1. A is the point (2, 3), and B is the point (4, 9).

    (a)   Find the gradient of the line segment [AB].

    (b)   Find the gradient of a line perpendicular to the line segment [AB].

    (c)   The line $2x + by - 12 = 0$ is perpendicular to the line segment [AB]. What is the value of b?

Working:

Answers:

(a) ....

(b) ....

(c) ....

(Total 4 marks)

2. The diagram below shows the line with equation $3x + 2y = 18$. The points A and B are the y and x-intercepts respectively. M is the midpoint of [AB].
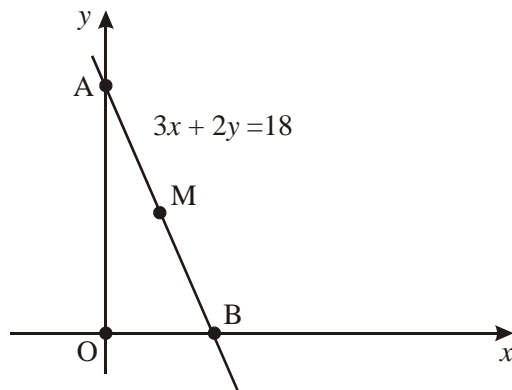

y

A

$3x + 2y = 18$

M

Diagram not to scale

B

O

x

Find the coordinates of

(a)   the point A;

(b)   the point B;

(c)   the point M.

Working:

Answers:

(a)   ....

(b)   ....

(c)   ....

(Total 8 marks)

3.
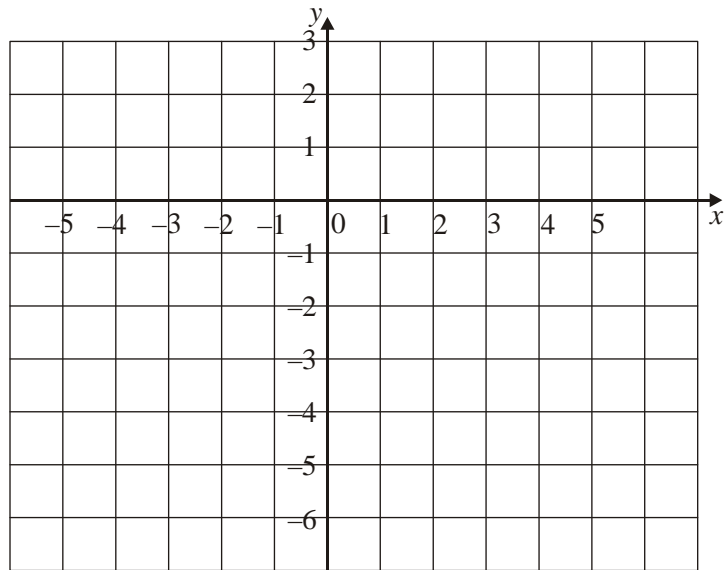
(a) On the grid above, draw a straight line with a gradient of –3 that passes through the point (–2, 0).
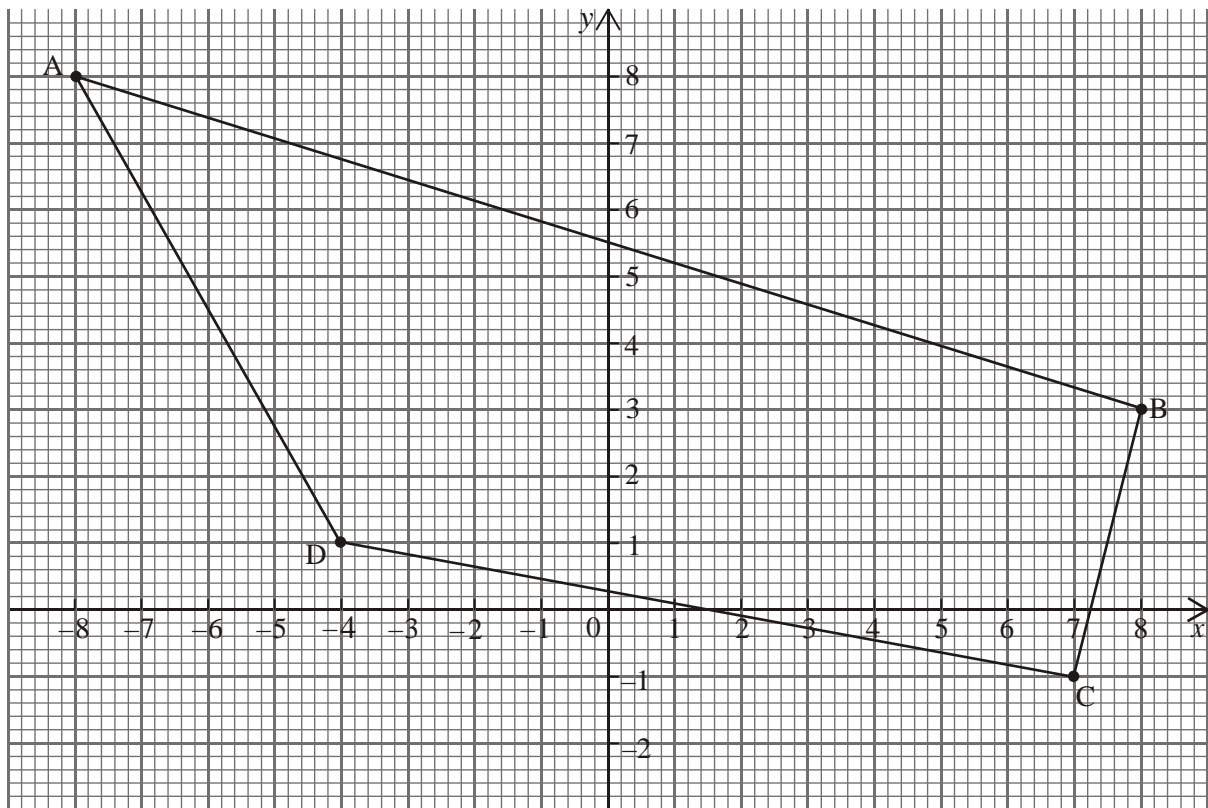
(b) Find the equation of this line.

Working:

Answer:

(b) ....

(Total 8 marks)

4. The vertices of quadrilateral ABCD as shown in the diagram are A (–8, 8), B (8, 3), C (7,–1) and D (–4, 1).

The gradient of the line AB is $-\dfrac{5}{16}$.

(a) Calculate the gradient of the line DC.

(2)

(b) State whether or not DC is parallel to AB and give a reason for your answer.

(2)

The equation of the line through A and C is $3x + 5y = 16$.

(c) Find the equation of the line through B and D expressing your answer in the form $ax + by = c$, where a, b and $c \in \mathbb{Z}$.

(5)

The lines AC and BD intersect at point T.

(d) Calculate the coordinates of T.

(4)
(Total 13 marks)

4

5. Three points are given A(0, 4), B(6, 0) and C(8, 3).

(a) Calculate the gradient (slope) of line AB.

(2)

(b) Find the coordinates of the midpoint, M, of the line AC.

(2)

(c) Calculate the length of line AC.

(2)

(d) Find the equation of the line BM giving your answer in the form $ax + by + d = 0$ where a, b and $d \in \mathbb{Z}$.

(5)

(e) State whether the line AB is perpendicular to the line BC showing clearly your working and reasoning.

(3)
(Total 14 marks)

1. (a) For the line (AB), $m = \dfrac{9-3}{4-2}$

$$= \frac{6}{2}$$
$$= 3 \hspace{6cm} \text{(A1)}$$

(b) $m = -\dfrac{1}{3}$ (A1)

(c) $2x + by - 12 = 0$

$$y = -\frac{2}{b}x + \frac{12}{b}$$

Therefore, $-\dfrac{1}{3} = -\dfrac{2}{b}$ (M1)

$6 = b$ (A1)
[4]

2. (a) $3x + 2y = 18$
$2x = 18$ (A1)
$y = 9$
therefore A = (0,9)   (A1) (C2)

(b) $3x = 18$ (A1)
$x = 6$
B = (6,0)   (A1)(C2)

Note: Award (A0), (A1) (ft) for A = 9, B = 6.
Award (A0), (A2) (ft) for A = (0, 6) and B = (9, 0).

(c)   (0, 9) (6, 0)   (A1)

midpoint = $\left(\dfrac{0+6}{2}, \dfrac{9+0}{2} \right)$ (A1)

= (3, 4.5)   (A1)(A1)(C2)(C2)

[8]

3.

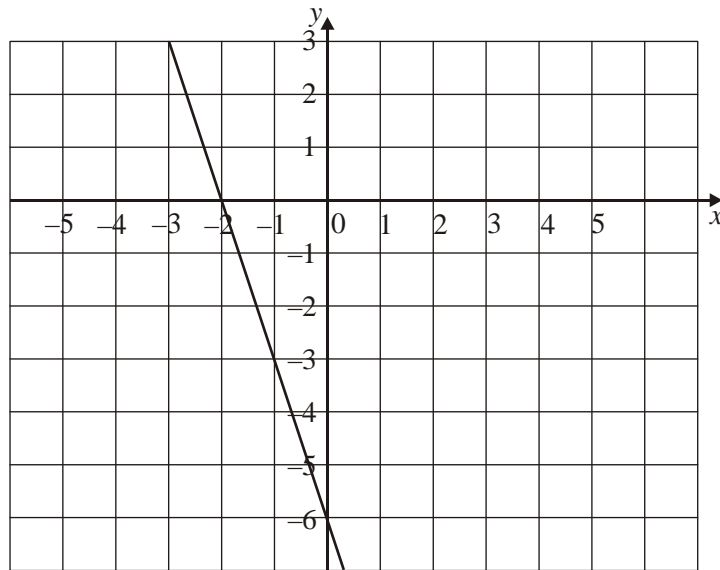(a) line passes through (–2, 0)   (A1)
line is straight   (A1)
negative gradient (line must be straight for mark to be awarded)   (A1)
correct gradient (line must be straight for mark to be awarded)   (A1)   (C4)

(b) $y – 0 = –3(x + 2)$ **or** $3x + y = 3(–2) + 1(0)$ **or** $y = –3x + c$ etc   (M1)
$3x + y = –6$ (or equivalent)   (A1)(A1)(A1)

> *Note: Award (C4) ft for $y = –3x$ + candidate's y-intercept (or equivalent).*
> *Otherwise award:*
> *(A1) for y with = in a linear equation,*
> *(A1) for $y = –3x$ or $y + 3x$ seen or for $m = –3$*
> *(A1) for candidate's y-intercept included in a linear expression.*
> ***Do not** ft candidate's gradient if it is wrong in the diagram, no mark for stand alone $–3x$*

[8]

4. (a) Gradient of DC $= –\dfrac{2}{11}$ (A2)   2

> *Note: Award (A1) for sign, (A1) for $\dfrac{2}{11}$.*

(b) No. The gradients are not equal.   (A1)(R1)

(c)   Gradient $= \dfrac{2}{12} = \dfrac{1}{6}$ (A1)

$y = \dfrac{1}{6}x + c$ (A1)

$3 = \dfrac{1}{6}(8) + c$

$18 = 8 + 6c$

$10 = 6c$

$c = \dfrac{10}{6} = \dfrac{5}{3}$

$6y = x + 10$ (M1)

$x - 6y = -10$ (A1)   5

(d) $3x + 5y = 16$

$x - 6y = -10$ (M1)

$3x - 18y = -30$ (M1)

$23y = 46$

$y = 2$ (A1)

$x = 2 \Rightarrow$ T(2,2)   (A1)   4

Note: Award (A2) for the answers only.

[13]

5.   (a)   gradient $= \dfrac{4-0}{0-6}$ (M1)

$= -\dfrac{2}{3}$ (A1)

or (G2)   2

(b)   midpoint $= \left(\dfrac{0+8}{2}, \dfrac{4+3}{2} \right)$

$= (4, 3.5)$ (A1)

(A1)   2

Note: Award (A1) if x and y coordinates not explicitly made clear.

(c) $AC = \sqrt{(0-8)^2 + (4-3)^2}$

(M1)

Note: Award (M1) *for using the distance formula and substituting the correct numbers.*

$= 8.06 \ (\sqrt{65})$ (A1)(G2) 2

(d)   Gradient BM $= \dfrac{3.5 - 0}{4 - 6}$

(M1)

Note: Award (M1) *for using values of B and M.*

$= \dfrac{7}{4}$

(A1)(ft)(G2)

$y = mx + c$

$0 = -\dfrac{7}{4} \times 6 + c$ (M1)

Note: Award (M1) *for using the equation of a straight line.*

$c = \dfrac{21}{2}$

$y = -\dfrac{7}{4} x + \dfrac{21}{2}$ (A1)(ft)(G1)

Note: Can award (G3) for this with no working.

$7x + 4y - 42 = 0$ (A1)(ft)(G4) 5

Note: This step can (ft) within part (d)

(e)   gradient AB $= -\dfrac{2}{3}$

gradient BC $= \dfrac{3}{2}$ (M1)

Note: Award (M1) *for attempting to find the gradient of BC.*

$-\dfrac{2}{3} \times \dfrac{3}{2} = -1$ (M1)

Note: Award (M1) *for multiplying their two gradients.*

Yes, they are perpendicular.   (A1)(ft) 3

Note: Accept any other valid mathematical method with working shown.

[14]