1. The equation of the line L_1 is $y = 3x - 2$
The equation of the line L_2 is $3y - 9x + 5 = 0$

Show that these two lines are parallel.

parallel lines have the same gradient.

General equation of a straight line: $y = mx + c$

gradient

y-intercept

y-coordinate

x-coordinate

$L_1: y = 3x - 2$

$c = -2$ y-intercept

$m = 3$ gradient

$L_2: 3y - 9x + 5 = 0$ $\xrightarrow{-5}$

$3y - 9x = -5$ $\xrightarrow{+9x}$ (1)

$3y = -5 + 9x$

$3y = -5 + 9x$. $3y = 9x - 5$

(Total for Question is 2 marks)

$3y = 9x - 5$

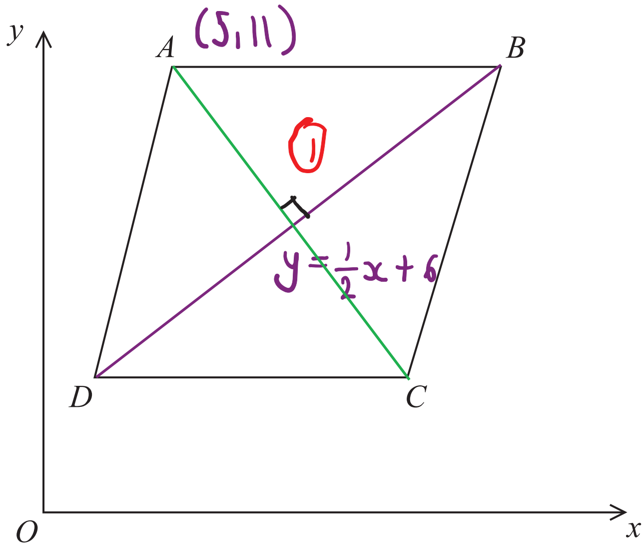
$\div 3$ $\quad y = 3x - \frac{5}{3}$ $\quad \div 3$

$L_1: y = 3x - 2$

$L_2: y = 3x - \frac{5}{3}$ (1)

L_1 and L_2 have the same gradient $\therefore$ they are parallel.

2.



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*.

when two lines are perpendicular, their gradients multiply to give an answer of −1.

$y = mx + c$. gradient of DB $= \frac{1}{2}$.
$\quad\;\,\downarrow$ gradient.

$\frac{1}{2} \times \boxed{} = -1$ gradient of AC $= -1 \div \frac{1}{2} = -2$. 1

$y = mx + c$. (5,11) lies on AC. 1

$y = 11$. $x = 5$. $m = -2$. $11 = -2(5) + c$. $11 = -10 + c$.

$c = 11 + 10 = 21$.

$y = -2x + 21$.

1 $y = -2x + 21$.

(Total for Question is 4 marks)

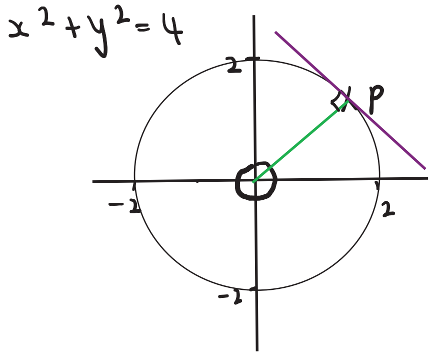
3. **L** is the circle with equation $x^2 + y^2 = 4$

$P\left(\frac{3}{2}, \frac{\sqrt{7}}{2}\right)$ is a point on **L**.

$x^2 + y^2 = r^2$. centre of circle = $(0,0)$

radius = 2.

Find an equation of the tangent to **L** at the point P.



Equation of OP:

$P = \left(\frac{3}{2}, \frac{\sqrt{7}}{2}\right)$. $O = (0,0)$.

$m_{OP} = \dfrac{\frac{\sqrt{7}}{2} - 0}{\frac{3}{2} - 0} = \dfrac{\sqrt{7}}{3}$ (1)

Gradient of tangent = m_t

$m_{OP} \times m_t = -1$.

$\dfrac{\sqrt{7}}{3} \times m_t = -1$.

$m_t = -\dfrac{3}{\sqrt{7}}$ (1)

Equation of tangent:

$y = mx + c$

$\dfrac{\sqrt{7}}{2} = -\dfrac{3}{\sqrt{7}}\left(\dfrac{3}{2}\right) + c$.

$\dfrac{\sqrt{7}}{2} = \dfrac{-9}{2\sqrt{7}} + c$.

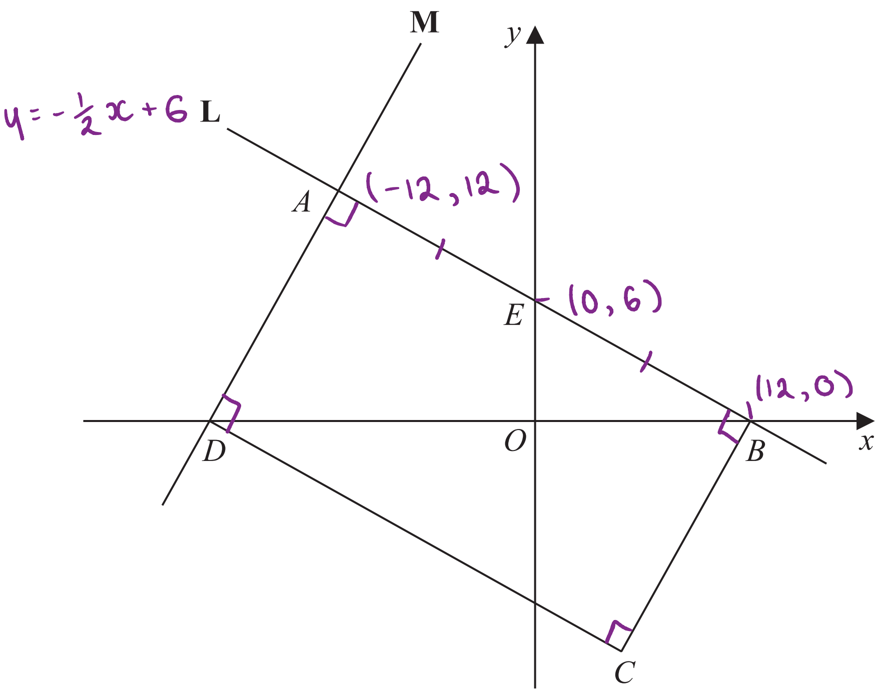
$c = \dfrac{8}{\sqrt{7}}$

$$\boxed{y = -\frac{3}{\sqrt{7}}x + \frac{8}{\sqrt{7}}}$$ (1)

$y = \dfrac{-3}{\sqrt{7}}x + \dfrac{8}{\sqrt{7}}$

(Total for Question is 3 marks)

4.



ABCD is a rectangle.

A, *E* and *B* are points on the straight line **L** with equation $x + 2y = 12$
A and *D* are points on the straight line **M**.

$AE = EB$

Find an equation for **M**.

$y = mx + c$ ← y-intercept
↑ gradient

Line M

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

$\div -\frac{1}{2} \qquad \div -\frac{1}{2}$

$m_M = 2$ ✓

$y = 2x + c$

$(12) = 2(-12) + c$

$12 = -24 + c$

$36 = c$

$y = 2x + 36$

Line L

$x + 2y = 12$

$(-x) \quad (-x)$

$2y = -x + 12$

$\div 2 \qquad \div 2$

$y = -\frac{1}{2}x + 6$ ✓

when $y = 0$

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

$\frac{1}{2}x = 6$

$x = 12$

$y = 2x + 36$ ✓✓

(Total for Question is 4 marks)

5. The straight line **L** has the equation $3y = 4x + 7$
The point A has coordinates $(3, -5)$

Find an equation of the straight line that is perpendicular to **L** and passes through A.

Line L : $3y = 4x + 7$

$y = \frac{4}{3}x + \frac{7}{3}$ (1)

perpendicular gradient is the negative reciprocal of the original gradient.

Negative reciprocal of $\frac{4}{3}$ is $-\frac{3}{4}$. (1)

New line : $y = -\frac{3}{4}x + c$

passes through $(3, -5)$ $\therefore$ $-5 = -\frac{3}{4}(3) + c$

$-5 = \frac{-9}{4} + c$

$\therefore c = \frac{-11}{4}$

$\therefore y = -\frac{3}{4}x - \frac{11}{4}$

(1) $y = -\frac{3}{4}x - \frac{11}{4}$

(Total for Question is 3 marks)

6. The straight line **L** has equation $3x + 2y = 17$

The point A has coordinates (0, 2)
The straight line **M** is perpendicular to **L** and passes through A.

Line **L** crosses the y-axis at the point B. ← B is y intercept
Lines **L** and **M** intersect at the point C.

Work out the area of triangle ABC.
You must show all your working.

$3x + 2y = 17$
$-3x \quad -3x$

$y = mx + c$ ← c: y intercept, m: gradient

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

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

Line L

$y = \frac{-3}{2}x + \frac{17}{2}$ 1

STEP 1

If lines are perpendicular their gradients are negative reciprocals of each other

Gradient of line L is $\frac{-3}{2}$

$\therefore$ the gradient of M is $\frac{2}{3}$ 1

We know M goes through $x = 0$ and $y = 2$

STEP 2

Using general equation of a line → $y - y_1 = m(x - x_1)$

$y - 2 = \frac{2}{3}(x - 0)$
$+2 \quad +2$

Line M

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

1

Point B is $(0, \frac{17}{2})$

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

$\frac{-3}{2}x = \frac{2}{3}x - \frac{13}{2}$
$-\frac{2}{3}x \quad -\frac{2}{3}x$

$\frac{-13}{6}x = -\frac{13}{2}$
$\times\frac{-6}{13} \quad \times\frac{-6}{13}$

$x = 3$

$y = \frac{2}{3}(3) + 2$
$= \frac{6}{3} + 2$
$= 2 + 2 = 4$

$y = 4$

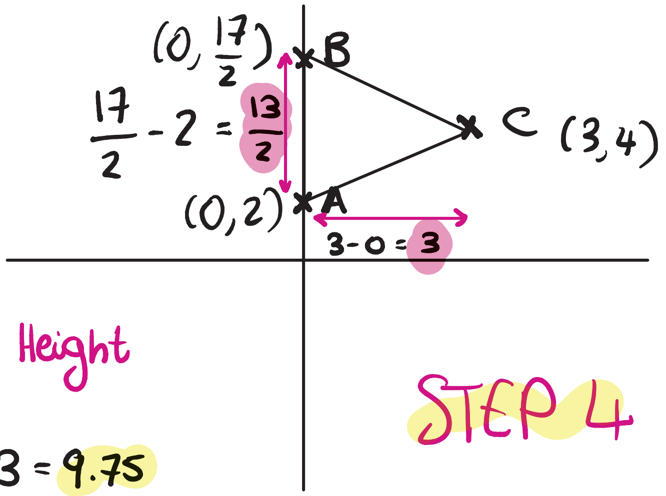
$\therefore$ Point C is $(3, 4)$

STEP 3 1

Point A is $(0, 2)$

Point B is $(0, \frac{17}{2})$

Point C is $(3, 4)$



STEP 4

Area Triangle $= \frac{1}{2} \times$ Base $\times$ Height

Area Triangle ABC $= \frac{1}{2} \times \frac{13}{2} \times 3 = 9.75$

1

7. The straight line L_1 has equation $y = 3x - 4$
The straight line L_2 is perpendicular to L_1 and passes through the point (9, 5)

Find an equation of line L_2

$m_{L_1} \times m_{L_2} = -1$

$3 \times m_{L_2} = -1$

$m_{L_2} = -\frac{1}{3}$ ✓1

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

at $x = 9$, $y = 5$

$5 = -\frac{1}{3} \times 9 + c$ ✓2

$5 = -3 + c$

$5 = -3 + c$ $\big\downarrow +3$

$c = 8$

$y = -\frac{1}{3}x + 8$ ✓3

....

(Total for Question is 3 marks)