St. Patrick's High School, Keady

Mathematics Department

GCSE Mathematics Practice Booklet

M4

Topic 7 –Algebra 2

Co-ordinate Geometry

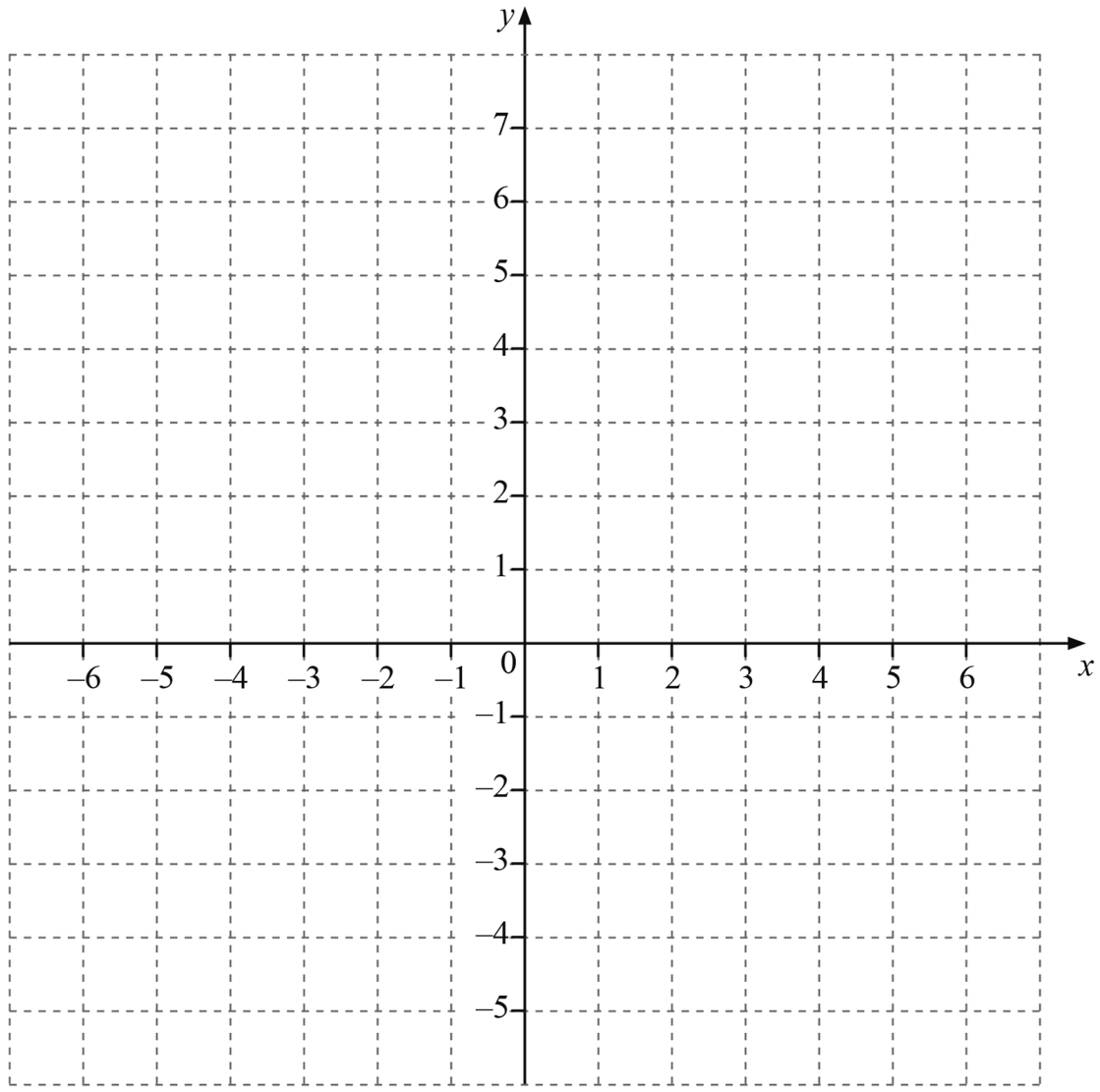
Graphs and Gradients

Questions taken from CCEA Past Papers

Mark Scheme included at the end of this booklet

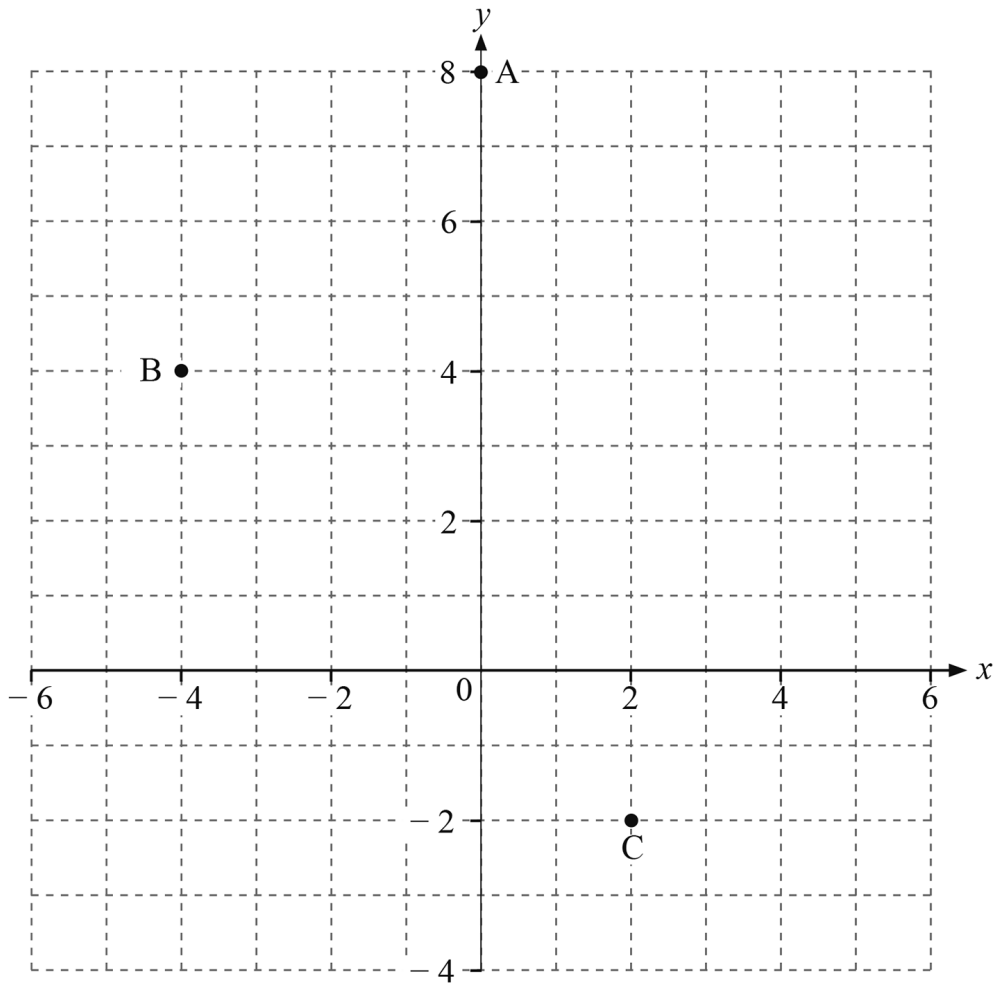
Q1 L is the point (−5, 6). N is the point (3, −2).

Write the co-ordinates of the midpoint of LN.



Answer (_____ , _____) [2]

Q2 The vertices A(0, 8) B(−4, 4) and C(2, −2) of a right-angled triangle are shown.



(a) Write down the coordinates of the midpoint of the line joining A and C.

Answer (_____, _____) [2]

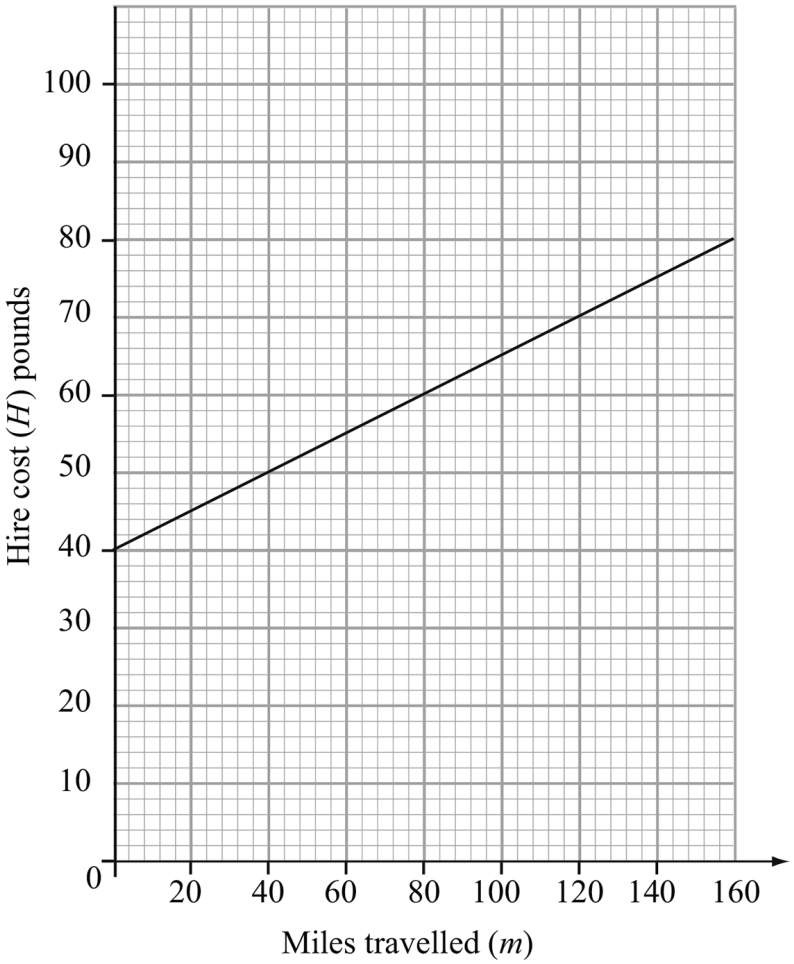
(b) A fourth point D is plotted so that ABCD forms a rectangle. Explain why the coordinates of D must be (6, 2).

[2]

Q3 Work out the midpoint of the line PQ joining P(4, −6) and Q(8, 2).

Answer (_____ , _____) [2]

Q4 Airport Autos is a car hire company.
The graph shows how the hire cost is calculated.



(a) Martha hired a car. The hire cost on return was £52
Use the graph to find how many miles Martha travelled.

Answer _____ miles [1]

The hire cost (H) is made up of a fixed charge plus a charge for the number of miles travelled (m).

(b) (i) How much is the fixed charge?

Answer £ _____ [1]

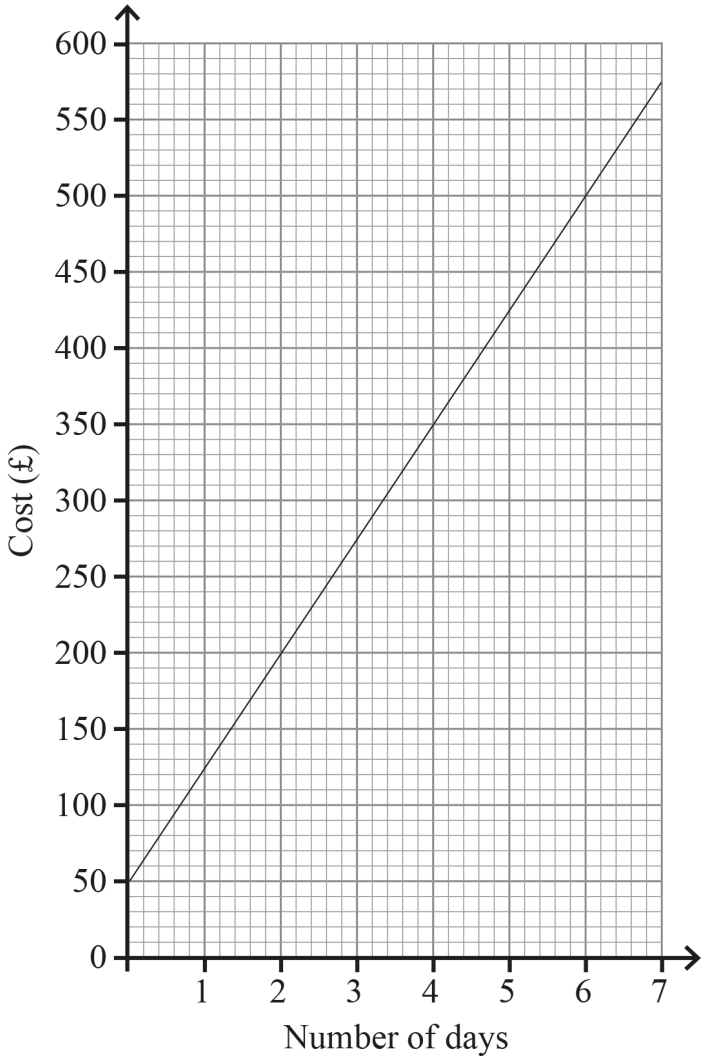
(ii) How much is the charge per mile?

Answer _____ [2]

(iii) Hence write down a formula for the hire cost H in terms of the number of miles travelled m.

Answer _____ [2]

Q5 The graph shows the costs of hiring a mini digger for up to seven days, including the delivery charge.



(a) Use the graph to find

(i) the delivery charge,

Answer £_____ [1]

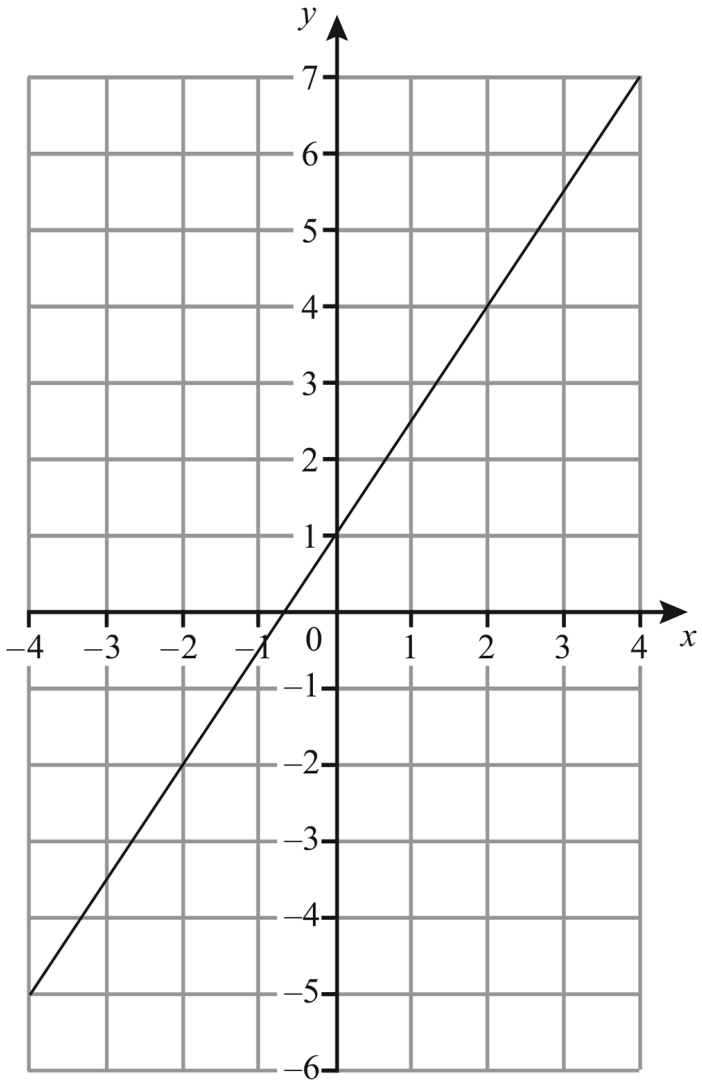
(ii) the gradient of the line.

Answer _____ [2]

(b) What does the gradient represent when hiring the mini digger?

Answer _____ [1]

Q6



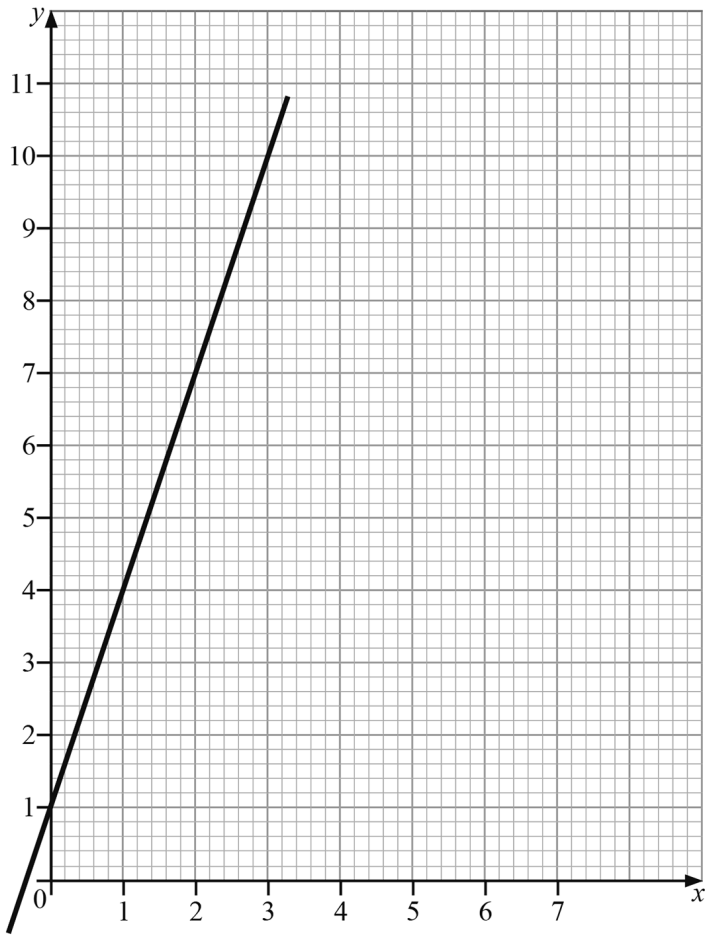
(a) Write down the gradient of the line drawn above.

Answer _____ [1]

(b) Hence write down the equation of this line.

Answer _____ [2]

Q7



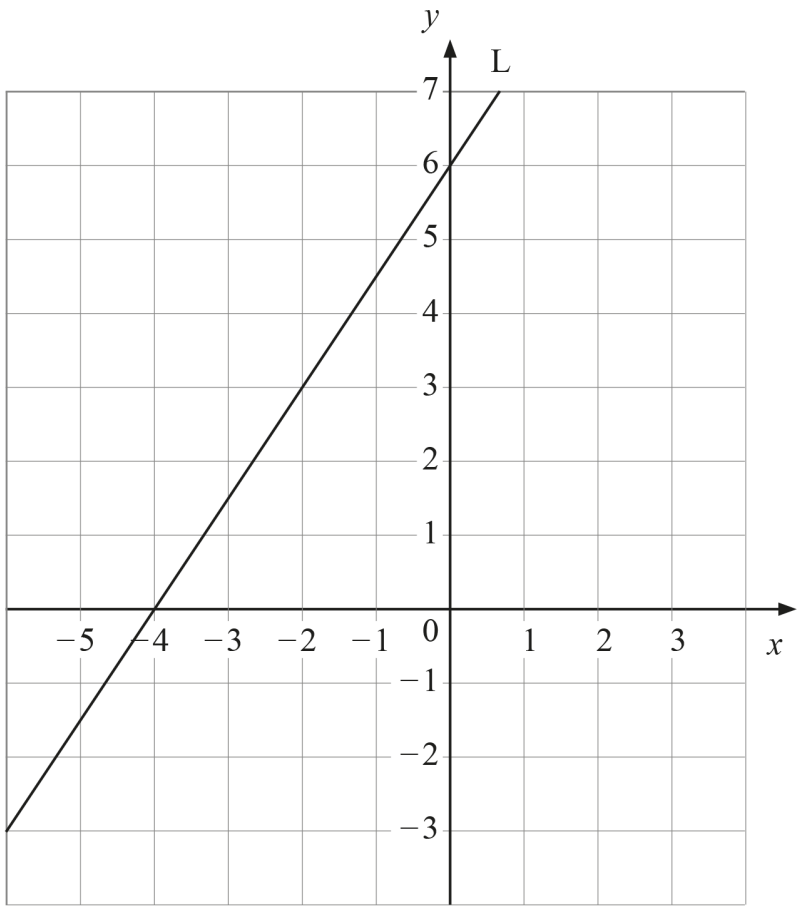
(a) Find the gradient of the line shown.

Answer _____ [1]

(b) Hence write down the equation of the line in the form $y = mx + c$

Answer _____ [1]

Q8



(a) Write down the equation of the line L shown.

Answer _____ [3]

(b) Write down the equation of any line parallel to line L.

Answer _____ [1]

Q9

Write down the equation of a line parallel to the line with equation $y = 3x + 5$

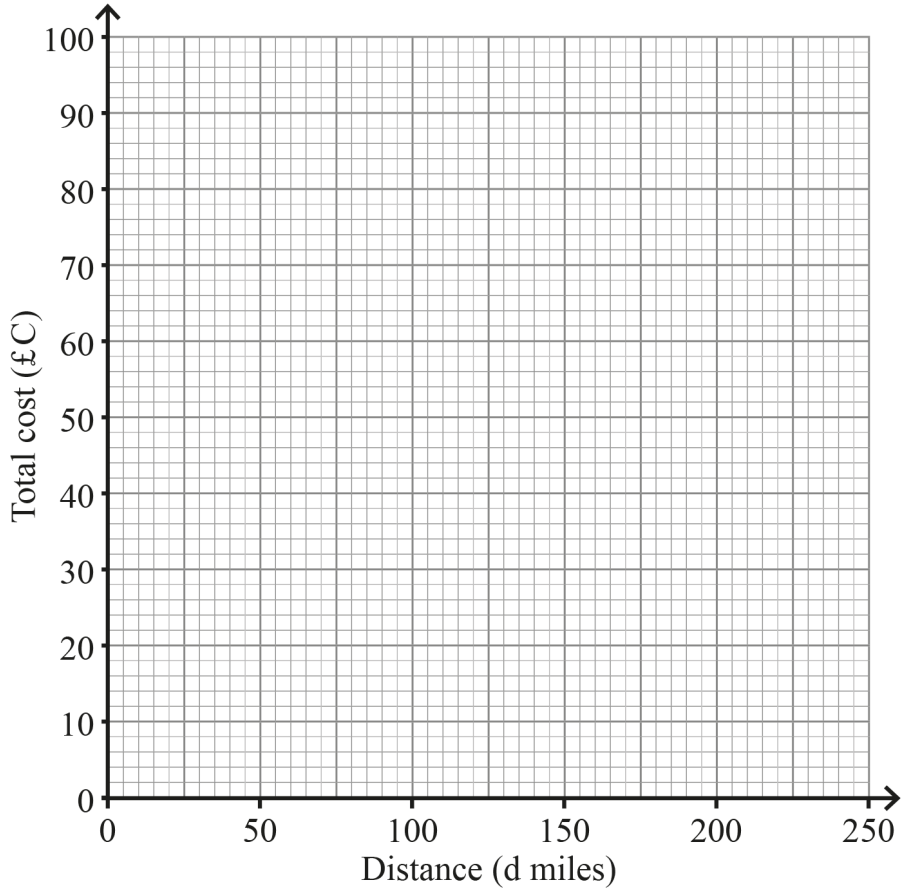
Answer _____ [2]

Q10 Martine wants to hire a van.

The table shows the costs for hiring the van.

Distance (d miles)	50	100	150	200	250
Total cost (£C)	50	60	70	80	90

(a) Draw a straight line graph to illustrate this information.



[2]

(b) Use the graph to find

(i) the initial fixed charge for hiring the van,

Answer £ _____ [1]

(ii) the cost per mile, in pence, for using the van.

Answer _____ p [1]

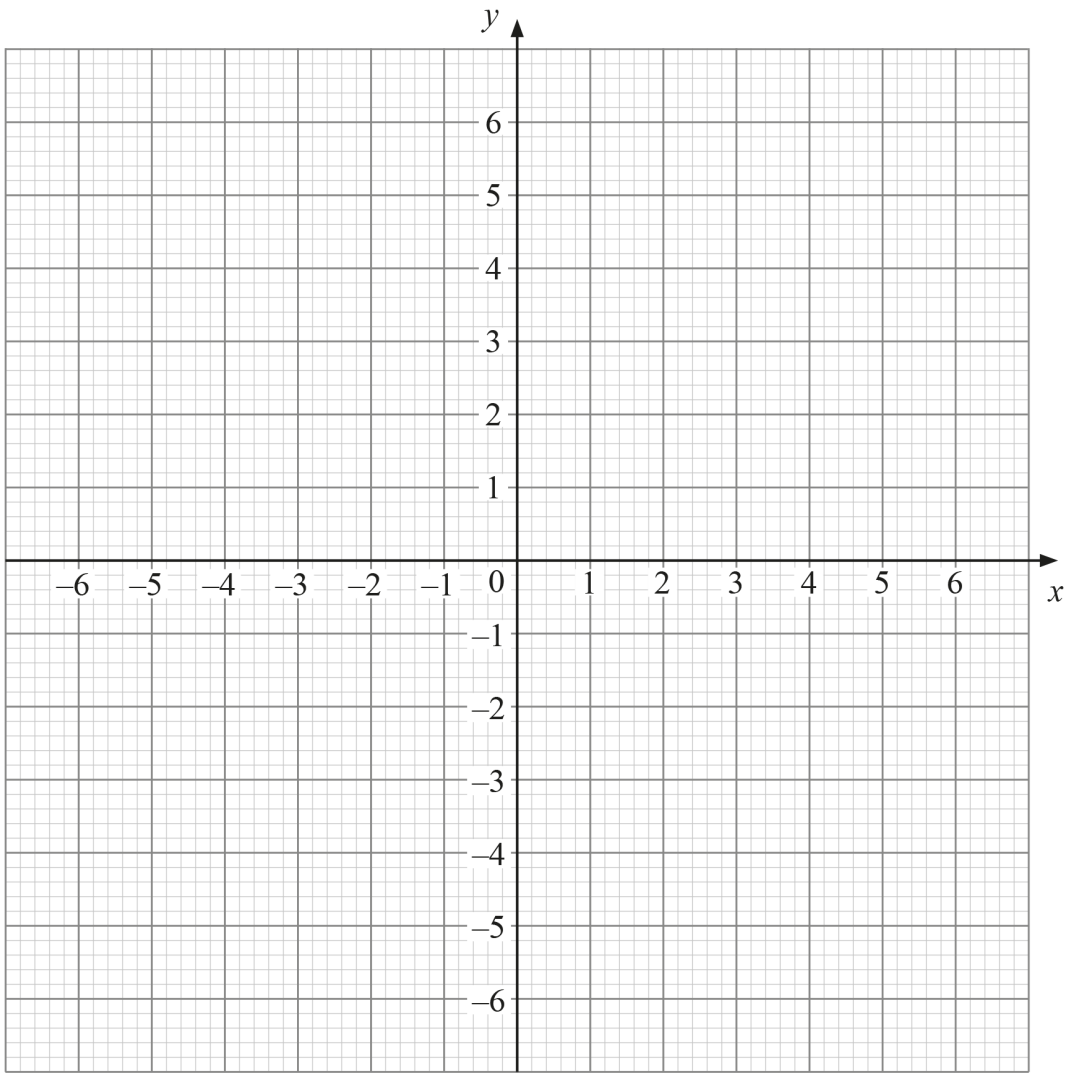
(c) Work out the total cost if the van travels 450 miles.

Answer £ _____ [2]

Q11 Find the equation of the line passing through the points (0, −2) and (6, 16)

Answer _____ [3]

Q12 **(a)** On the grid below draw the graph of $y = 3 - 2x$



[3]

(b) Write down the equation of any line parallel to $y = 3 - 2x$

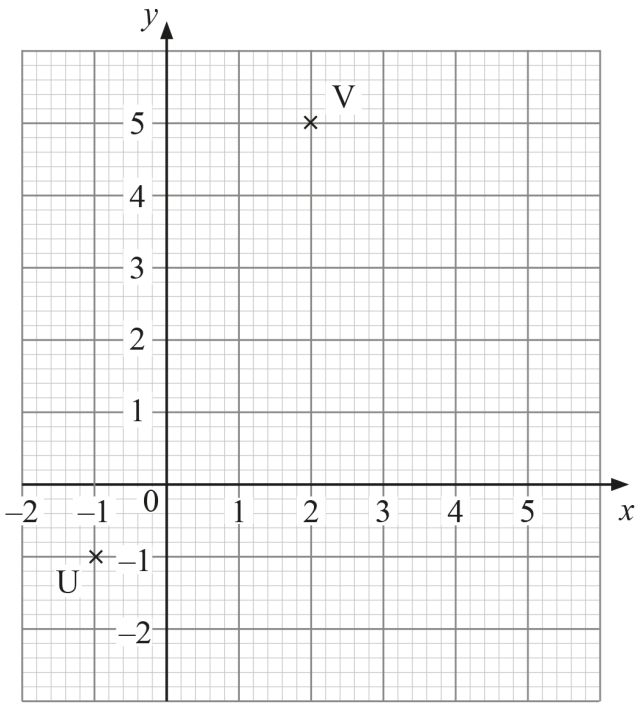
Answer _____ [1]

Q13 A line L passes through the points with coordinates (0, 2) and (2, 8).

Find the equation of any line parallel to line L.

Answer _____ [4]

Q14 U has coordinates (–1, –1) and V has coordinates (2, 5) as shown.



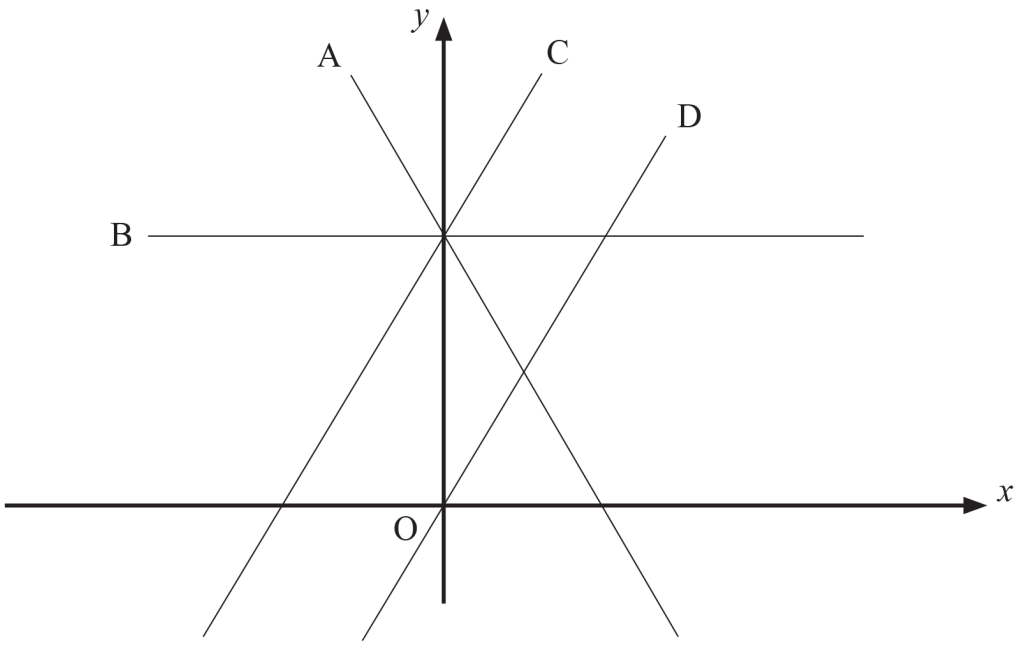
(a) Write down the coordinates of the midpoint of the line joining U and V.

Answer (_____ , _____) [2]

(b) Find the equation of the straight line joining U and V.

Answer _____ [3]

Q15



A, B, C and D are four straight lines.

C and D are parallel.

The equations of three of these lines are

$$y = 4x \qquad y = 5 - 4x \qquad y = 5$$

Use this information to find the equation of the fourth line.

Answer _____ [4]

Q16 The line L has equation $y = -3x - 6$

This line crosses the y axis at the point A and the x axis at the point B.

(a) Write down the co-ordinates of A.

Answer (_____ , _____) [1]

(b) Find the equation of the line perpendicular to L which passes through the point B.

Answer _____ [4]

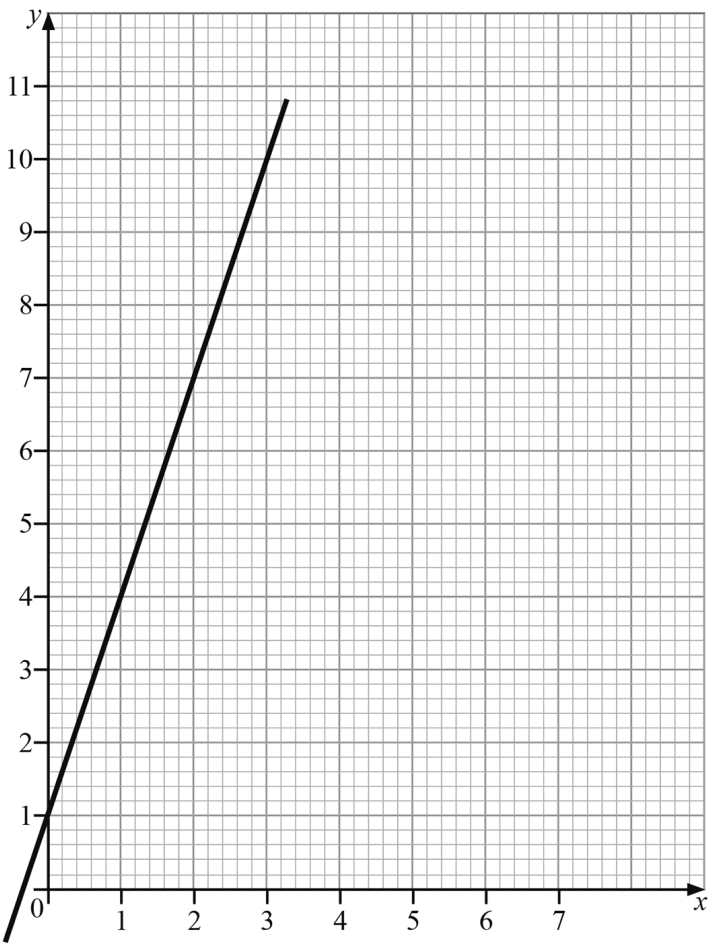
Q17 Find the equation of the line through (0, 4) perpendicular to the line $y = 3x$

Answer _____ [2]

Q18 Find the equation of the line through (0, –5) which is perpendicular to the line $y = 4x + 9$

Answer _____ [2]

Q19



(a) Find the gradient of the line shown.

Answer _____ [1]

(b) Hence write down the equation of the line in the form $y = mx + c$

Answer _____ [1]

(c) Write down the equation of the line which is parallel to the line shown and which passes through the point $(0, -1)$.

Answer _____ [2]

(d) Explain why the straight lines $y = 3x - 2$ and $3y + x = 5$ are perpendicular.

[2]

Q20 **(a)** Find the equation of the line joining the points A (0, –1) and B (6, –4).

Answer _____ [3]

(b) Find the equation of the line perpendicular to AB which passes through B.

Answer _____ [3]

Q21 Find the equation of the line which goes through $(0, -4)$ and is perpendicular to the line $2x + 3y = 9$

Answer _____ [3]

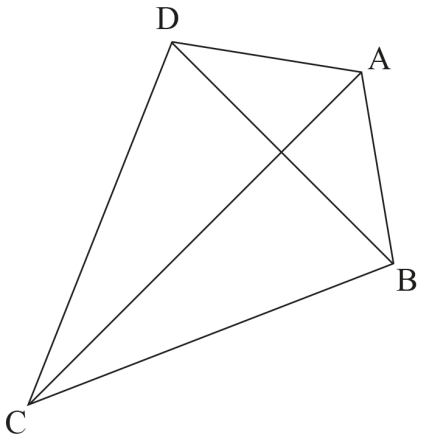
Q22

The lines AC and BD are diagonals of a kite.

The line AC has equation $y = 3x + 2$

The diagonals meet at (1, 5).

Find the equation of the line BD.



Answer _____ [4]

Q23

The line joining $(a, 7)$ to $(-1, 10)$ is perpendicular to the line joining $(a, 7)$ to $(9, -6)$.

Find the possible values of a.

A solution by trial and improvement will not be accepted.

Answer $a =$ _____ or $a =$ _____ [6]

1. (–1, 2) A1 A1

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2. **(a)** (1, 3) A1 A1

(b) M must also be midpoint of BD M1

So (1, 3) = $\left(\frac{-4+6}{2}, \frac{4+2}{2}\right)$ A1

Alternative solution

proof using translations
e.g. BA = translation 4 across and 4 up so CD must have translation 4 across and 4 up
(hence 2 + 4 = 6 and –2 + 4 = 2) M1 A1

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3. **26** (6, –2) A1 A1

4.

(a) 48 A1

(b) **(i)** £40 A1

(ii) £5/20 miles M1
= 25p per mile or £0.25 A1 (answer must have appropriate units)

(iii) $H = 40 + 0.25m$ A2

5.

(a) **(i)** 50 A1

(ii) gradient $= \frac{150}{2}$ (or equivalent) $= 75$ M1 A1

(b) The mini digger costs £75 a day to hire A1

6.

(a) $\frac{3}{2}$ MA1

(b) $y = \frac{3}{2}x + 1$ MA2

7.

(a) Gradient = 3 A1

(b) $y = 3x + 1$ A1

8.

(a) $m = \frac{6}{4}$ or $\frac{3}{2}$ or 1.5 MA1

$c = 6$ A1

$y = 1.5x + 6$ MA1

(b) Any line of the form $y = 1.5x + c$, $c \neq 6$ A1

9.

$y = 3x + c$ (c = any numerical value, c ≠ 5) M1 A1

10.

(a) all points correctly plotted MA1

straight line A1

(b) **(i)** 40 A1

(ii) 20 A1

(c) £40 + 450 × 20p M1

130 A1

11.

$m = \frac{16 - -2}{6 - 0}$ MA1

$= 3$ A1

$y = 3x - 2$ MA1

12.

(a) first correct point plotted MA1

second correct point plotted MA1

straight line drawn A1

(b) any equation of the form $y = c - 2x$ ($c \neq 3$) A1

13.

gradient $= \frac{8 - 2}{2 - 0} = 3$ M1A1

$y = 3x + c$ (where $c \neq 2$) MA2
(award A1 if $y = 3x + 2$ written)

14.

(a) $\left(\frac{1}{2}, 2\right)$ A1 A1

(b) $\frac{5-(-1)}{2-(-1)} = \frac{6}{3}$ or 2 MA1

c = 1 A1

$y = 2x + 1$ A1

15.

D: $y = 4x$ A: $y = 5 - 4x$ B: $y = 5$ MA2
allow MA1 for 2 correct
(C) $y = 4x + 5$ A1 A1

16.

(a) (0, – 6) A1

(b) Gradient of line = –3
Gradient of perpendicular = $\frac{1}{3}$ MA1

Line crosses x axis $0 = -3x - 6$
$x = -2$
B (–2, 0) MA1

$y = 1/3\ x + c$
$0 = -2/3 + c$
c = 2/3 MA1

Line is $y = \frac{1}{3}x + \frac{2}{3}$ A1

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17. $y = -\frac{1}{3}x + 4$ A1 A1

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18. $-\frac{1}{4}$ MA1

$y = -\frac{1}{4}x - 5$ MA1

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19. **(a)** Gradient $= 3$ A1

(b) $y = 3x + 1$ A1

(c) $y = 3x - 1$ A1 A1

(d) Gradients are 3 and $-\frac{1}{3}$ A1

Gradients multiply to give –1 A1

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20. **(a)** Gradient $= \frac{(-4 - -1)}{(6 - 0)} = \frac{-3}{6} = -\frac{1}{2}$ MA1 MA1

$y = -\frac{1}{2}x - 1$ MA1

(b) Gradient of perpendicular = 2 MA1

$y = 2x + c$

$-4 = 12 + c, c = -16$ MA1

$y = 2x - 16$ MA1

21.

Gradient of given line $= -\frac{2}{3}$ MA1

Gradient of perp line $= \frac{3}{2}$ MA1

Equation is $y = \frac{3}{2}x - 4$ MA1

22.

Gradient of BD $= -\frac{1}{3}$ MA1

$y = mx + c$ through (1, 5) MA1

MA means method of line, with accuracy of using (1, 5)
(mark for 2 solutions)

$5 = -\frac{1}{3} + c$

$c = 5\frac{1}{3}$ MA1

$y = -\frac{1}{3}x + 5\frac{1}{3}$ A1

(final 2 marks also gained for correct line equation using formula with (1, 5) and $-\frac{1}{3}$: $(y - 5) = -\frac{1}{3}(x - 1)$)

23.

Gradients $\frac{10-7}{-1-a}$, $\frac{-6-7}{9-a}$ MA1 MA1

$\frac{10-7}{-1-a} \times \frac{-6-7}{9-a} = -1$ MA1

$3 \times (-13) = (9 - a)(-1 - a) \times (-1)$ MA1

$39 = -9 - 8a + a^2$

$a^2 - 8a - 48 = 0$ MA1

$a = 12$ **or** -4 A1
