

5.2 Answers

A-Level Pure Mathematics, Year 1
Additional Mathematics
GCSE
Coordinate Geometry

Answer 1

$$m_{AB} = \frac{6 - 2}{15 - 7} = \frac{4}{8} = \frac{1}{2}$$

[2 marks]

Answer 2

$$\text{Midpoint } AB = \left(\frac{6 + 4}{2}, \frac{7 + (-9)}{2} \right) = (5, -1)$$

[2 marks]

Answer 3

$$D = \sqrt{(15 - 3)^2 + (4 - (-1))^2} = \sqrt{12^2 + 5^2} = 13$$

[2 marks]

Answer 4

(i) $m_{\text{parallel}} = -\frac{4}{5}$

(ii) $m_{\text{perpendicular}} = \frac{5}{4}$

[1, 1 mark]

Answer 5

$$y = mx + c$$

$$21 = 5 \times 11 + c \Rightarrow c = -34$$

$\therefore$ The line will have equation $y = 5x - 34$

[3 marks]

Answer 6

$$5x - 4y - 12 = 0$$

$$4y = 5x - 12$$

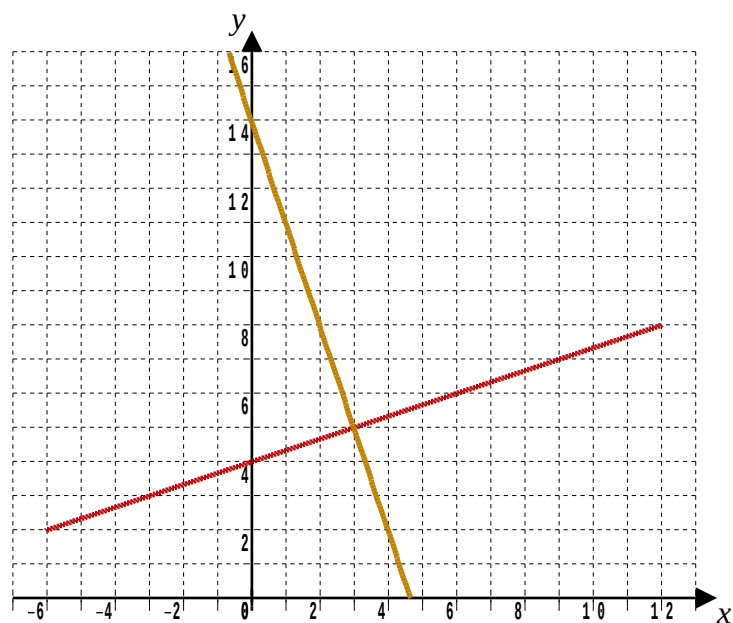
$$y = \frac{5}{4}x - 3$$

The gradient is $\frac{5}{4}$

[2 marks]

Answer 7

(i), (iii)



[3, 2 marks]

(ii)

$$f(-6) = \frac{1}{3} \times (-6) + 4 = 2 \Rightarrow (-6, 2) \text{ is an endpoint}$$

$$f(12) = \frac{1}{3} \times 12 + 4 = 8 \Rightarrow (12, 8) \text{ is an endpoint}$$

$$\text{Midpoint} = \left(\frac{12 + (-6)}{2}, \frac{8 + 2}{2} \right) = (3, 5)$$

$$\text{Gradient} = \frac{1}{3} \text{ from the equation given in the question}$$

Require a line with the sign changed reciprocal gradient through (3, 5)

$$y = mx + c$$

$$5 = -3 \times 3 + c \Rightarrow c = 14$$

$$\therefore y = -3x + 14$$

[5 marks]

Answer 8

$$\text{Midpoint } BD = \left(\frac{2 + 10}{2}, \frac{7 + 19}{2} \right) = (6, 13)$$

$$\text{Gradient } BD = \frac{7 - 19}{2 - 10} = \frac{-12}{-8} = \frac{3}{2}$$

Require a line with the sign changed reciprocal gradient through (6, 13)

$$y = mx + c$$

$$13 = -\frac{2}{3} \times 6 + c \Rightarrow c = 17$$

$$\therefore y = -\frac{2}{3}x + 17$$

multiply through by 3

$$3y = -2x + 51$$

$$3y + 2x = 51$$

[5 marks]

Answer 9

(i) The sign changed reciprocal gradient is -2

$$y = mx + c$$

$$7 = -2 \times 3 + c \Rightarrow c = 13$$

$\therefore$ The line l has equation $y = -2x + 13$

[3 marks]

(ii)

$$-2x + 13 = \frac{1}{2}x - 2$$

multiply through by 2

$$-4x + 26 = x - 4$$

$$5x = 30$$

$$x = 6 \Rightarrow y = 1$$

The two lines intersect at the point (6, 1)

[3 marks]

Answer 10

$$m_{AB} = \frac{18 - 3}{2 - (-3)} = \frac{15}{5} = 3$$

$$y = mx + c$$

$$18 = 3 \times 2 + c \Rightarrow c = 12$$

$\therefore$ The line through A and B is $y = 3x + 12$

This line cuts the x-axis when $y = 0 \Rightarrow (-4, 0)$

and cuts the y-axis at $(0, 12)$

Square has sides of length $\sqrt{12^2 + 4^2} = \sqrt{160} (= 4\sqrt{10})$

$\therefore$ Area of the square is 160 units²

[5 marks]

Answer 11

$$3x + 8 = -2x + 13$$

$$5x = 5$$

$$x = 1 \Rightarrow y = 11$$

So a line through $(1, 11)$ with gradient $\frac{1}{2}$ is required

$$y = mx + c$$

$$11 = \frac{1}{2} \times 1 + c \Rightarrow c = \frac{21}{2}$$

$$y = \frac{1}{2}x + \frac{21}{2}$$

$$\therefore x - 2y + 21 = 0$$

[6 marks]

Answer 12

$$x^2 + 4x - 5 = 3x + 1$$

$$x^2 + x - 6 = 0$$

$$(x + 3)(x - 2) = 0$$

$$\text{Either } x = -3 \text{ or } x = 2$$

Points of intersection are thus $(-3, -8)$, $(2, 7)$

$$\begin{aligned} D &= \sqrt{(7 - (-8))^2 + (2 - (-3))^2} \\ &= \sqrt{15^2 + 5^2} \\ &= \sqrt{250} \\ &= 5\sqrt{10} \quad (\text{about } 15.8) \end{aligned}$$

[6 marks]

Answer 13

$$(a) \quad 2x - 3y + 12 = 0 \Rightarrow y = \frac{2}{3}x + 4 \quad \therefore m = \frac{2}{3}$$

[1 mark]

$$(b) \quad A(-6, 0) \quad B(0, 4)$$

l_2 has a sign changed reciprocal gradient of $-\frac{3}{2}$ through $B(0, 4)$

$$\therefore y = -\frac{3}{2}x + 4$$

[3 marks]

$$(c) \quad C\left(\frac{8}{3}, 0\right)$$

$$\begin{aligned} \text{Area } \triangle ABC &= \frac{1}{2} \times \left(6 + \frac{8}{3}\right) \times 4 \\ &= \frac{1}{2} \times \frac{26}{3} \times 4 \\ &= \frac{52}{3} = 17\frac{1}{3} \end{aligned}$$

[4 marks]

Answer 14

$$(a) \quad m = \frac{8 - 2}{11 - (-1)} = \frac{6}{12} = \frac{1}{2}$$

$$y = mx + c$$

$$8 = \frac{1}{2} \times 11 + c \Rightarrow c = \frac{5}{2}$$

$$\therefore y = \frac{1}{2}x + \frac{5}{2}$$

[3 marks]

(b) l_2 has a sign changed reciprocal gradient of -2 through $R(10, 0)$

$$y = mx + c$$

$$0 = -2 \times 10 + c \Rightarrow c = 20$$

$\therefore y = -2x + 20$ is the equation of l_2

Intersection is when, $\frac{1}{2}x + \frac{5}{2} = -2x + 20$

multiply through by 2

$$x + 5 = -4x + 40$$

$$5x = 35$$

$$x = 7 \Rightarrow y = 6$$

$$\therefore S(7, 6)$$

[4 marks]

(c) $R(10, 0), S(7, 6)$

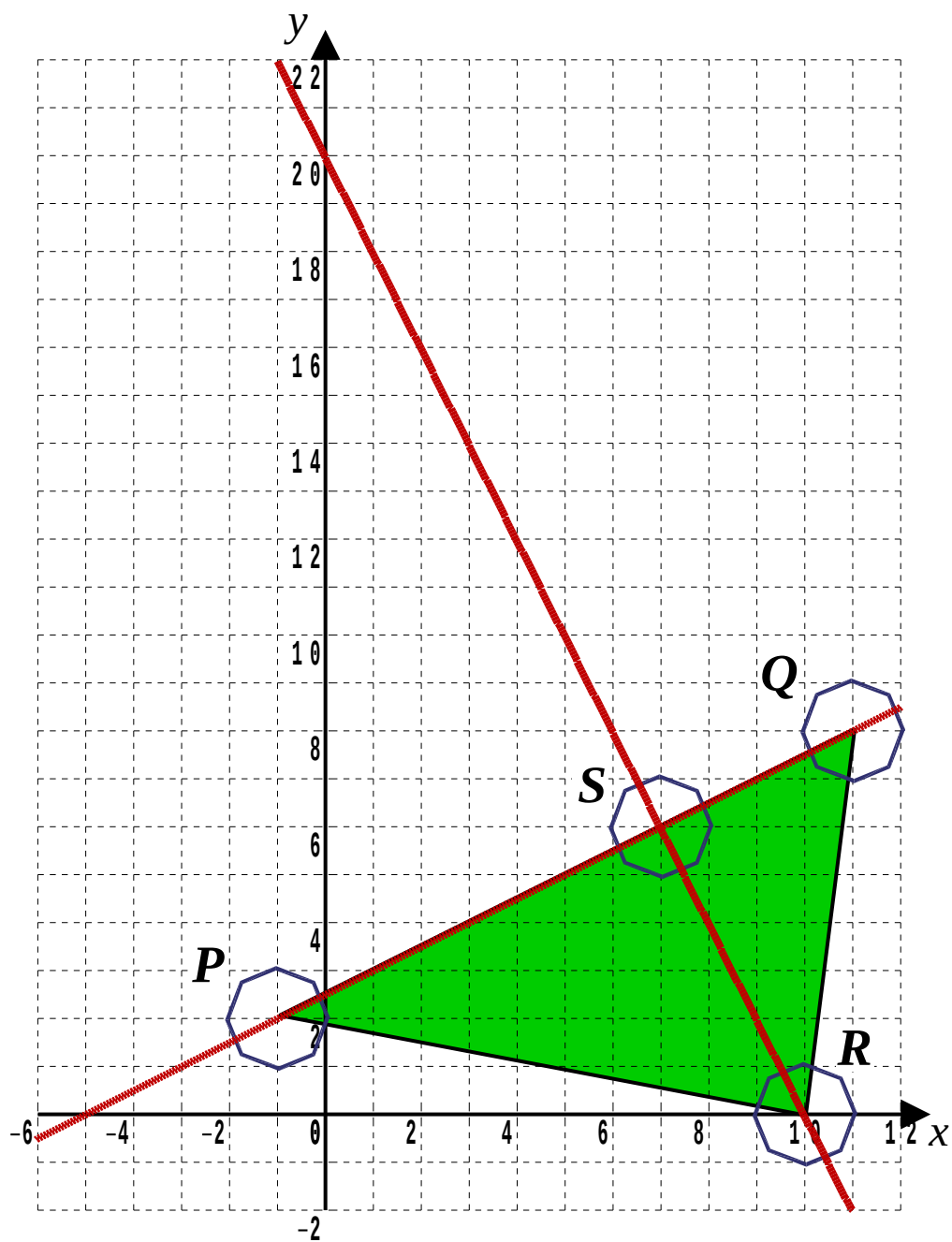
$$\begin{aligned} |RS| &= \sqrt{(7 - 10)^2 + (6 - 0)^2} \\ &= \sqrt{3^2 + 6^2} \\ &= \sqrt{45} \\ &= 3\sqrt{5} \quad \square \end{aligned}$$

[2 marks]

(d) $P(-1, 2), Q(11, 8)$

$$\begin{aligned} |PQ| &= \sqrt{(8 - 2)^2 + (11 - (-1))^2} \\ &= \sqrt{6^2 + 12^2} \\ &= \sqrt{180} \\ &= 6\sqrt{5} \quad \square \end{aligned}$$

A diagram is needed to properly see what is going on...



(d) $P(-1, 2)$, $Q(11, 8)$, $R(10, 0)$, $S(7, 6)$

$$\begin{aligned}
 \text{Area } \triangle PQR &= \frac{1}{2} \times |PQ| \times |RS| \\
 &= \frac{1}{2} \times 6\sqrt{5} \times 3\sqrt{5} \\
 &= 45
 \end{aligned}$$

[4 marks]

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