

Perpendicular lines:

Perpendicular Line Gradients



Perpendicular lines cross at a right angle, and if you multiply their gradients together you'll get -1. Pretty nifty that.

If the gradient of the first line is m , the gradient of the other line will be $-\frac{1}{m}$, because $m \times -\frac{1}{m} = -1$.

Negative
reciprocal

$$\text{Ex: } m = 0.5 \rightarrow m = -\frac{1}{0.5} = -\frac{1}{\frac{1}{2}} = -1 \times \frac{2}{1} = -2$$

11 Line A has equation $y = 4x - 1$

Line B is

perpendicular to line A $\rightarrow m = -\frac{1}{4}$
and
passes through the point $(8, 5)$

Work out the coordinates of the point where line B intersects the x -axis.

$$y = -\frac{1}{4}x + c$$

$$5 = -\frac{1}{4}(\overset{2}{\cancel{8}}) + c$$

$$5 = -2 + c$$

$$c = 7$$

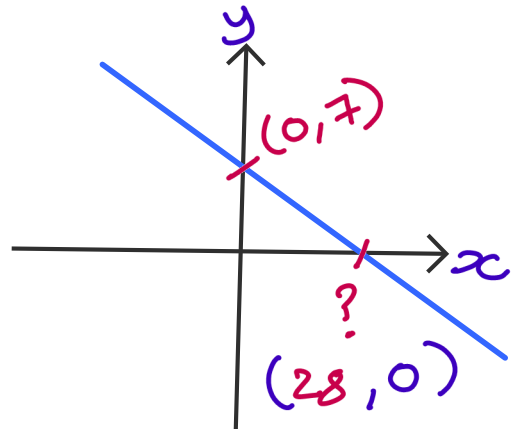
$$B: y = -\frac{1}{4}x + 7$$

$$0 = -\frac{1}{4}x + 7$$

$$(-4) - 7 = -\frac{1}{\cancel{4}}x \times (-\cancel{4})$$

$$x = 28$$

$$x\text{-int: } (28, 0)$$



- 10 The straight line **L** passes through point **A** $(-6, 2)$ and point **B** $(5, 3)$
 The straight line **M** is perpendicular to **L** and passes through the midpoint of **A** and **B**.
 The line **M** intersects the line $x = -1$ at point **C**.

Calculate the area of triangle **ABC**.

$$\text{Line L: } m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 2}{5 - (-6)} = \frac{1}{11}$$

$$\text{Line M: } m = -11$$

$$y = -11x + c$$

A $(-6, 2)$ and point **B** $(5, 3)$

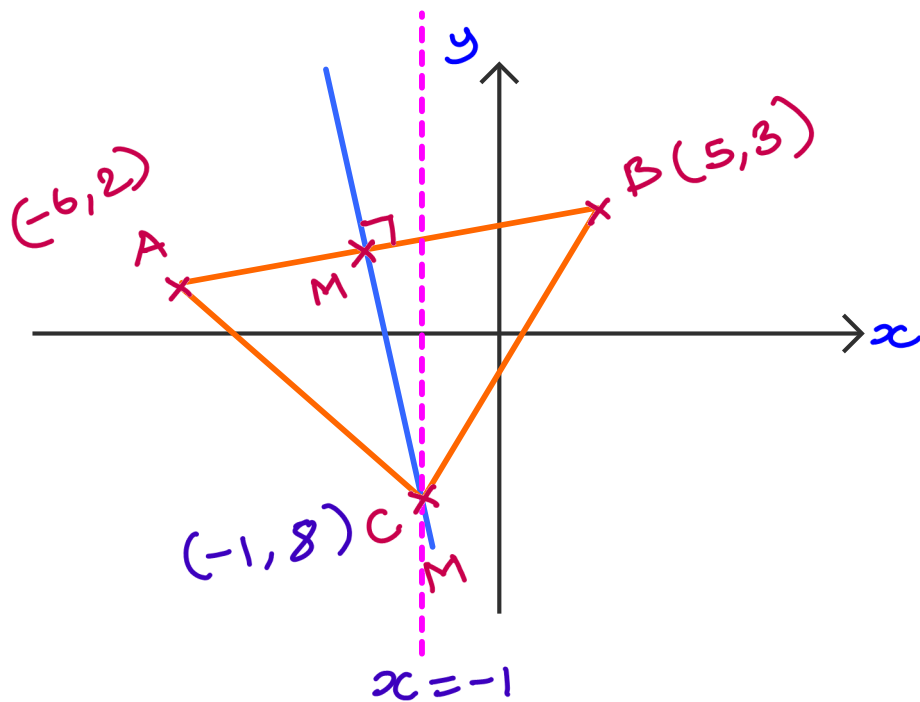
$$\text{Midpoint } \left(\frac{-6 + 5}{2}, \frac{2 + 3}{2} \right) = \left(-\frac{1}{2}, \frac{5}{2} \right)$$

$$\frac{5}{2} = -11\left(-\frac{1}{2}\right) + c$$

$$\frac{5}{2} = \frac{11}{2} + c$$

$$c = \frac{5}{2} - \frac{11}{2} = -3$$

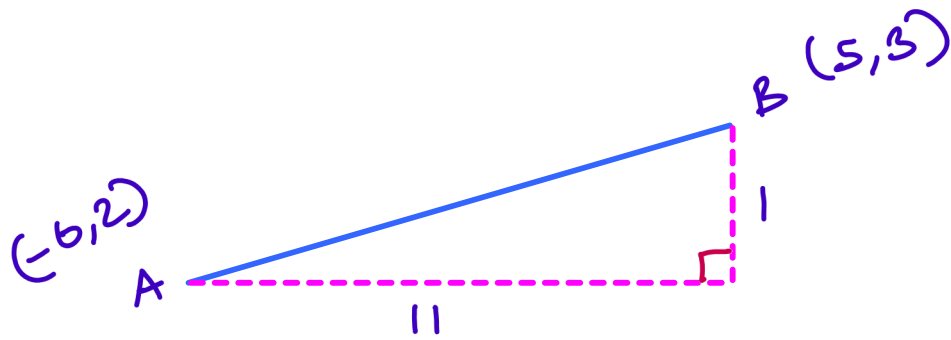
Line M: $y = -11x - 3$



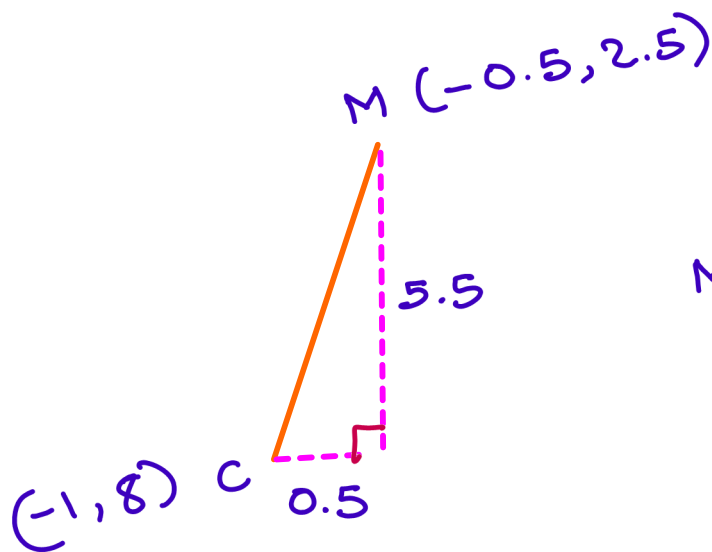
To find C,

$$y = -11x - 3$$

$$y = -11(-1) - 3 = 8$$



$$AB = \sqrt{11^2 + 1^2} = \sqrt{122} \text{ (base)}$$



$$\begin{aligned} MC &= \sqrt{0.5^2 + 5.5^2} \\ &= \sqrt{30.5} \text{ (height)} \end{aligned}$$

$$\begin{aligned} \text{Area } \triangle ABC &= \frac{1}{2} \times \sqrt{122} \times \sqrt{30.5} \\ &= 30.5 \text{ sq. units} \end{aligned}$$

9 L_1 and L_2 are two straight lines.

The origin of the coordinate axes is O .

L_1 has equation $5x + 10y = 8$

L_2 is perpendicular to L_1 and passes through the point with coordinates $(8, 6)$

L_2 crosses the x -axis at the point A .

L_2 intersects the straight line with equation $x = -3$ at the point B .

Find the area of triangle AOB .

Show your working clearly.

$$L_2: m = 2$$

$$y = 2x + c$$

$$6 = 2(8) + c$$

$$c = -10$$

$$y = 2x - 10$$

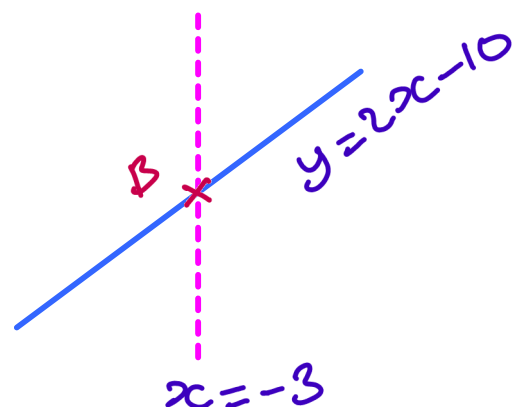
$$\text{point } A: y = 0, x = 5$$

$$A(5, 0)$$

$$\text{find } B: y = 2(-3) - 10$$

$$y = -16$$

$$B(-3, -16)$$



$$10y = -5x + 8$$

$$y = -\frac{1}{2}x + \frac{4}{5}$$

$$\text{Area} = \frac{1}{2} \times 5 \times \overset{8}{\cancel{16}}$$

$$= 40 \text{ sq. units}$$

