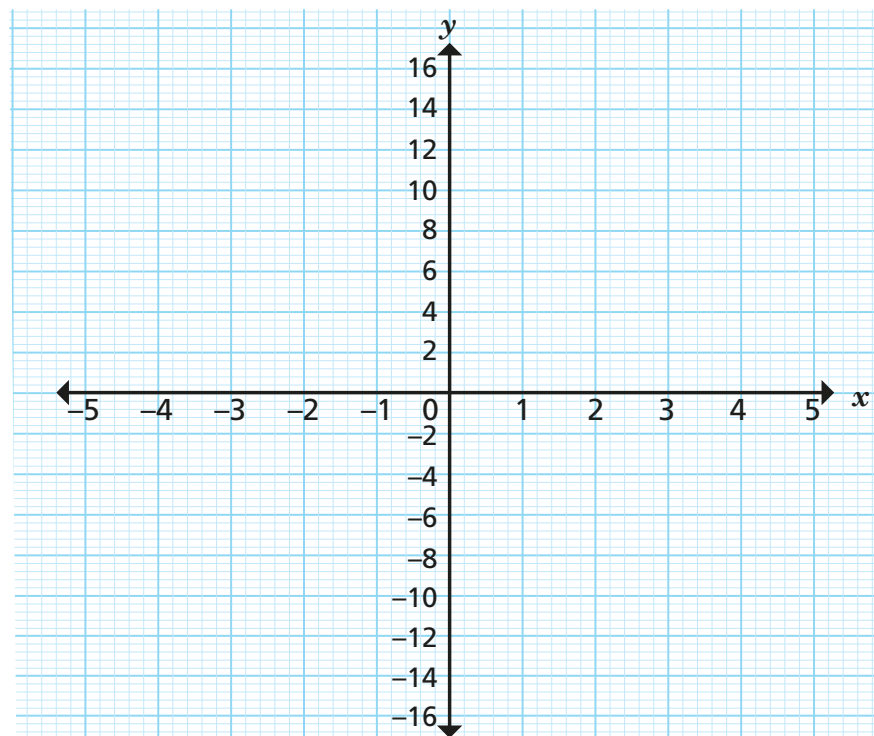(☐ , ☐), (☐ , ☐)

c) Plot the graph of $y = 3x$.

d) Complete the sentence.

On the graph $y = 3x$, the y-coordinate is always ☐ times the _____-coordinate.

4 Here is a blank coordinate grid.

a) Plot the graphs on the same grid. Label each graph.

  A $y = 2x$ **B** $y = 5x$ **C** $y = \frac{1}{2}x$
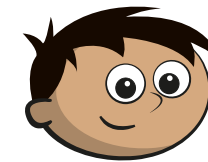
b) What do you notice?

c) Complete the sentences to describe lines of the form $y = kx$

The _____ the value of k, the _____ the line.

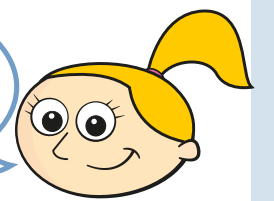All lines will go through the point _____
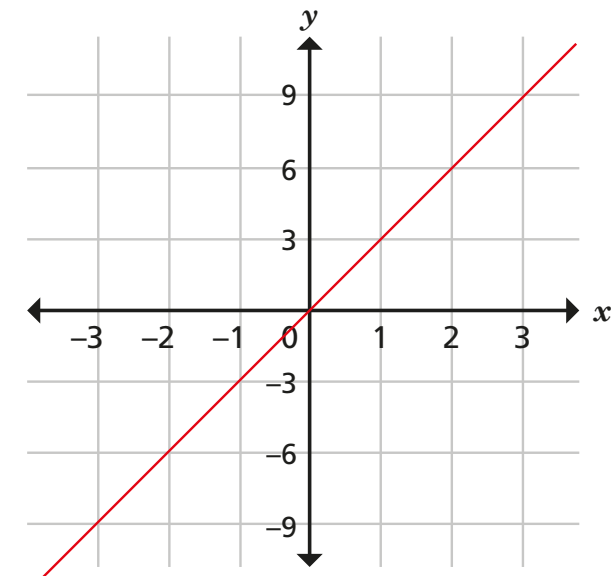
5

Amir: This is the graph of $y = x$.

Eva: This is the graph of $y = 3x$.

Who is correct? _____

Explain your reasons.

_____

_____

6 Put the graphs in order of steepness.

| $y - 3x = 0$ | $y = x$ | $3y = x$ | $x = 3$ |

_____

Link $y = kx$ to direct proportion problems

1 The cost of 4 bananas is 60p.
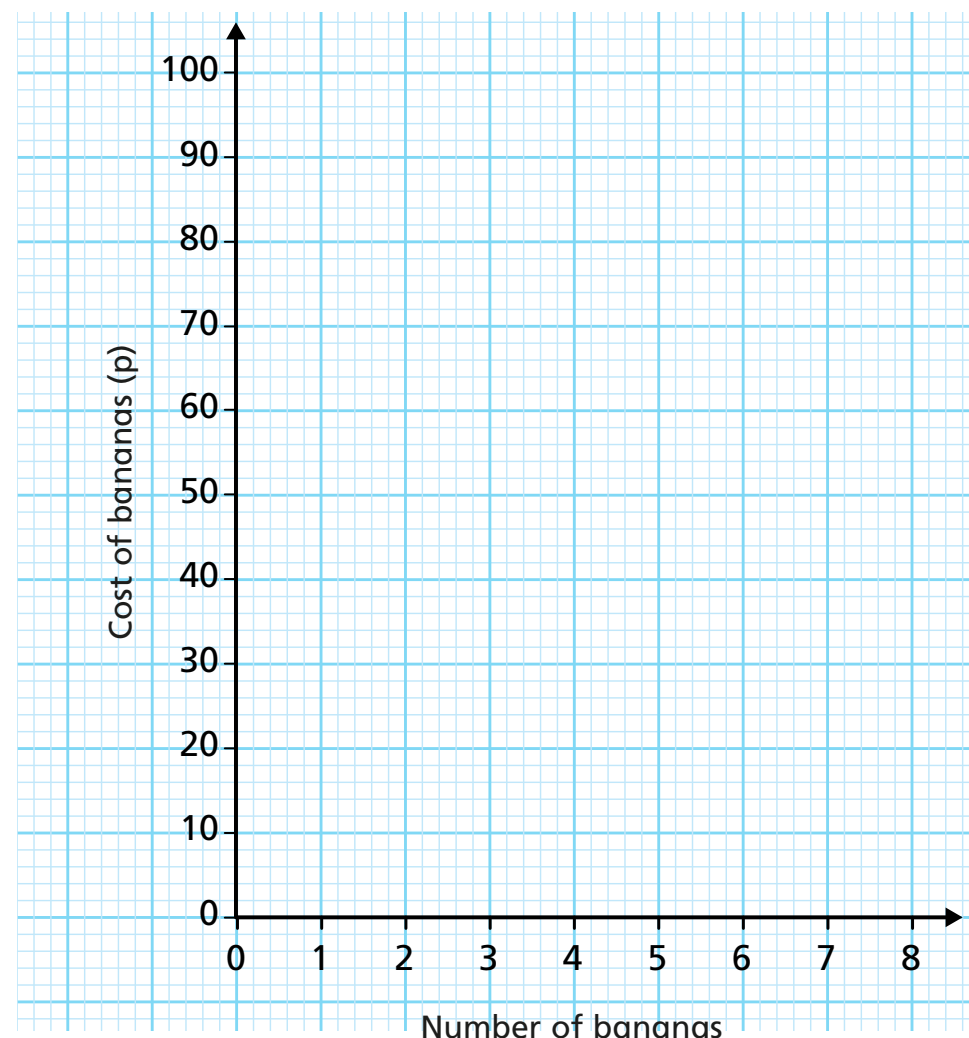
a) Find the cost of:

1 banana ☐ 7 bananas ☐

5 bananas ☐ x bananas _____

b) Complete the table showing the cost of bananas.

Number of bananas (x)	1	2	3	4	5	6
Cost of bananas (y)				60p		

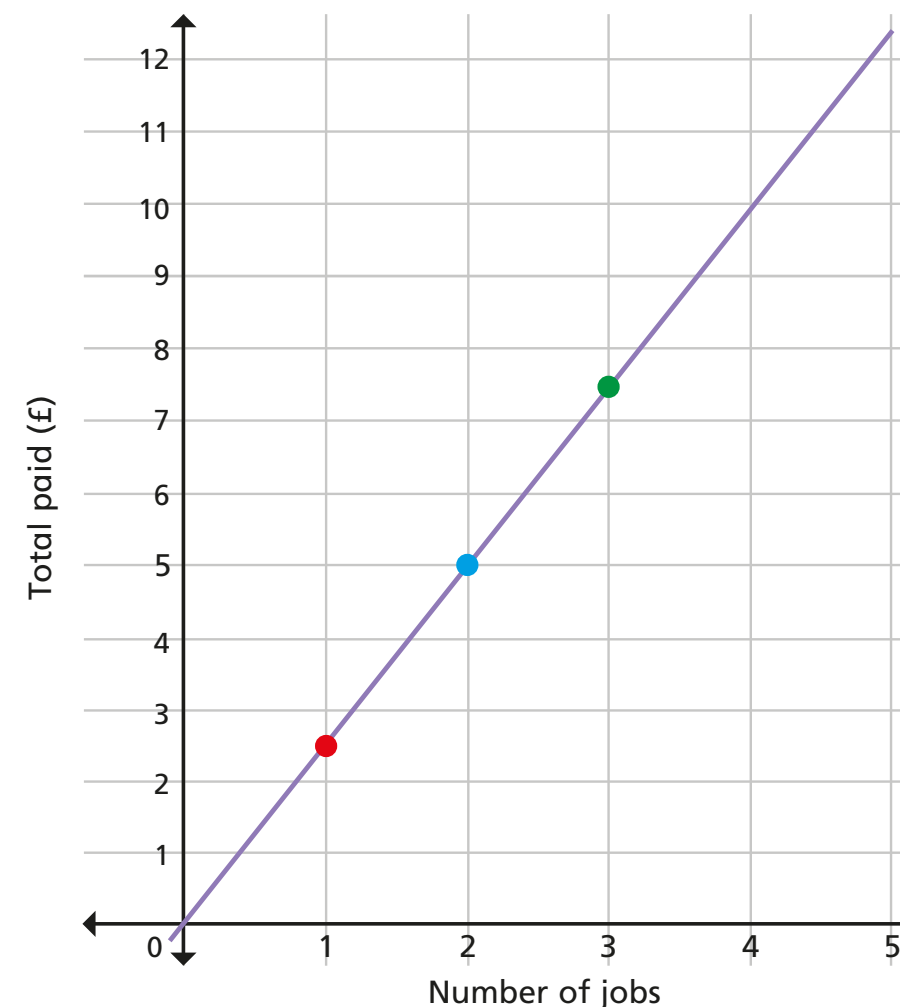**c)** Plot a graph to show the cost of bananas.

What is the equation of the line formed by the points?

_____

2 Ron is paid for every job he completes.

He has made a graph to keep track of his jobs.

a) How much money does Ron make for each job? £ ☐

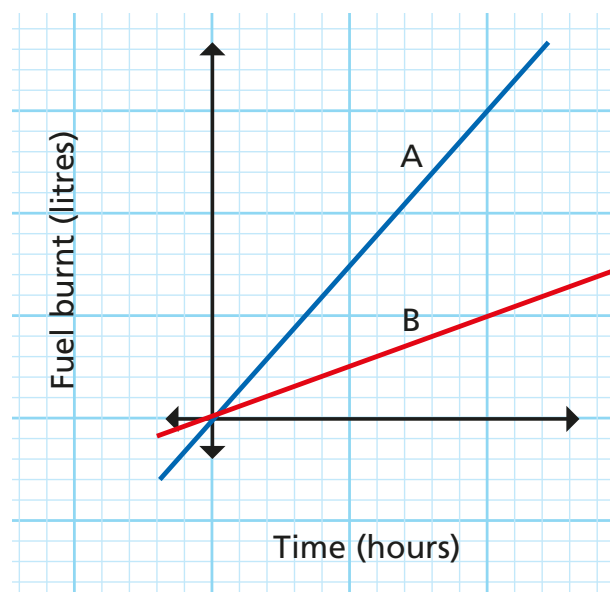**b)** Tick the correct equation for Ron's graph.

$y = 2.50$ ☐ $y = x + 2.50$ ☐

$y = 250x$ ☐ $y = 2.5x$ ☐

c) Ron completes 16 jobs in a week.

How can you use the graph to work out how much money he earns?

_____

_____

3 A small aeroplane burns 24 litres of fuel every hour.
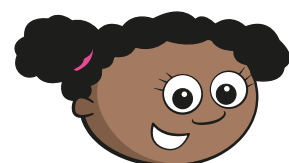
A lorry burns 8 litres every hour.

a) Which graph shows the fuel usage of each vehicle?

- lorry: _____
- aeroplane: _____

b) After 8 hours, how many litres have been used by each vehicle?

- lorry: _____
- aeroplane: _____

c)

After 16 hours they will have used twice as much fuel as after 8 hours.

Check to see if Whitney is correct.

d) Suggest an equation for each line.

- lorry: _____
- aeroplane: _____

4 Tick the true statements.

A direct proportion graph always goes through (0, 0). ☐

On a direct proportion graph, if the x-coordinate halves, so does the y-coordinate. ☐

All linear graphs are direct proportion graphs. ☐

5

One bottle of ketchup requires 150 grams of tomatoes.

a) A company wants to produce a graph that shows how many tomatoes they will need for up to 2,000 bottles of ketchup.

Which of these is a sensible range for the y-axis? Tick your answer.

$0 \leq y \leq 180$ ☐

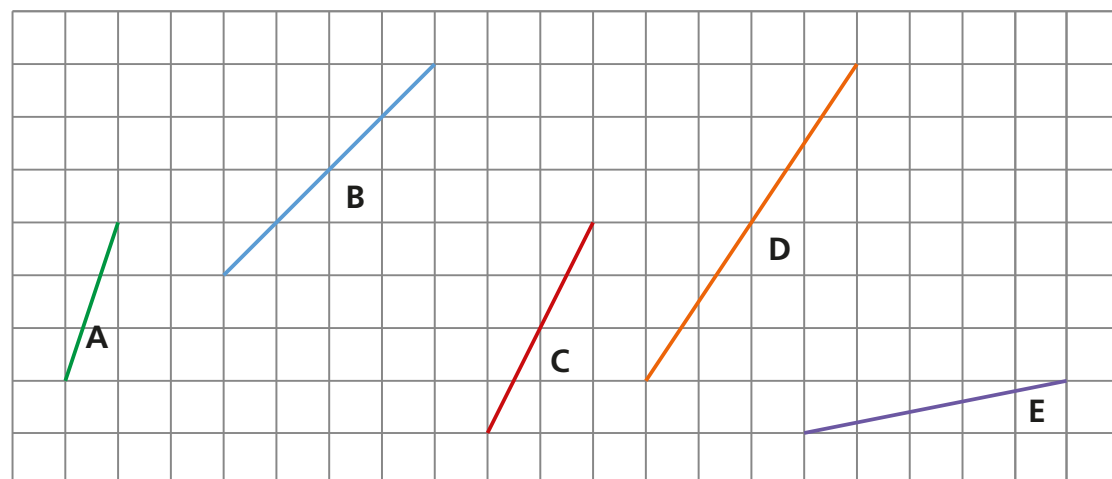$0 \leq y \leq 2,500$ ☐

$0 \leq y \leq 350,000$ ☐

$0 \leq y \leq 500,000$ ☐

b) Each bottle of ketchup weighs 100 grams.

Show why $y = \frac{3}{2}x$ is the equation of the graph for grams of ketchup (x) to grams of tomatoes (y).

Explore the gradient of the line $y = kx$ **H**

1

Complete the sentences for each line.

a) For every 1 square across, it goes ☐ squares up.

The gradient of line A is ☐

b) For every 1 square across, it goes ☐ squares up.
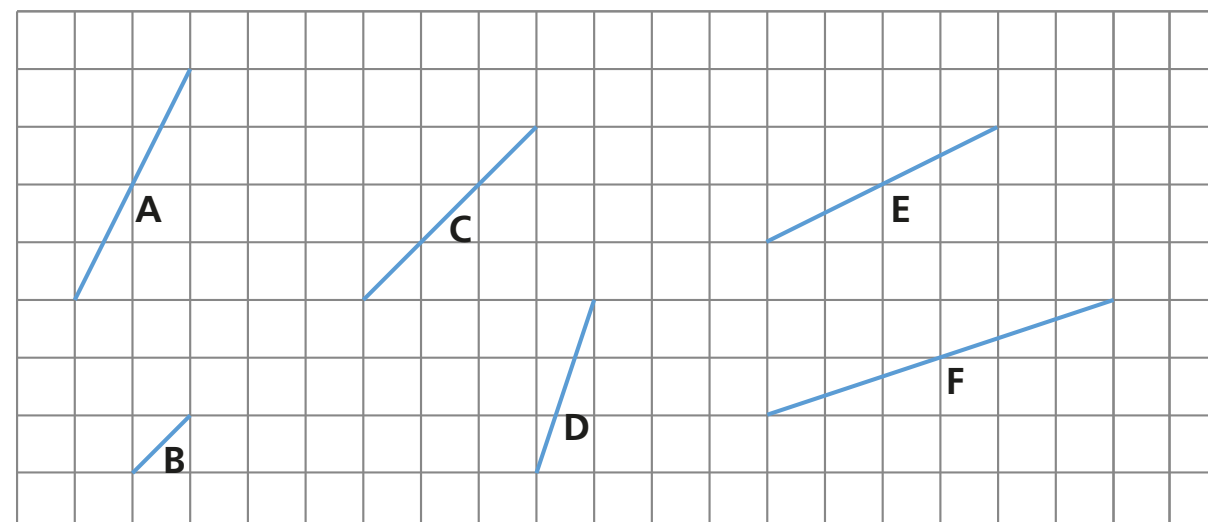
The gradient of line B is ☐

c) For every 1 square across, it goes ☐ squares up.

The gradient of line C is ☐

d) For every 1 square across, it goes ☐ squares up.

The gradient of line D is ☐

e) For every 1 square across, it goes ☐ squares up.

The gradient of line E is ☐

2 Work out the gradient of each line.

Gradient of A = ☐   Gradient of D = ☐

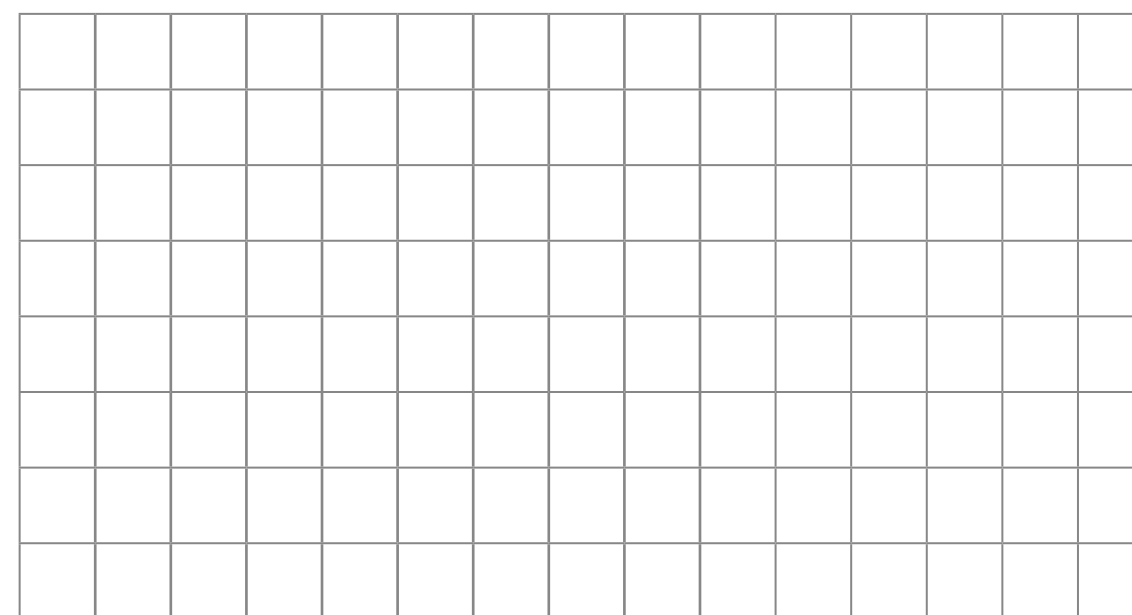Gradient of B = ☐   Gradient of E = ☐

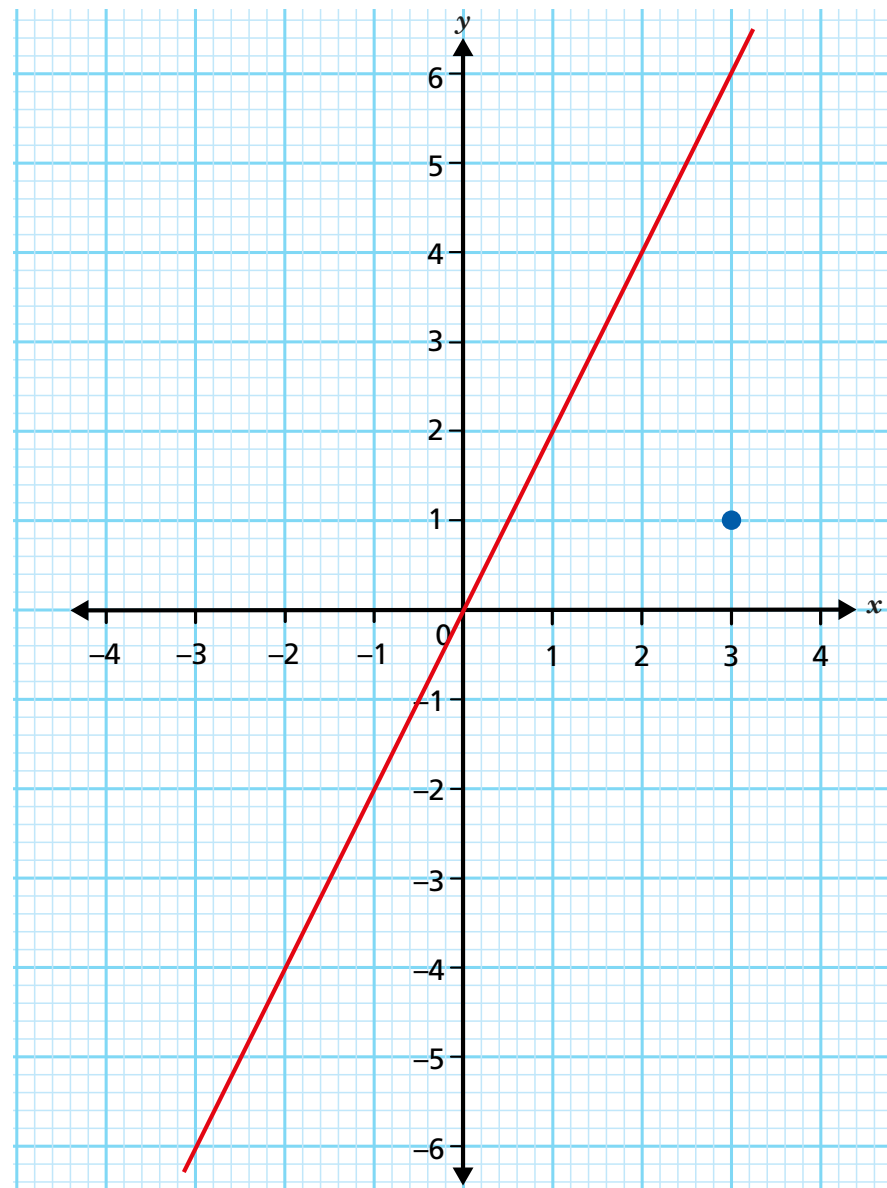Gradient of C = ☐   Gradient of F = ☐

3 Draw three lines of different lengths with a gradient of 3

What do you notice about your lines?

4 Here is the graph of $y = 2x$, and the point (3, 1).

a) Suggest the equation of a line that is steeper than $y = 2x$.

Explain your answer.

$y = $ _____

_____

_____

b) Find the equation of the line that passes through the point (3, 1) and the origin.

_____

5 Write the lines in ascending order of steepness.

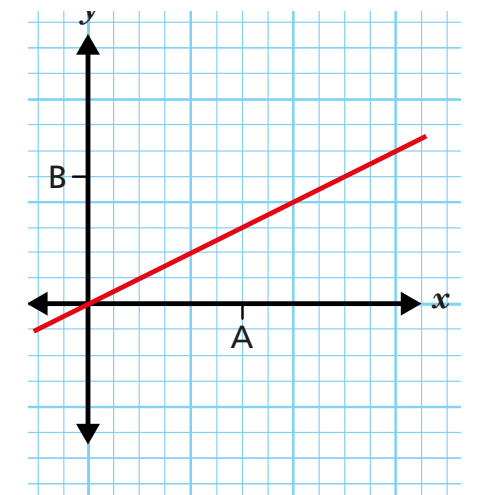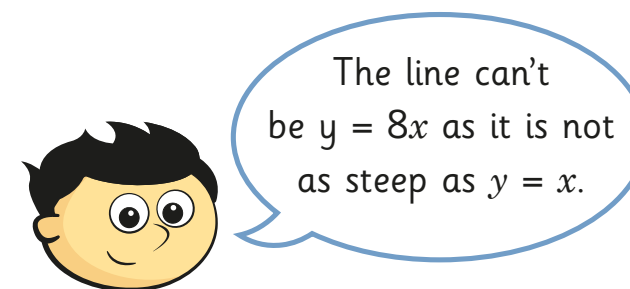**L** $y = 6x$ **M** $x = 6y$ **N** $y = 0.6x$

_____

6 The line $y = gx$ passes through the points (5, 12) and (0, 0).

a) Find the value of g.

_____

b) The line $y = gx$ is steeper than the line $y = hx$.

What could the value of h be?

_____

7 The equation of this line is $y = 8x$.

A and B are points on the axes.

The line can't be $y = 8x$ as it is not as steep as $y = x$.

a) Explain why Jack is wrong.

_____

_____

b) Suggest values for A and B.

A = ☐   B = ☐

c) On the same grid, draw the line $y = 16x$.

Recognise and use lines of the form $y = x + a$

1 The table gives the coordinates for the graph $y = x$.

x	–3	–2	–1	0	1	2	3
y	–3	–2	–1	0	1	2	3

a) Add 3 to all the y-values. The first is done for you.

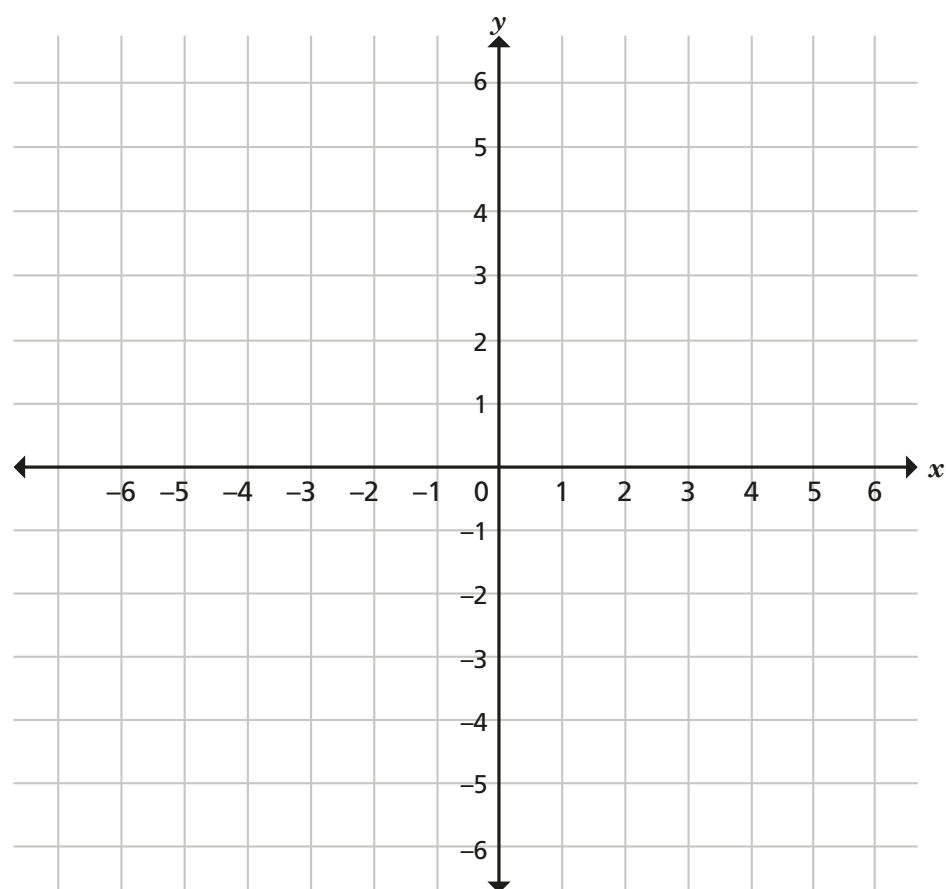| x	–3	–2	–1	0	1	2	3
y	0						

b) Complete the sentence.

The y-values are all ☐ more than the x-values, so the table shows

$y = x +$ ☐

c) Plot the points from part a).

Join the points with a straight line.
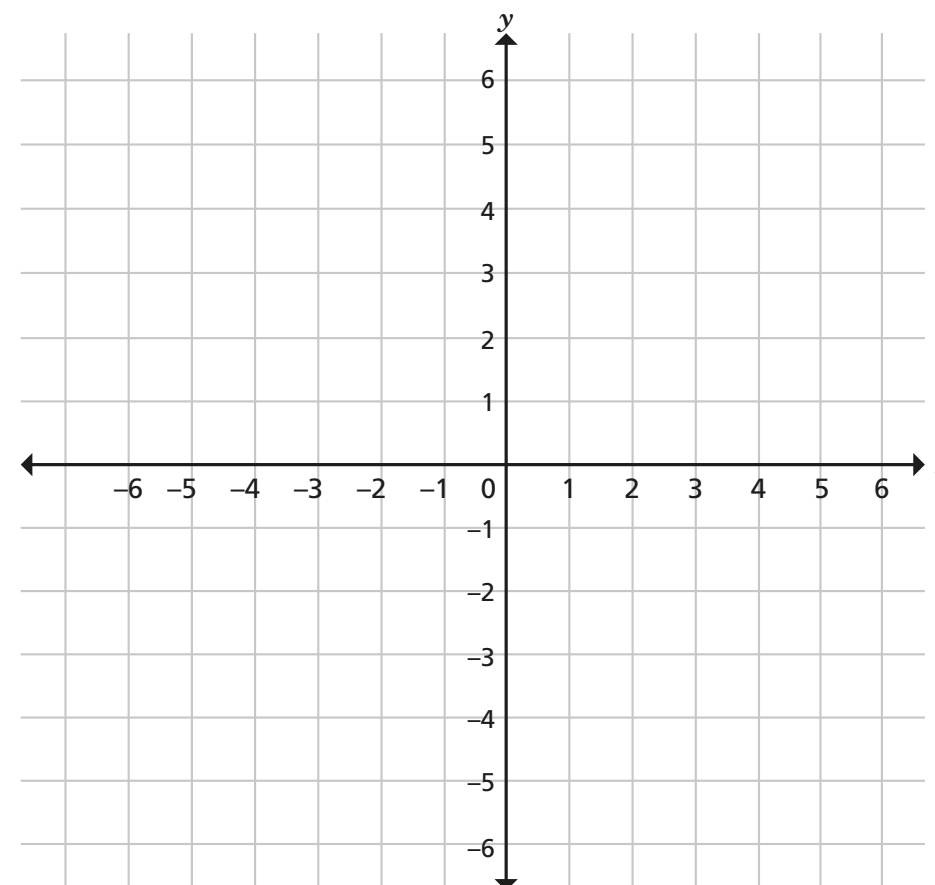
2 **a)** Complete each table of values.

$y = x - 2$

x	–2	–1	0	1	2
y					

$y = x + 5$

x	–2	–1	0	1	2
y					

b) Plot both lines on the axes below.

c) What do you notice?

d) Draw the line $y = x + 1$ on the same coordinate grid.

Discuss your method with a partner.

3 Here is a sequence of coordinates.

$(-2, 2)$, $(-1, 3)$, $(0, \boxed{})$, $(\boxed{}, \boxed{})$, $(\boxed{}, \boxed{})$

a) Continue the sequence.

b) Complete the sentence.

The y-coordinates are all $\boxed{}$ more than the x-coordinates,

so the graph is $y = x + \boxed{}$
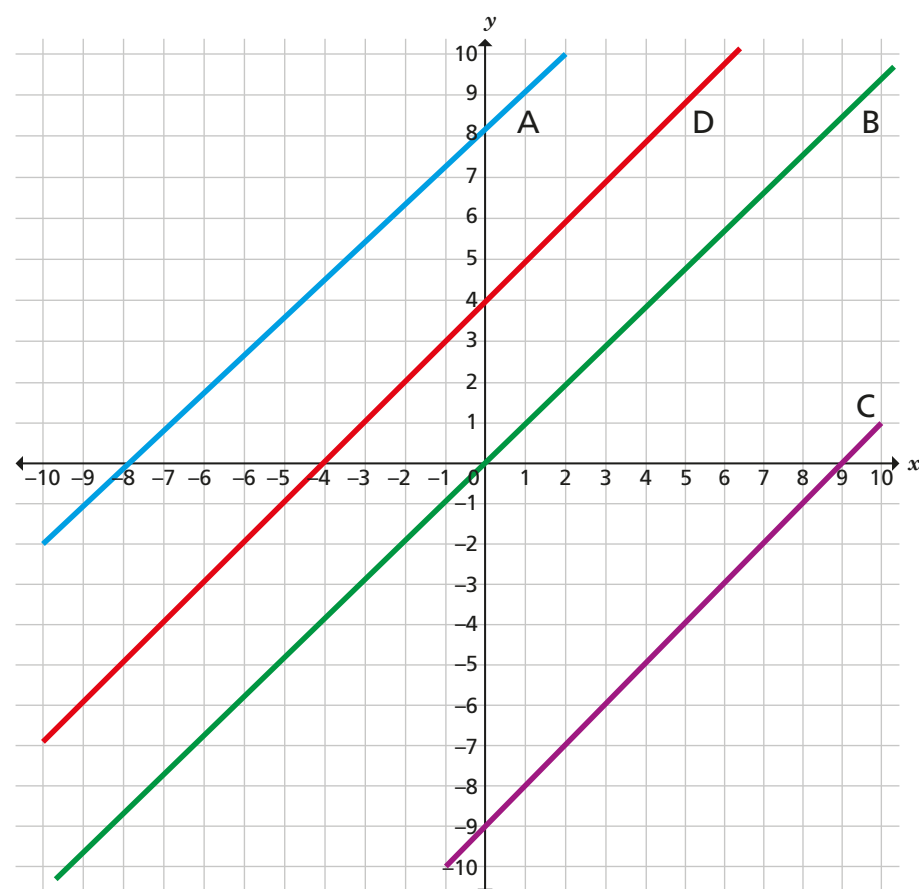
c) Which coordinate helps you to find one part of the equation of the line?

4 Circle all the coordinates that lie on the line $y = x - 7$

$(0, 7)$ $(7, 0)$ $(12, 5)$ $(5, 12)$ $(0, -7)$

Explain your answers.

5 **a)** Write the equations of lines A, B and C.
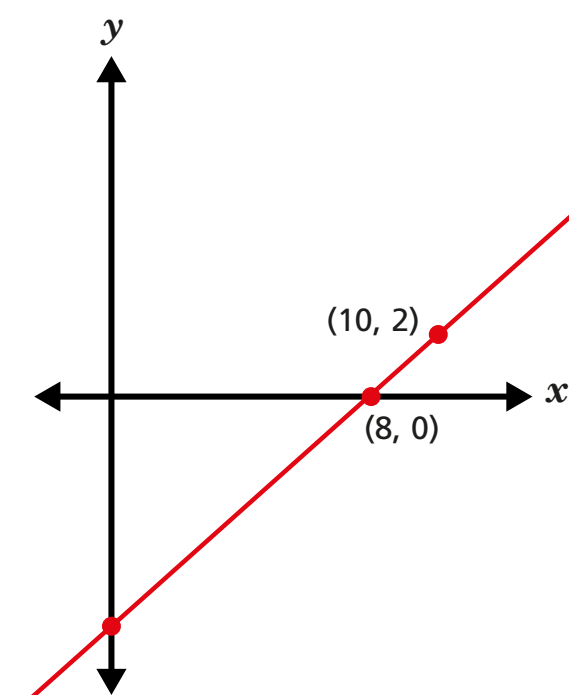
A _____   B _____   C _____

b)

Line D is $y = 4 + x$.

Do you agree with Mo? _____

Explain your answer.

_____

_____

6 The graph shows two points on a line.

$(10, 2)$
$(8, 0)$

a) Explain why the gradient of the line is 1

_____

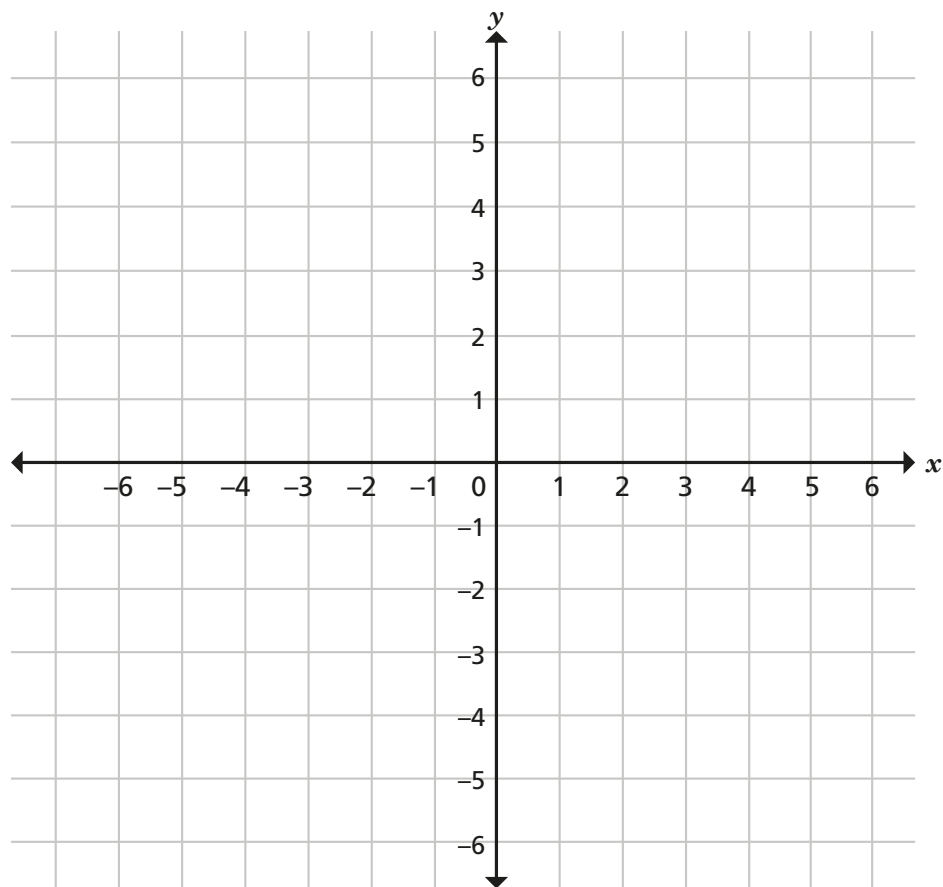**b)** Find the y-intercept of the line. $\boxed{}$

c) What is the equation of the line? _____

Explore graphs with negative gradient ($y = -kx$, $y = a - x$, $x + y = a$)

1 Here is the table for values of $y = -x$.

x	−3	−2	−1	0	1	2	3
y	3		1	0	−1		

a) Complete the table.

b) Plot the graph of $y = -x$ on the coordinate grid.

c) Plot the graph of $y = x$ on the same grid.

d) What is the same and what is different about the lines $y = -x$ and $y = x$?

_____

_____

2 **a)** Complete each table of values.

$y = -2x$

x	−2	−1	0	1	2
y					

$y = 2 - x$

x	−2	−1	0	1	2
y					

$y = -3x$

x	−2	−1	0	1	2
y					

$y = -2 - x$

x	−2	−1	0	1	2
y					

b) Plot the graphs from part a) on the coordinate grid.
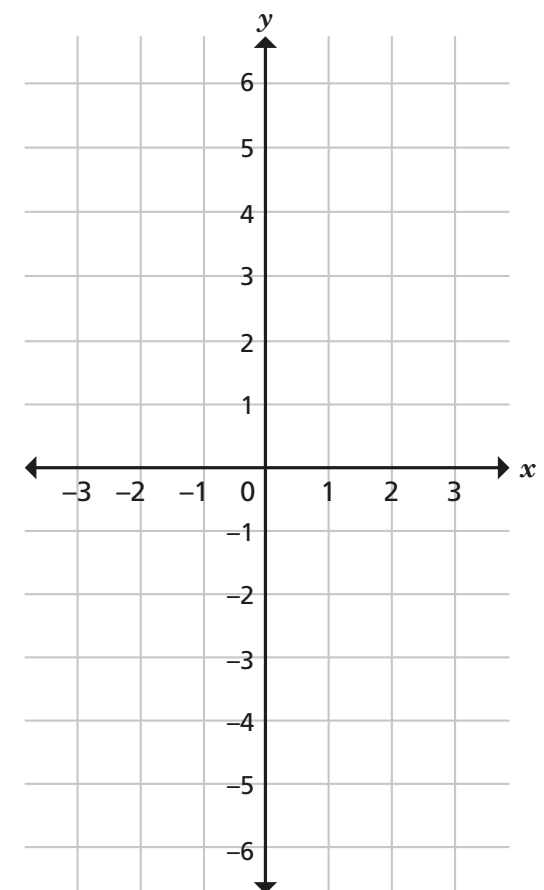
3 **a)** Tick the graphs with a negative gradient.

A

D

B

E

C

F
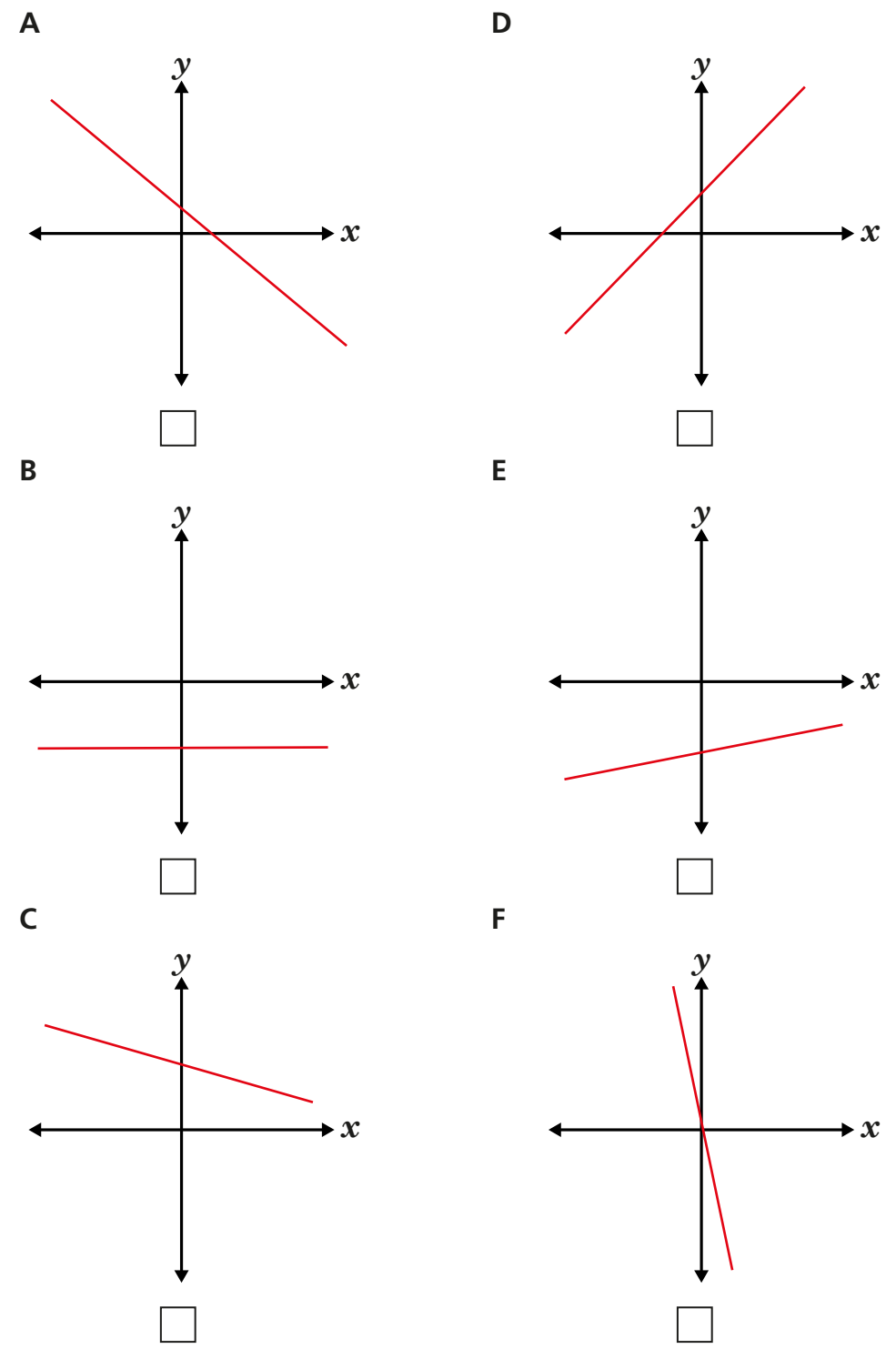
b) For each graph that you ticked, suggest a reasonable equation for the line.

Graph _____: _____

Graph _____: _____
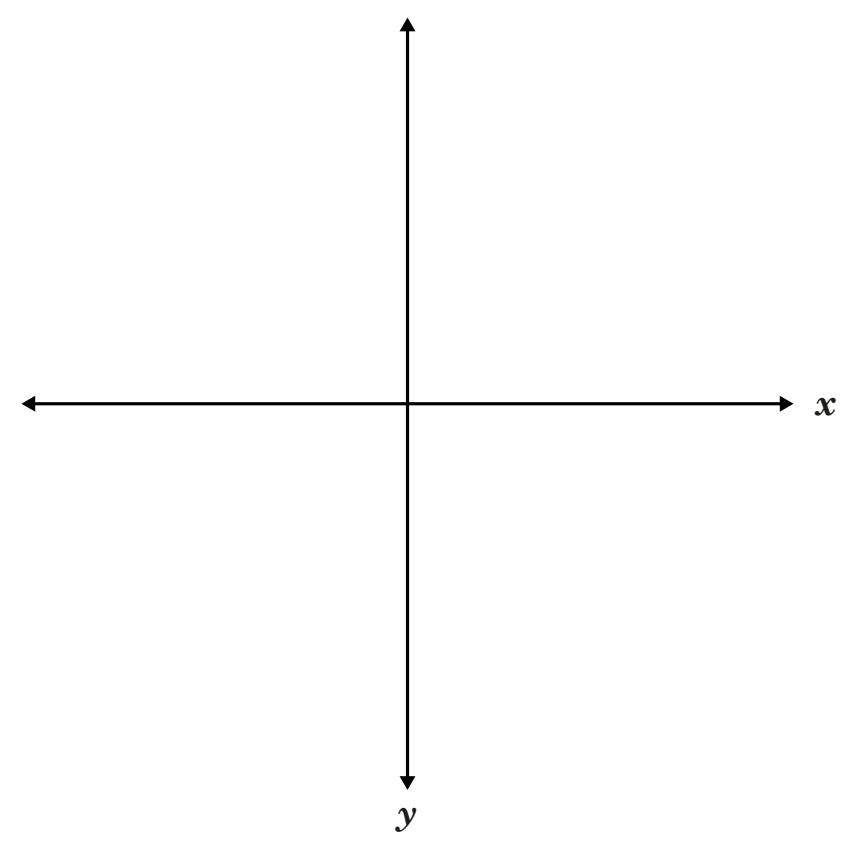
Graph _____: _____

Discuss your answers with a partner.

What is the same and what is different?

4 Tick the equations that have a negative gradient.

$x - 3 = y$ ☐

$3 - x = y$ ☐

$y = -20x$ ☐

$y - x = 1$ ☐

5 Without working out any coordinates, sketch the graphs on the axes.

A $y = -5x$ **B** $y = 7 - 5x$ **C** $y = 7 - \frac{1}{5}x$

Compare sketches with a partner.

Link graphs to linear sequences

1   Here are four sequences.

A

6, 11, 16, 21, …

C

7, 4, 1, −2, …

B

1, 3, 9, 27, …

D

0.5, 0, −0.5, −1, …

a)   Describe the term-to-term rule for each of the sequences.
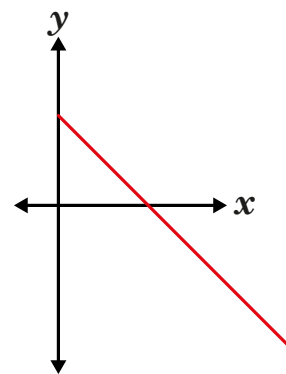
A _____   C _____

B _____   D _____

b)   Which sequences are linear?

_____

c)   A linear graph goes through the points generated by one of the sequences.

Which sequence could it be?

Explain your reasoning.

_____

_____

2   Here is a sequence:

5, 8, 11, 14, …

a)   Complete the sentence.

The numbers in the sequence are all ☐ more than a multiple of ☐

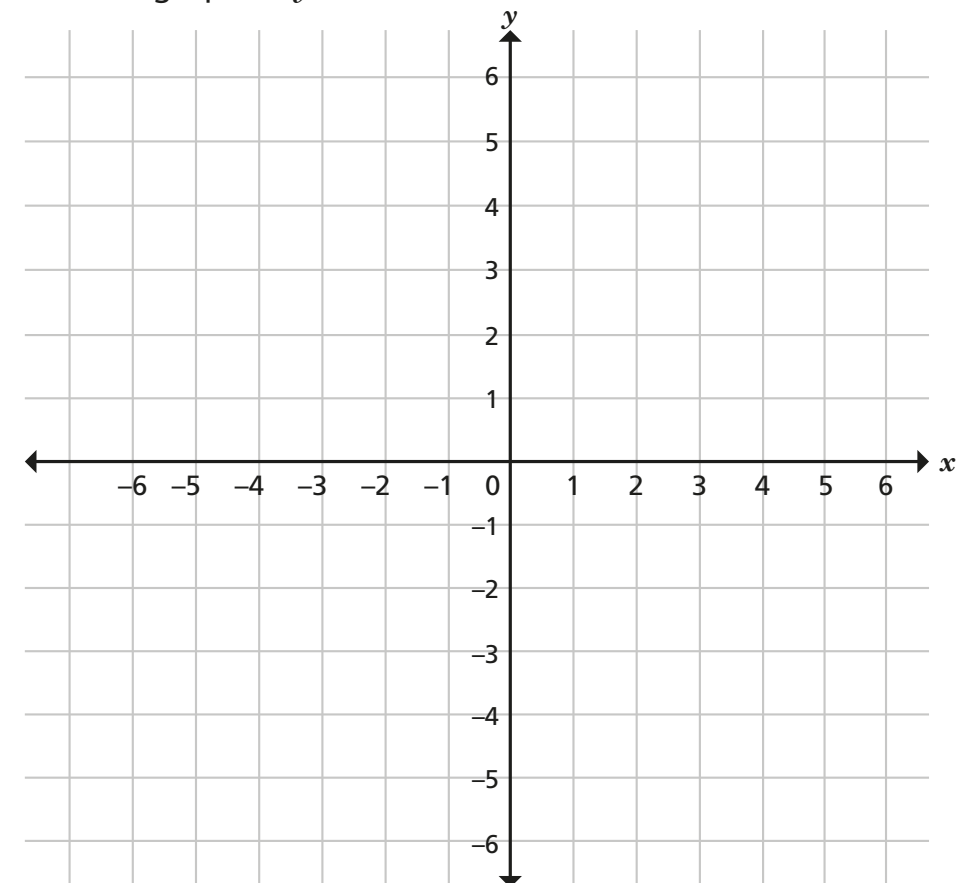The 1st term is 5, so (1, 5) are the coordinates of a point generated by the sequence.

b)   What point does the 3rd term generate? (☐ , ☐)

c)   What point does the 6th term generate? (☐ , ☐)

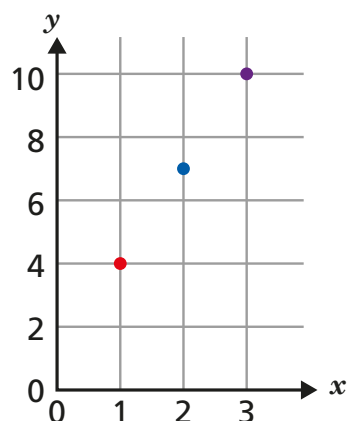**d)**   Complete the sentence to describe the line $y = 3x + 2$

The y-coordinates are all ☐ more than ☐ lots of the x-coordinate.

e)   Draw the graph of $y = 3x + 2$

f)   What is the same and what is different about the sequence and the graph?

3 A sequence is made using rods and then plotted on a graph.

a) Write the coordinates of the three points on the graph.

_____

b) Draw the 5th term of the sequence.

c) Complete the coordinates for the point (5, ☐).

d) Circle the equation of the line that goes through the marked points.
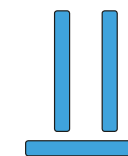
$y = 3x + 4$ $y = 1x + 4$ $y = 1.5x + 0.5$ $y = 3x + 1$
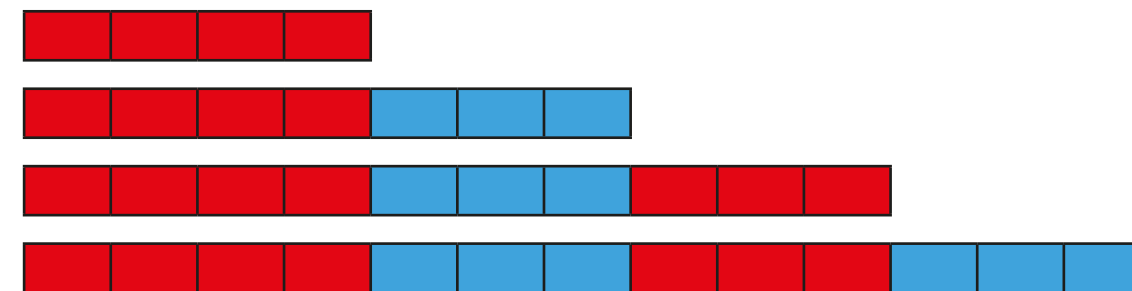
4 Here is the 1st pattern in a sequence.

a) Draw the next two patterns such that the line $y = 3x$ goes through the points generated by the sequence.
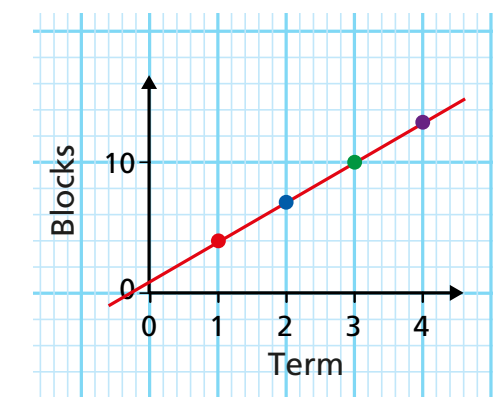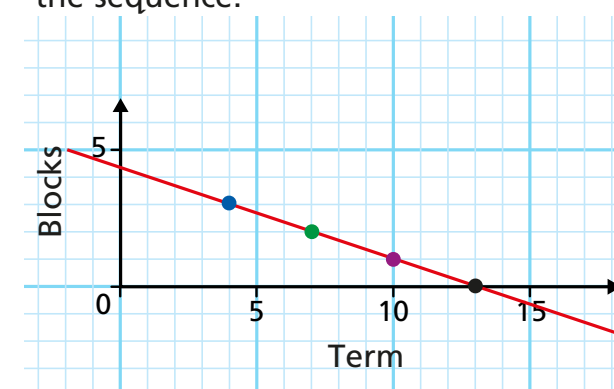
b) Draw the next two patterns such that the line $y = 2x + 1$ goes through the points generated by the sequence.

5 Rosie has started to build a sequence of blocks.

Tick the graph that would go through the points generated by the sequence.
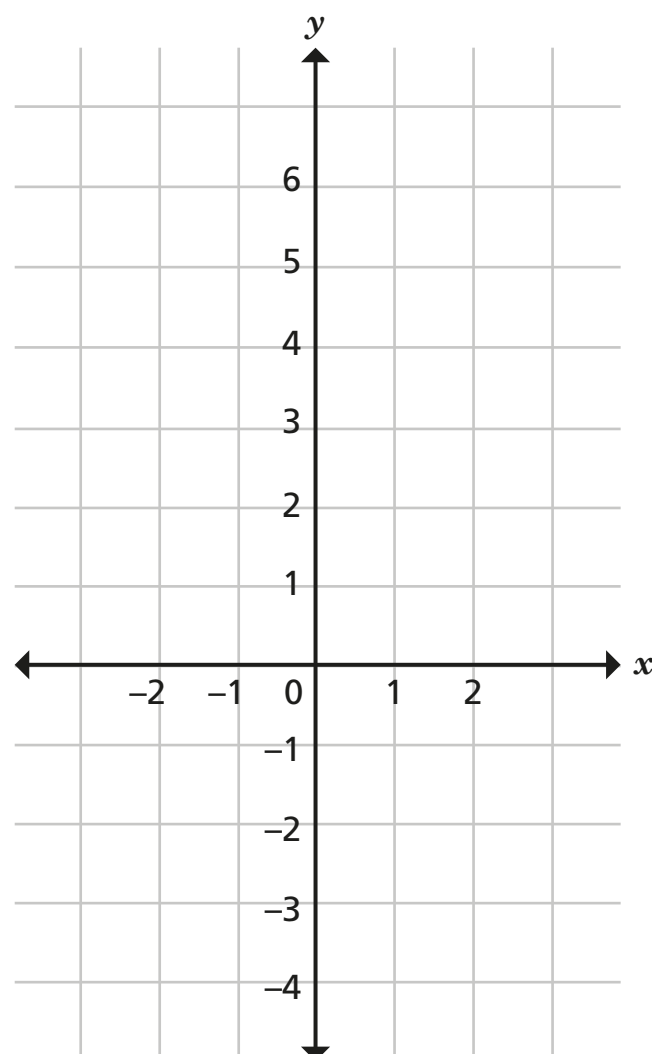

☐   ☐

Explain your answer.

Plot graphs of the form $y = mx + c$

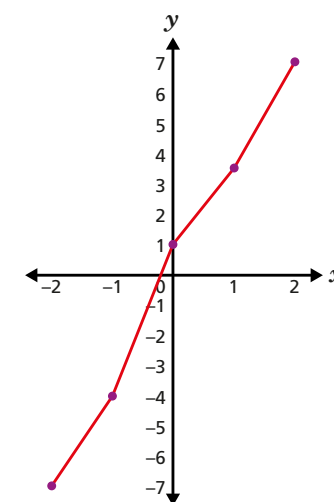**1** **a)** Complete the table of values for $y = 2x + 1$

x	−2	−1	0	1	2
y					

b) Draw the graph of $y = 2x + 1$ for values of x from $x = -2$ to $x = 2$

2 Annie is plotting the graph of the line $y = 3x + 1$
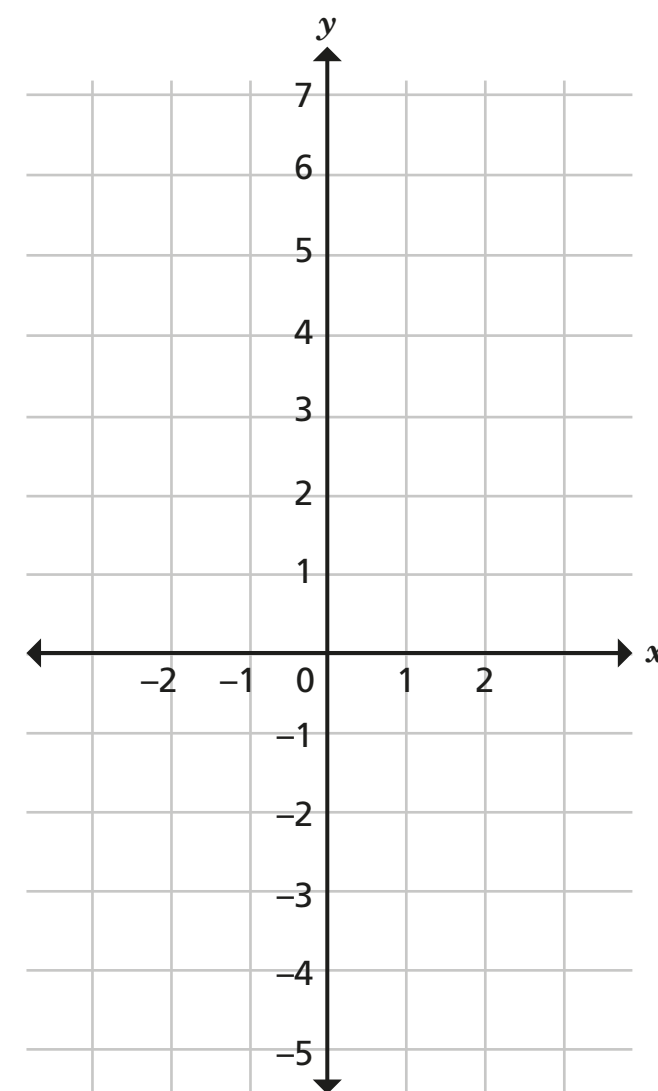Here is her coordinate table and graph.

x	−2	−1	0	1	2
y	−7	−4	1	4	7

a) How can Annie tell from her graph that she is wrong?

b) Complete the coordinate table correctly.

x	−2	−1	0	1	2
y					

c) Correctly draw the line $y = 3x + 1$

3 Here are three tables of values for the lines P, Q and R.

a) Complete the tables.
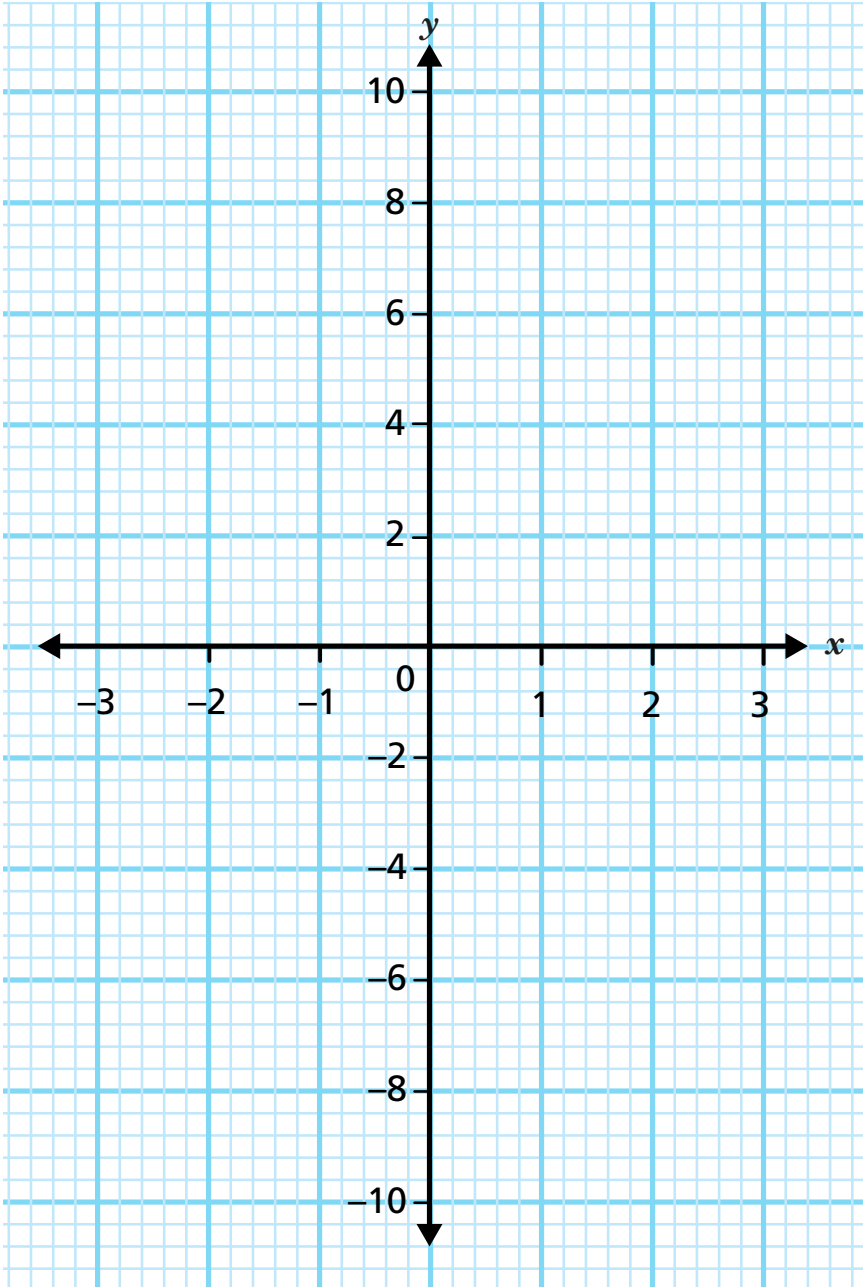
P $y = 3x + 4$

x	−2	−1	0	1	2
y					

Q $y = -x + 2$

x	−2	−1	0	1	2
y					

R $y = 0.5x - 3$

x	−2	−1	0	1	2
y					

b) Plot and label lines P, Q and R.

c) Write the coordinates of a point that is not on any of the lines.

(⬚ , ⬚)

d) Write the coordinates of a point that is on two of the lines.

(⬚ , ⬚)

e) Which line is parallel to $y = \frac{1}{2}x$? _____

4 A line passes through the points A(0, 6) and B(2, 0).

a) Draw a sketch to help find the equation of the line.

$y = $ _____

Another line passes through A and the point C(−2, 0).

b) What is the same and what is different about the two lines?

_____

_____

c) Find the equation of the new line.
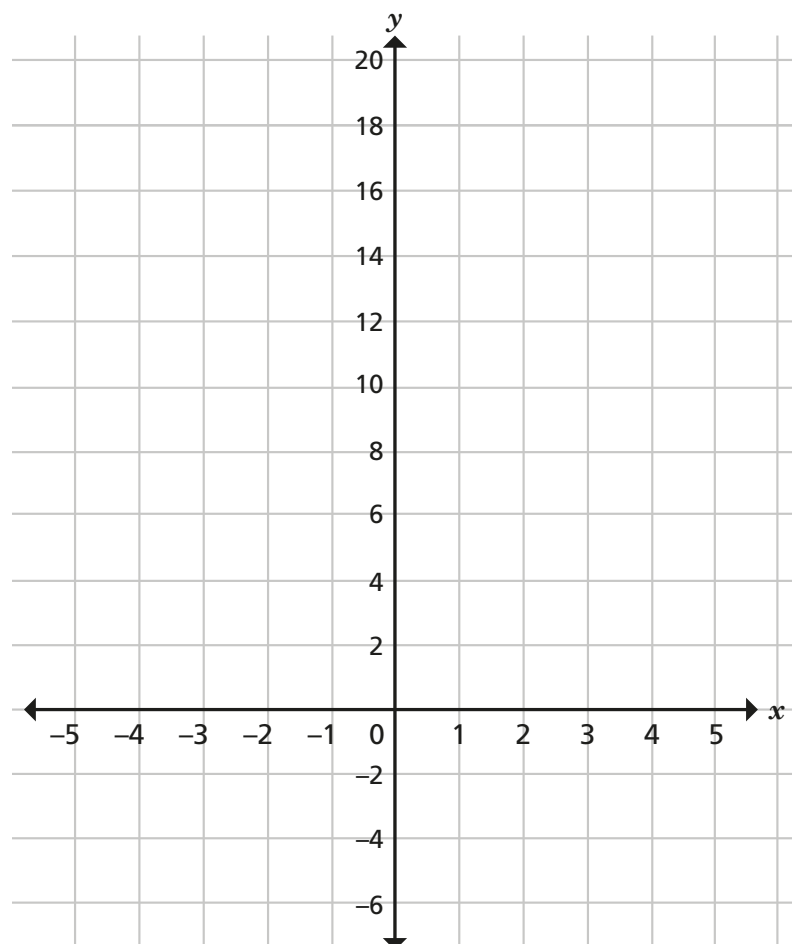
$y = $ _____

Explore non-linear graphs **H**

d) Use the function machine to generate coordinates for $y = 0.5x^2$.

Plot the graph on the same grid.

input   output

| x | → | $\square^2$ | → | × 0.5 | → | y |

---

1 Here is a table of values for $y = x^2$.

x	−4	−3	−2	−1	0	1	2	3	4
y	16				0			9	

a) Complete the table of values.

b) Explain why y is positive for negative values of x.

_____

_____

c) Plot the coordinates on the grid. Connect the points with a smooth curve to plot the graph $y = x^2$.
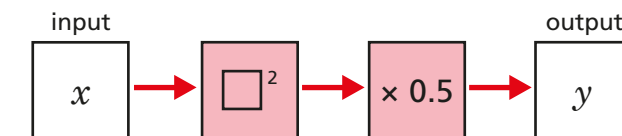
2 Here is a table of values for $y = x^3$.

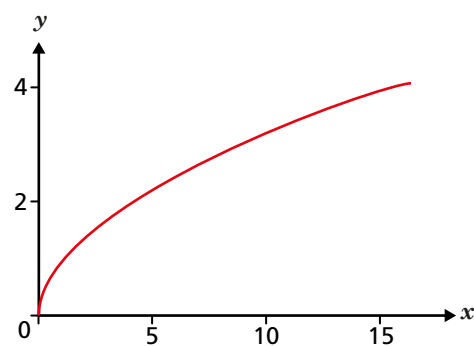| x	−3	−2	−1	0	1	2	3
y				0			

a) Complete the table of values and plot the curve $y = x^3$.
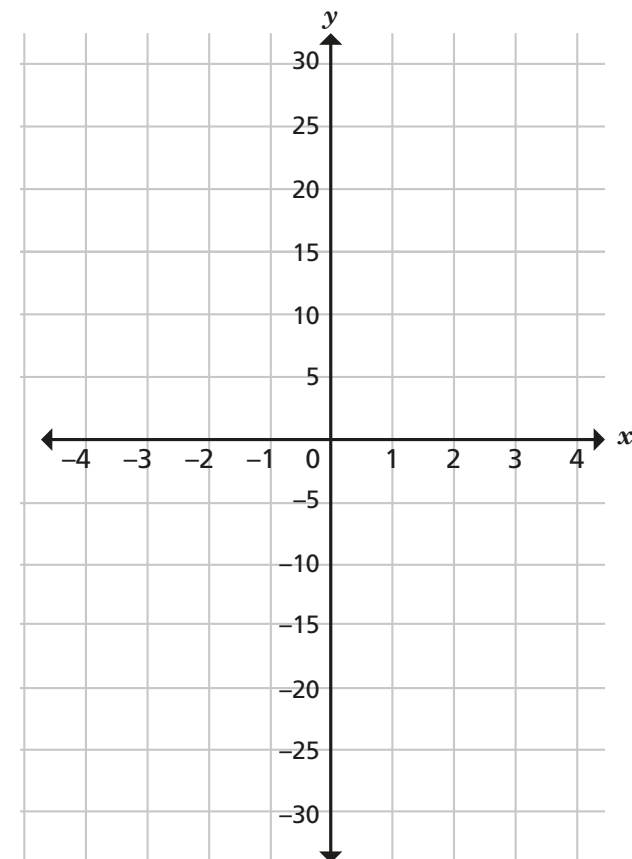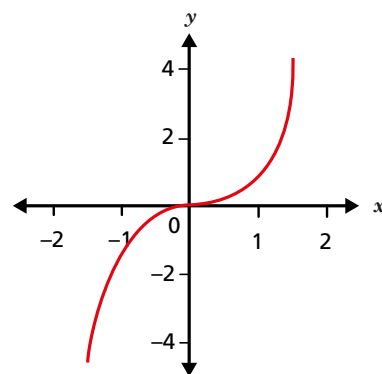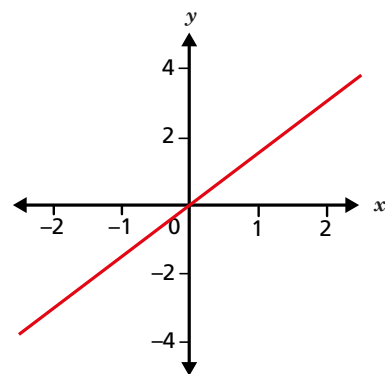

b) Explain why y is negative for negative values of x.

_____

_____

3 Under each graph, write whether it is linear or non-linear.

_____

_____
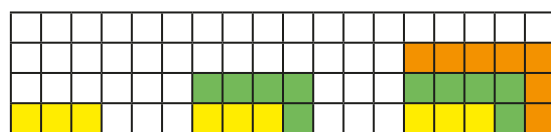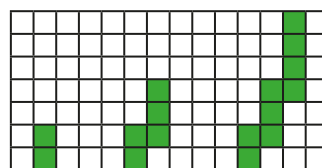

_____

_____
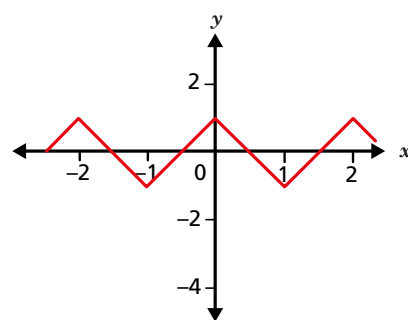
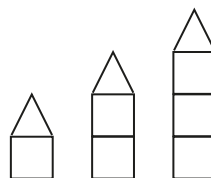**4** Here are four sequences.

A Total number of blocks

B Total number of blocks

C Total perimeter

a) Which of these sequences are non-linear? _____

b) Explain why a graph going through the points generated by any of the sequences will have no negative x-coordinates.

_____
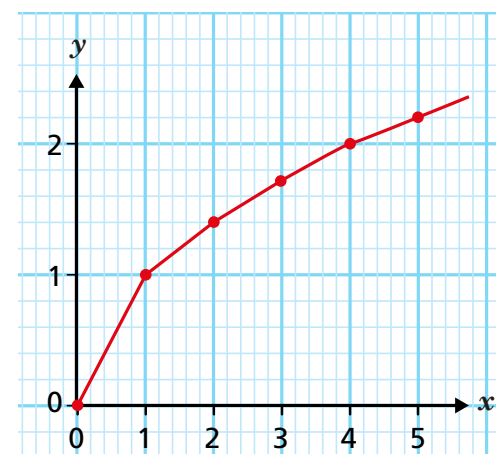
c) Complete the points generated by the sequences.
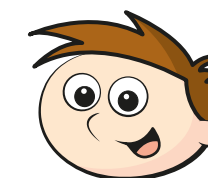
A (4, ☐)   **B** (4, ☐)   **C** (10, ☐)

d) Which of the sequences grows the fastest? _____

Explain your answer.

_____

_____

5 Teddy has plotted the graph of $y = \sqrt{x}$.

> It is a linear graph because all the coordinates have been joined with straight lines.

Explain why Teddy is mistaken.

_____

_____

Correct Teddy's mistake on his graph.

1 Write the number that is halfway between:

a) 1 and 3 ☐

d) 2 and 6 ☐

b) 1 and 4 ☐

e) 0.2 and 0.6 ☐

c) 1 and 5 ☐

f) 0.2 and 1.6 ☐

2 Some students are finding the halfway point between 5 and 41

Huan uses the difference between the numbers.

$$41 - 5 = 36$$
$$36 \div 2 = 18$$
$$5 + 18 = 23$$

a) Use Huan's method to find the number halfway between 11 and 57
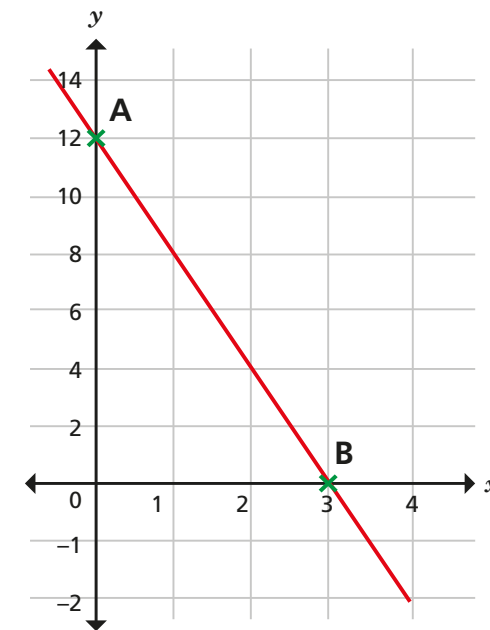
☐

Alex uses the mean.

$$\frac{5 + 41}{2} = 23$$

b) Use Alex's method to find the number halfway between 17 and 43

☐

Which method did you prefer? Discuss it with a partner.

3 Here is the graph of $y = -4x + 12$

a) What are the coordinates of point A? (☐ , ☐)

b) What are the coordinates of point B? (☐ , ☐)

c) Mark the midpoint of the line segment AB on the graph.

d) What are the coordinates of the midpoint? (☐ , ☐)

e) How could you have worked the midpoint out without using the graph?

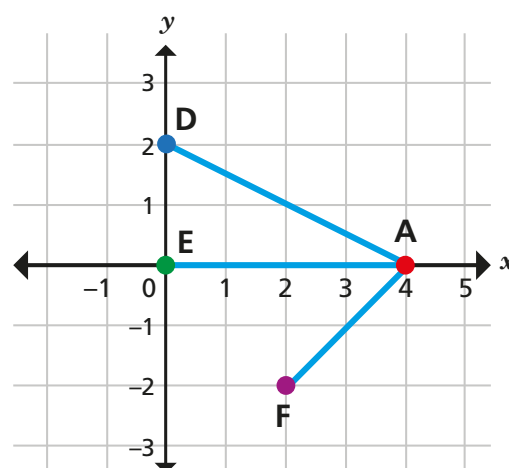**4** Here are four points.

J (0, 6)   K (−4, 4)   L (−4, 0)   M (2, −2)

a) Which two points have a midpoint of (−4, 2)? _____ and _____

b) Which two points have a midpoint of (1, 2)? _____ and _____

5 The diagram shows three line segments joining point A to three other points.

a) On the diagram, draw the midpoint of each line segment.

b) Write a calculation to show that the midpoint of AD is (2, 1).

c) Write a calculation to show that the midpoint of AF is (3, −1).
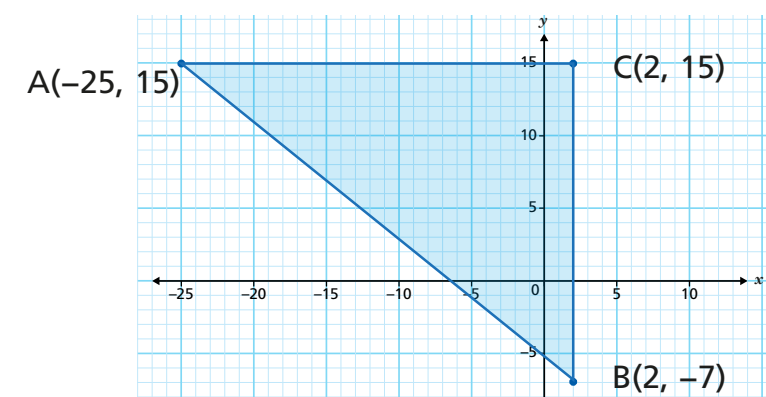
A line segment is drawn from point A to point G(7, 10).

d) Find the midpoint of AG.

e) Explain why A is the midpoint between E and (8, 0).

f) A is the midpoint of D and which other point?

6 Find the midpoints of these pairs of points.

a) (0, 0) and (4, 12) _____

b) (0, −2) and (4, 12) _____

c) (2, −2) and (4, 12) _____

d) (2, −2) and (5, 13) _____

e) (2, −2) and (a, b) _____

f) $(-a, -b)$ and (a, b) _____

7 The diagram shows the triangle ABC.

The midpoints of each side are joined to make a new triangle.

a) Find the coordinates of the new triangle.

(☐ , ☐), (☐ , ☐)

and (☐ , ☐)

b) What is the area of the new triangle?

_____

c) What percentage of the area of ABC is the new triangle?

_____