



EXAM PAPERS PRACTICE

GCSE Edexcel Math

1MA1

Perpendicular Lines

Answers

*"We will help you to
achieve A Star "*

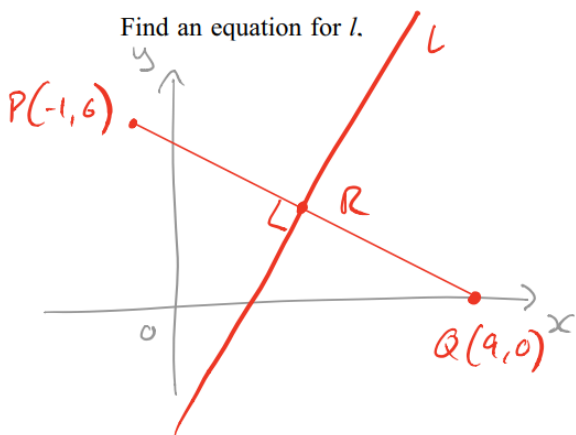


Answer 1

The points P and Q have coordinates $(-1, 6)$ and $(9, 0)$ respectively.

The line l is perpendicular to PQ and passes through the mid-point of PQ .

Find an equation for l .



$$R\left(\frac{-1+9}{2}, \frac{6+0}{2}\right) \text{ so } \underline{R(4, 3)}$$

$$\text{GRAD}_{PQ} = \frac{0-6}{9-(-1)} = \frac{-6}{10} = -\frac{3}{5}$$

$$m = \frac{5}{3} \quad (\text{SINCE } -\frac{3}{5} \times \frac{5}{3} = -1)$$

$$\text{EQN OF } l: y = \frac{5}{3}x + c$$

$$R(4, 3) : 3 = \frac{5}{3} \times 4 + c$$

$$\frac{9}{3} = \frac{20}{3} + c$$

$$-\frac{11}{3} = c$$

$$l: y = \frac{5}{3}x - \frac{11}{3}$$

Multiply both sides by 3

$$3y = 5x - 11$$

rearrange

$$\underline{5x - 3y - 11 = 0}$$

EQUATION OF A STRAIGHT LINE

$$y = mx + c$$

GRADIENT \uparrow \uparrow y-INTERCEPT

MIDPOINT

(AVERAGE POINT)

OF (x_1, y_1) AND (x_2, y_2)

$$\text{IS } \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

GRADIENT

$$m = \frac{\text{RISE}}{\text{RUN}}$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

FOR TWO POINTS

(x_1, y_1) AND (x_2, y_2)

PERPENDICULAR

GRADIENTS

MULTIPLY TO

GIVE -1



Answer 2

The line l_1 has equation $y = -2x + 3$

The line l_2 is perpendicular to l_1 and passes through the point (5, 6).

(a) Find an equation for l_2 .

(a) $m_1 = -2$ so $m_2 = \frac{1}{2}$ (since $-2 \times \frac{1}{2} = -1$)

PERPENDICULAR
GRADIENTS
MULTIPLY TO
GIVE -1

EQN OF l_2 : $y = \frac{1}{2}x + c$

(5, 6): $6 = \frac{1}{2} \times 5 + c$ so $c = \frac{7}{2}$

$l_2: y = \frac{1}{2}x + \frac{7}{2}$

Multiply both sides by 2

$2y = x + 7$

rearrange

$x - 2y + 7 = 0$

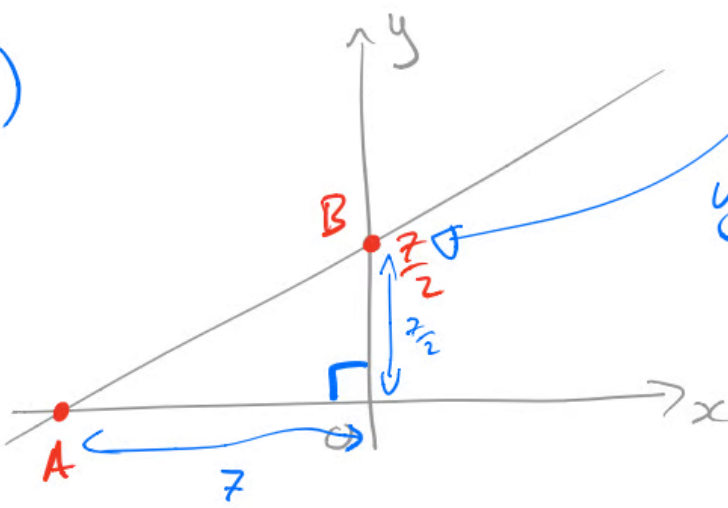
EQUATION OF A
STRAIGHT LINE

$y = m \cdot x + c$
↑ ↑
GRADIENT y-INTERCEPT



Answer 3

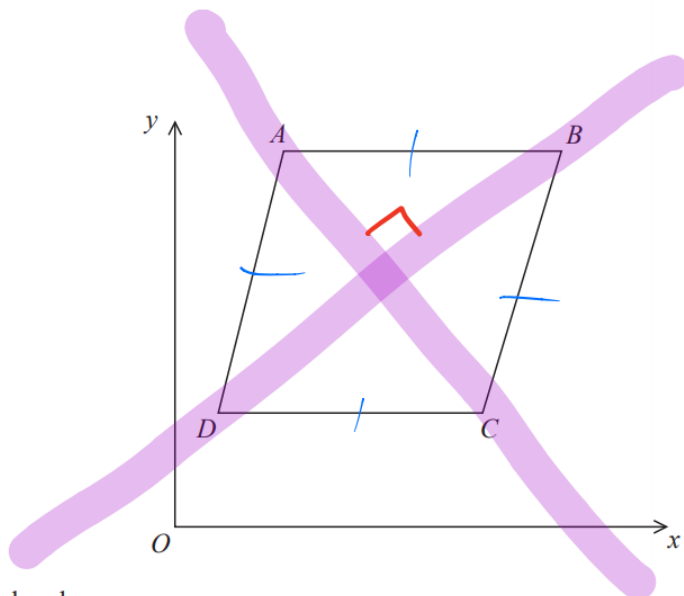
(b)



$$B: \underline{y = \frac{7}{2}}$$
$$y=0: A: 0 = \frac{1}{2}x + \frac{7}{2}$$
$$- \frac{7}{2} \qquad \qquad - \frac{7}{2}$$
$$2x - \frac{7}{1} = \frac{1}{1}x + \frac{7}{1}$$
$$\underline{\underline{2x = -7}}$$



Answer 4



$ABCD$ is a rhombus.

The coordinates of A are $(5, 11)$

The equation of the diagonal DB is $y = \frac{1}{2}x + 6$

Find an equation of the diagonal AC .

DIAGONALS OF A RHOMBUS MEET
AT RIGHT ANGLES

So

$$m \times \frac{1}{2} = -1$$

$$m = -2$$

AC: $y = -2x + c$

Use $A(5, 11)$ $11 = -2 \times 5 + c$

$$11 = -10 + c$$
$$+10 \quad +10$$

$$c = 21$$

EQUATION OF A
STRAIGHT LINE

$$y = m \cdot x + c$$

↑ ↑
GRADIENT y-INTERCEPT

PERPENDICULAR
GRADIENTS
MULTIPLY TO
GIVE -1



Answer 5

The line l_1 has equation $3x + 5y - 2 = 0$

(a) Find the gradient of l_1 .

(a) l_1 : $3x + 5y - 2 = 0$
 $-3x \quad +2 \quad -3x + 2$

$$\frac{5y}{5} = \frac{-3x + 2}{5}$$
$$y = -\frac{3}{5}x + \frac{2}{5}$$

So $m_1 = -\frac{3}{5}$

EQUATION OF A STRAIGHT LINE

$$y = mx + c$$

↑ ↑
GRADIENT y-INTERCEPT



Answer 6

(b) $m_1 = -\frac{3}{5}$ so $m_2 = \frac{5}{3}$ (SINCE $-\frac{3}{5} \times \frac{5}{3} = -1$)

EQUATION OF L_2 : $y = \frac{5}{3}x + c$

$(3, 1)$: $1 = \frac{5}{3} \times 3 + c$
 $-5 \quad -5$

$-4 = c$

L_2 : $y = \frac{5}{3}x - 4$

PERPENDICULAR
GRADIENTS
MULTIPLY TO
GIVE -1

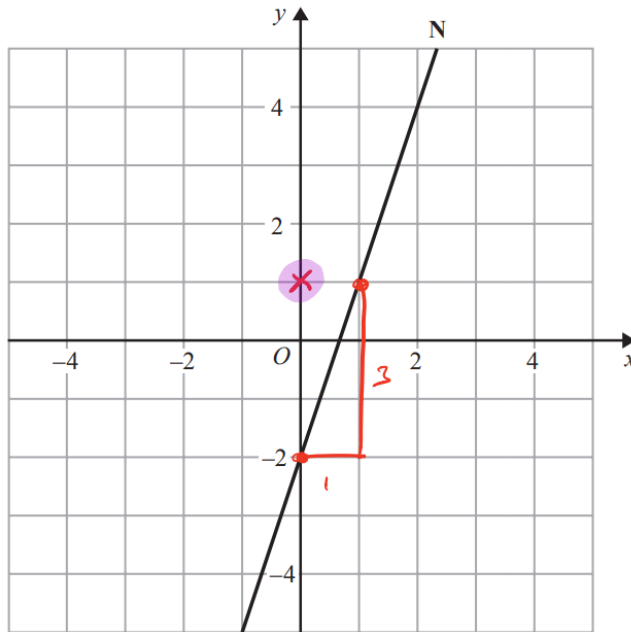


Answer 7

The line N is drawn below.

EQUATION OF A STRAIGHT LINE
 $y = mx + c$
↑ ↑
GRADIENT y-Intercept

PERPENDICULAR GRADIENTS MULTIPLY TO GIVE -1



$$\begin{aligned} \text{GRAD} &= \frac{\text{RISE}}{\text{RUN}} \\ &= \frac{3}{1} \\ &= 3 \end{aligned}$$

Find an equation of the line perpendicular to line N that passes through the point (0, 1).

$$\text{GRADIENT OF N} = 3$$

$$\text{PERPENDICULAR} \Rightarrow \frac{3}{3} + \frac{m}{3} = \frac{-1}{3}$$

$$\underline{m = -\frac{1}{3}}$$

$$\text{GOES THRU } (0, 1) \text{ SO } \underline{c = 1}$$

$$\text{EQUATION: } \underline{y = -\frac{1}{3}x + 1}$$



Answer 8

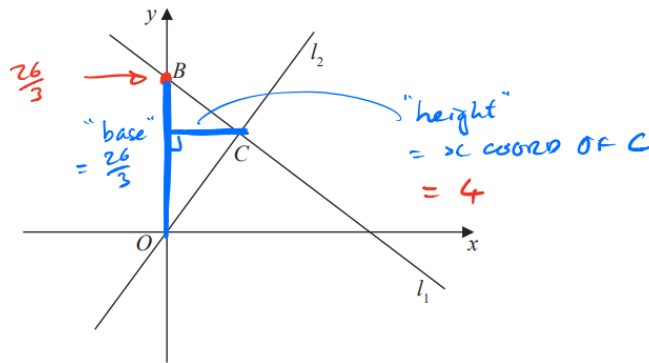


Figure 2

The line l_1 , shown in Figure 2 has equation $2x + 3y = 26$

The line l_2 passes through the origin O and is perpendicular to l_1

(a) Find an equation for the line l_2

$$\begin{aligned} \text{(a) } l_1: 2x + 3y &= 26 \\ -2x & \quad -2x \\ \hline 3y &= -2x + 26 \\ \frac{3y}{3} &= \frac{-2x + 26}{3} \\ y &= -\frac{2}{3}x + \frac{26}{3} \end{aligned}$$

$$\begin{aligned} \text{So } m_1 &= -\frac{2}{3} \quad \text{so } m_2 = \frac{3}{2} \\ (\text{SINCE } -\frac{2}{3} \times \frac{3}{2} &= -1) \end{aligned}$$

$$\begin{aligned} l_2: y &= \frac{3}{2}x \\ \text{C=O AS } l_2 &\text{ PASSES} \\ &\text{THROUGH } (0,0) \end{aligned}$$



Answer 9

The line L has equation $y = 5 - 2x$. $\rightarrow y = -2x + 5$

(a) Show that the point $P(3, -1)$ lies on L .

$$(a) \quad x = 3 : \quad y = -2 \times 3 + 5$$
$$y = -1$$

So $P(3, -1)$ LIES ON L .



Answer 10

$$(b) \text{ GRAD}_\perp = -2$$

$$\text{SO } m = \frac{1}{2} \text{ (SINCE } -2 \times \frac{1}{2} = -1)$$

$$\text{EQN: } y = \frac{1}{2}x + c$$

$$P(3, -1): \quad -1 = \frac{1}{2} \times 3 + c$$

$\quad \quad \quad -\frac{3}{2} \quad \quad -\frac{3}{2}$

$$-\frac{5}{2} = c$$

$$\text{EQN: } y = \frac{1}{2}x - \frac{5}{2}$$

$$2y = x - 5$$

$$\underline{x - 2y - 5 = 0}$$

Multiply both sides
by 2
rearrange

EQUATION OF A
STRAIGHT LINE

$$y = mx + c$$

↑ ↑
GRADIENT y-INTERCEPT

PERPENDICULAR
GRADIENTS
MULTIPLY TO
GIVE -1



Answer 12

(b) Find an equation of l_2 .

(b) $m_1 = \frac{2}{3}$ so $m_2 = -\frac{3}{2}$ (SINCE $-\frac{3}{2} \times \frac{2}{3} = -1$)

EQN OF l_2 : $y = -\frac{3}{2}x + 4$

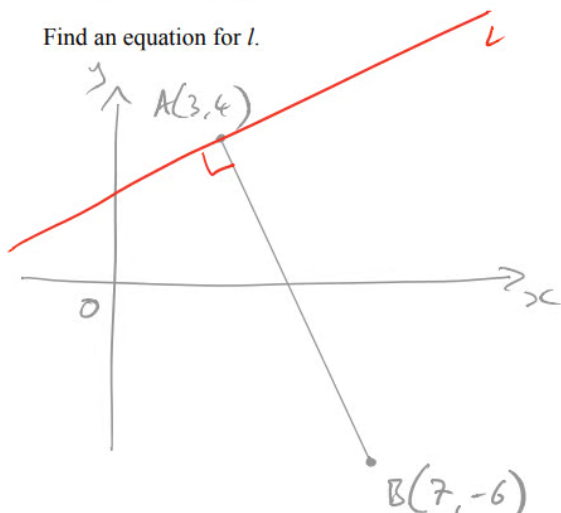
PERPENDICULAR
GRADIENTS
MULTIPLY TO
GIVE -1



Answer 13

The points A and B have coordinates $(3, 4)$ and $(7, -6)$ respectively. The straight line l passes through A and is perpendicular to AB .

Find an equation for l .



$$\text{GRAD}_{AB} = \frac{-6-4}{7-3} = \frac{-10}{4} = -\frac{5}{2}$$

$$\text{SO } m = \frac{2}{5} \text{ (SINCE } -\frac{5}{2} \times \frac{2}{5} = -1)$$

$$\text{EQN OF } l: y = \frac{2}{5}x + c$$

$$\begin{aligned} A(3, 4): \quad 4 &= \frac{2}{5} \times 3 + c \\ &\quad -\frac{6}{5} \qquad -\frac{6}{5} \\ \frac{14}{5} &= c \end{aligned}$$

$$\text{SO } l: y = \frac{2}{5}x + \frac{14}{5} \text{ Multiply both sides by 5}$$

$$5y = 2x + 14 \text{ rearrange}$$

$$\underline{2x - 5y + 14 = 0}$$

EQUATION OF A STRAIGHT LINE
 $y = mx + c$
↑ ↑
GRADIENT y-INTERCEPT

PERPENDICULAR GRADIENTS MULTIPLY TO GIVE -1

GRADIENT
 $m = \frac{\text{RISE}}{\text{RUN}}$
 $m = \frac{y_2 - y_1}{x_2 - x_1}$
FOR TWO POINTS (x_1, y_1) AND (x_2, y_2)



Answer 14

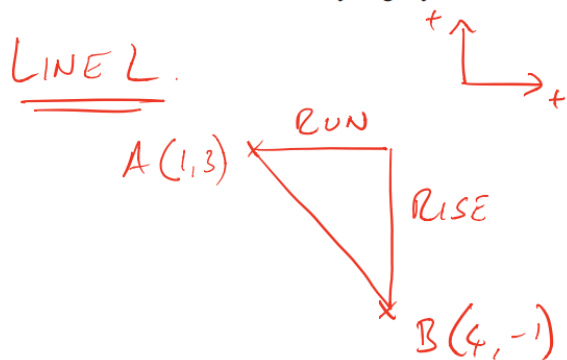
A is the point with coordinates (1, 3)

B is the point with coordinates (4, -1)

The straight line L goes through both A and B.

Is the line with equation $2y = 3x - 4$ perpendicular to line L?

You must show how you got your answer.



$$m = \frac{-1 - 3}{4 - 1}$$

$$= \frac{-4}{3}$$

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

$$y = \frac{3}{2}x - 2$$

$$m = \frac{3}{2}$$

MULTIPLY TOGETHER

$$\frac{-4}{3} \times \frac{3}{2} = -2 \neq -1 \text{ so NOT PERPENDICULAR}$$

EQUATION OF A
STRAIGHT LINE

$$y = mx + c$$

↑ ↑
GRADIENT y-Intercept

PERPENDICULAR
GRADIENTS
MULTIPLY TO
GIVE -1

GRADIENT

$$m = \frac{\text{RISE}}{\text{RUN}}$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

FOR TWO POINTS
(x_1, y_1) AND (x_2, y_2)



Answer15

The point P has coordinates $(3, 4)$

The point Q has coordinates (a, b)

A line perpendicular to PQ is given by the equation $3x + 2y = 7$

Find an expression for b in terms of a .

$$\text{GRAD}_{PQ} = \frac{b-4}{a-3}$$

$$3x + 2y = 7$$

$-3x$ $-3x$

$$\frac{2y}{2} = \frac{-3x + 7}{2}$$

$$y = -\frac{3}{2}x + \frac{7}{2}$$

$$m = -\frac{3}{2}$$

$$\text{GRAD}_{PQ} \times -\frac{3}{2} = -1$$

$$\text{GRAD}_{PQ} = \frac{2}{3}$$

$$\text{So } \frac{3(b-4)}{a-3} = \frac{2}{3} \times (a-3)$$

$$3(b-4) = 2(a-3)$$

$$3b - 12 = 2a - 6$$

$+12$ $+12$

$$\frac{3b}{3} = \frac{2a + 6}{3}$$

$$b = \frac{2a + 6}{3}$$

EQUATION OF A STRAIGHT LINE

$$y = mx + c$$

\uparrow \uparrow
GRADIENT y-INTERCEPT

PERPENDICULAR GRADIENTS MULTIPLY TO GIVE -1

GRADIENT

$$m = \frac{\text{RISE}}{\text{RUN}}$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

FOR TWO POINTS (x_1, y_1) AND (x_2, y_2)