Planner

Linear functions

- Plotting the graph of a linear function given in the form $ay + bx + c = 0$
- Calculating the gradient and y-intercept from a straight-line graph
- Finding the coordinates of the midpoint of a line
- Finding the inverse of a linear function and plotting its graph
- Knowing about the gradient of perpendicular and parallel lines
- Plotting graphs of simple quadratic and cubic functions

Keywords

You should know

explanation 1

online

1 **a** Copy and complete the table for each of these functions.

x	−3	−2	−1	0	1	2	3
y							

i $y = 3x - 1$ **ii** $y = 2x + 5$ **iii** $y = \frac{1}{2}x + 6$

iv $y = 7 + x$ **v** $y = 3(x - 2)$

b Use a scale of 2 cm for 1 unit horizontally from −3 to 3 for each graph. Choose a sensible vertical scale for the y-values based on the table of results. Draw a graph for each function.

Write down the coordinates of the point where each line cuts the y-axis.

2 **a** Copy and complete the table for each of these functions.

x	−3	−2	−1	0	1	2	3
y							

i $y = 5 - x$ **ii** $y = 6 - 2x$ **iii** $y = 12 - \frac{3}{2}x$

iv $y = 20 - 5x$ **v** $y = 2(3 - 2x)$

b Use a scale of 2 cm for 1 unit horizontally from −3 to 3 for each graph. Choose a sensible vertical scale for the y-values based on the table of results. Draw a graph for each function.

Write down the coordinates of the point where each line cuts the y-axis.

explanation 2

3 For each of these equations, use the 'cover up' method to work out the coordinates of two points.

Use these points to draw a separate graph for each function.

a $y - 3x = 1$ **b** $y - 2x = 3$ **c** $2y - x = 5$

d $3y - 2x = 6$ **e** $2x + y - 3 = 0$ **f** $3x + 2y + 12 = 0$

4 Draw the graphs of these functions on the same grid.

What do you notice?

$2x - 3y + 2 = 0$ $y = \frac{2}{3}x - 1$ $-2x + 3y - 6 = 0$

explanation 3a explanation 3b explanation 3c explanation 3d online

5 Without drawing the graphs, write the gradient and y-intercept of these functions.

a $y = 4x - 3$ **b** $y = 6 - 2x$ **c** $y = 6x + 1$

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

g $y = 0.3x + 2$ **h** $y = \frac{2}{3}x - 8$ **i** $y = \frac{3x - 1}{4}$

6 Rearrange each of these equations into the form $y = mx + c$ then write the gradient and y-intercept.

a $2y = 5x - 4$ **b** $3y = 6x + 9$ **c** $y + 3x = 7$

d $y - 2x - 5 = 0$ **e** $3y + 5x - 6 = 0$ **f** $6x + 2y = 9$

g $5x = 4y$ **h** $5x - y = 7$ **i** $1 - x - 2.5y = 0$

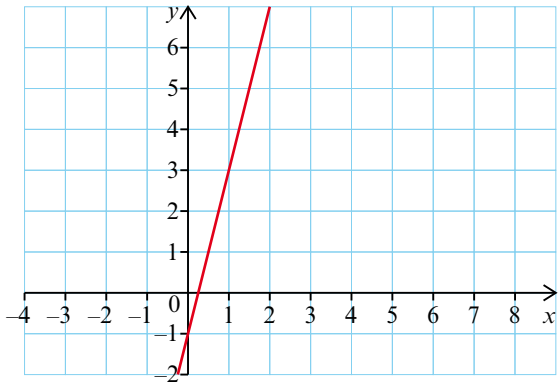
7 Rearrange these equations and identify the equations of parallel lines.

a $y = 3x - 1$ **b** $2y = 3x - 1$ **c** $2y = 5 + 6x$

d $3y = x + 5$ **e** $6 + 2y - 6x = 0$ **f** $2 - y - 3x = 0$

8 For each of these straight lines, work out the gradient and y-intercept and write its equation in the form $y = mx + c$.

a



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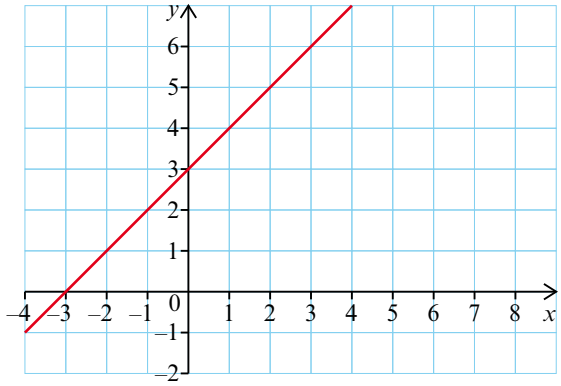

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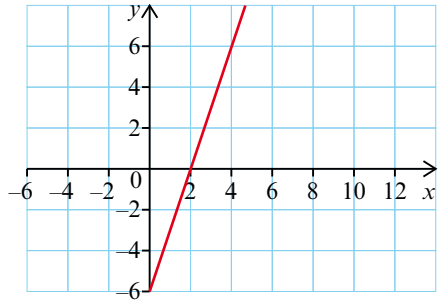

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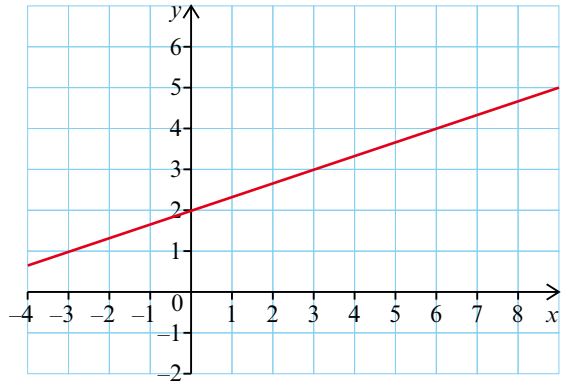

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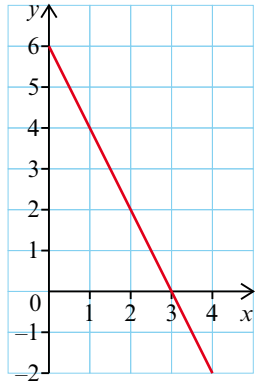

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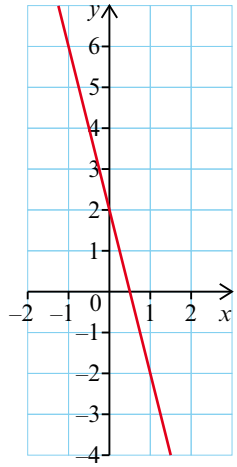
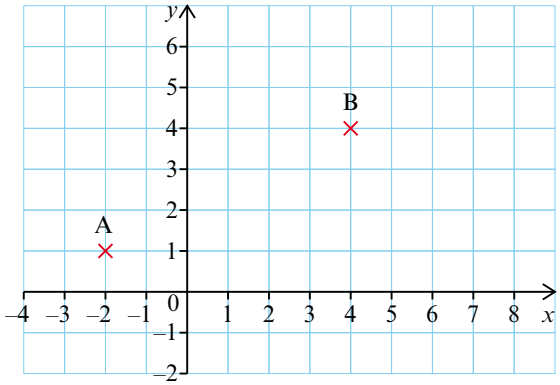


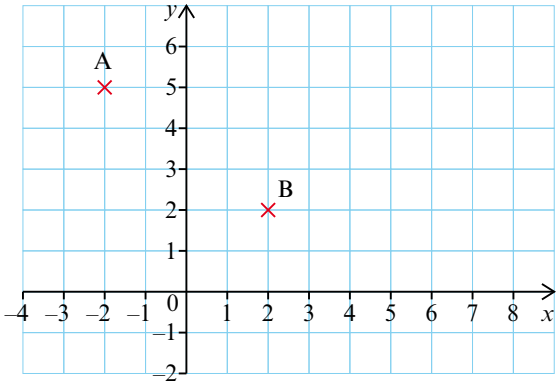
explanation 4a | explanation 4b | explanation 4c

9 Write the coordinates of the midpoint of the line AB.



10 Find the coordinates of the midpoint of the line AB and the line CD.

a



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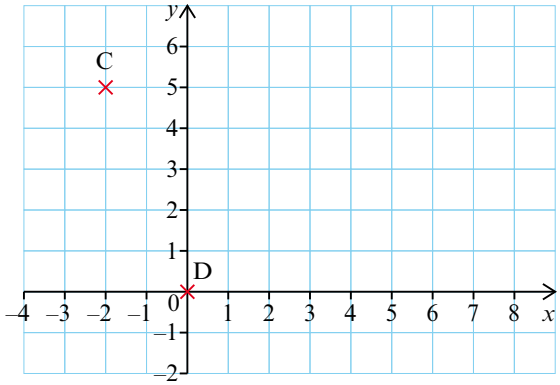


11 Find the coordinates of the midpoint of the line between each pair of points.

a (2, 1) and (−3, 4)

b (0, 4) and (8, −2)

c (5, −2) and (1, 2)

d (6, 0.5) and (−1, −1)

12 **a** Find the coordinates of the midpoint of the line PQ when P is (−3, 1) and Q is (5, −2).

b If the point P changed to (−2, 1), what would the midpoint be?

c If the midpoint of PQ was (0, 1) and Q stayed at (5, −2), what would the coordinates of P be?

13 If the midpoint of a line AB is (3, 2), give the coordinates of three possible pairs of points A and B.

explanation 5

14 Write the gradients of the lines perpendicular to the lines with these gradients.

a 5 **b** 4 **c** -6 **d** $\frac{1}{5}$ **e** $\frac{4}{7}$

15 Write the gradients of lines that are perpendicular to these functions.

a $y = 2x - 1$ **b** $y = 4x + 3$ **c** $y = \frac{1}{3}x + 4$ **d** $y = 6 - x$

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

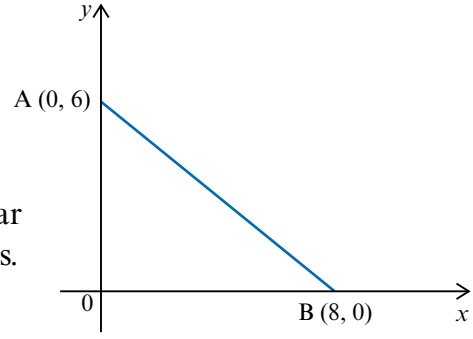
16 Which of these lines are perpendicular to $y = 4x - 3$.

a $y = 4x + 2$ **b** $y = \frac{1}{4}x - 5$ **c** $y = 6 - \frac{1}{4}x$ **d** $2y + 8x = 9$

17 Find the equations of the lines that are perpendicular to $y = \frac{1}{2}x + 5$ and pass through these points.

a (0, 0) **b** (0, 7) **c** (0, -3)

18 The sketch shows the line AB.



a Show that the gradient of the line AB is $-\frac{3}{4}$.

b Find the equation of the line AB.

c Find the equation of a line perpendicular to AB which passes through these points.

i A

ii the midpoint of AB

explanation 6a explanation 6b

19 Find the inverse of each function.

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

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

20 **i** Rearrange each of these to give y as a function of x.

ii Find the inverse of each function.

a $y = 6 - x$ **b** $x + y = 8$ **c** $y = 6 - 2x$ **d** $3x + y = 12$

e $3x + 4y = 8$ **f** $2x - 3y = 12$ **g** $5x + 2y - 20 = 0$

21 Draw a graph of each pair of functions.

a $y = 3x$ and the inverse of $y = 3x$

b $y = 2x - 1$ and the inverse of $y = 2x - 1$

c $y = \frac{1}{2}x + 2$ and the inverse of $y = \frac{1}{2}x + 2$

22 Choose the correct transformation from the list below to complete the sentence.

Rotation of 90° clockwise	Translation by $\begin{pmatrix}0\\5\end{pmatrix}$	Reflection in the line $y = x$	Enlargement scale factor 2

The graph of an inverse function is a _____ of the graph of the original function.

explanation 7a explanation 7b

23 **i** Copy and complete this table of values for each quadratic function.

ii Draw a graph for each function.

x	−3	−2	−1	0	1	2	3
y							

a $y = x^2 + 4$ **b** $y = 2x^2 - 5$ **c** $y = 4 - x^2$

d $y = 10 - 2x^2$ **e** $y = x^2 + 2x - 2$ **f** $y = x^2 - x + 3$

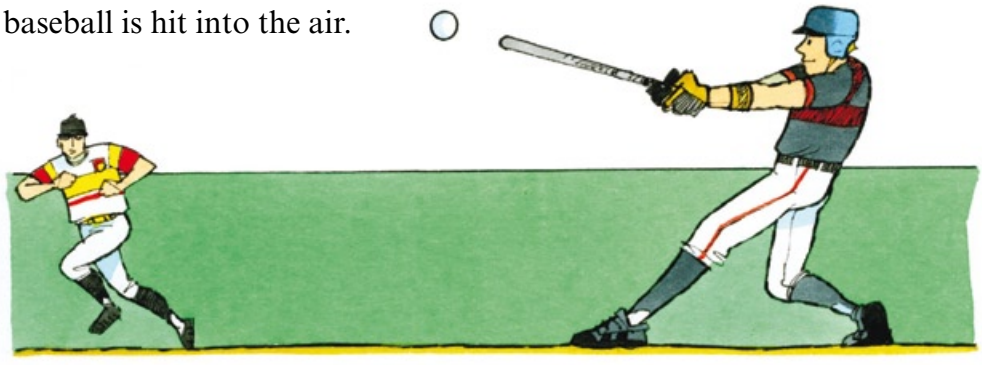
g $y = x^2 + 3x - 4$ **h** $y = x^2 - 2x + 5$

24 For each of the functions in question **23** write the minimum or maximum value of the curve.

25 Without drawing the function, write down the minimum or maximum values of these curves. State whether this value is a minimum or a maximum.

a $y = 3x^2 - 7$ **b** $y = -12x^2 + 5$ **c** $y = 12 + x^2$ **d** $y = 7 - 3x^2$

26 A baseball is hit into the air.



The height of the ball is given by the equation $h = 12t - 3t^2$ where h is the height in metres and t is the time in seconds.

a Copy and complete this table.

t	0	1	2	3	4
h					

b Draw the graph of $h = 12t - 3t^2$.

c What is the maximum height reached by the baseball?

d For how long is the baseball more than 8 m above the ground?

explanation 8a explanation 8b

27 **i** Copy and complete this table of values for each cubic function.

ii Draw a graph for each function.

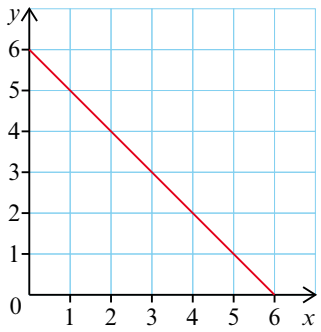
x	−3	−2	−1	0	1	2	3
y							

a $y = x^3$ **b** $y = x^3 + 5$ **c** $y = 2 - x^3$ **d** $y = 10 - x^3$

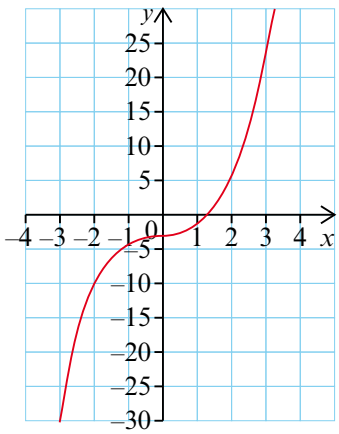
28 Write the coordinates of the points where each of your graphs in question **27** crosses the y-axis.

29 Match each equation to its graph.

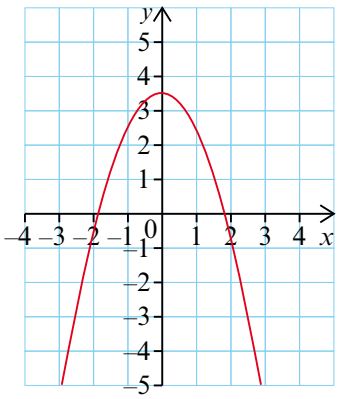
Graph 1



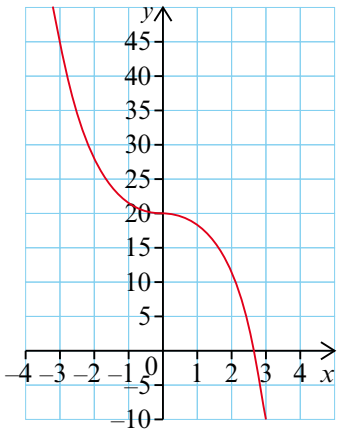
Graph 2



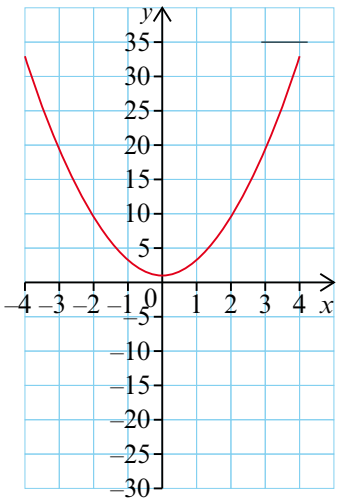
Graph 3



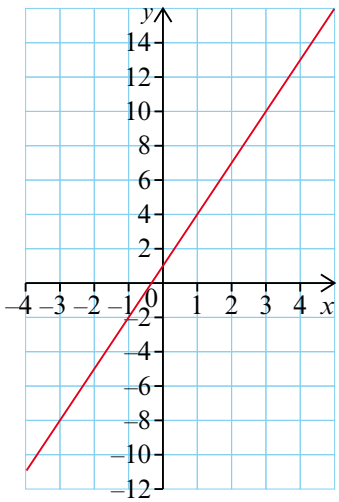
Graph 4



Graph 5



Graph 6



a $y = 2x^2 + 1$ **b** $y = 3x + 1$ **c** $y = 20 - x^3$

d $y = 6 - x$ **e** $y = 3.5 - x^2$ **f** $y = -3 + x^3$