

# PERPENDICULAR LINES (EX 3E)

## SOLUTIONS

### Question 1

- a. If a line has a gradient equal to  $-1$ , what is the gradient of any line perpendicular to it? 1
- b. If a line has a gradient equal to  $3$ , what is the gradient of any line perpendicular to it?  $-\frac{1}{3}$
- c. If a line has a gradient equal to  $\frac{3}{5}$ , write down the gradient of any line perpendicular to it.  $-\frac{5}{3}$
- d. If a line has a gradient equal to  $-\frac{11}{17}$ , write down the gradient of any line perpendicular to it.  $\frac{17}{11}$
- e. If a line has a gradient equal to  $\frac{9}{4}$ , write down the gradient of any line perpendicular to it.  $-\frac{4}{9}$
- f. If a line has a gradient of  $6$ , write down the gradient of any line parallel to it. 6

### Question 2

A line is perpendicular to the line  $y = \frac{1}{5}x$  and passes through the point  $(2, 7)$ . Find the equation of this line.

$$m = -5$$

$$y = -5x + c$$

Sub.  $(2, 7)$

$$7 = -5 \times 2 + c$$

$$\therefore 7 = -10 + c$$

$$c = 17$$

$$\boxed{y = -5x + 17}$$

### Question 3

A line is perpendicular to the line with equation:  $y = \frac{-7x}{4} + 3$ , and passes through the point  $(-14, 6)$ . Find the equation of this line.

$$m = \frac{4}{7}$$

$$y = \frac{4}{7}x + c$$

Sub.  $(-14, 6)$

$$6 = \frac{4}{7} \times -14 + c$$

$$6 = 4x - 2 + c$$

$$6 = -8 + c$$

$$c = 14$$

$$\boxed{\therefore y = \frac{4x}{7} + 14}$$

### Question 4

A line is perpendicular to the line  $y = 2x + 10$  and has an x-intercept at  $(12, 0)$ . Find the equation of this line.

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

Sub.  $(12, 0)$   $y = -\frac{1}{2}x + c$

$$0 = -\frac{1}{2} \times 12 + c$$

$$0 = -6 + c$$

$$c = 6$$

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

### Question 5

Consider the line with equation:  $2y + 5x = 10$ .

a. Write this equation in the form:  $y = mx + c$ .

$$y = \frac{10 - 5x}{2} \quad \text{or: } y = 5 - \frac{5x}{2}$$

b. State the gradient of this line.

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

c. State the gradient of any line perpendicular to the line  $2y + 5x = 10$ .

$$\frac{2}{5}$$

d. A line L is perpendicular to  $2y + 5x = 10$  and passes through the point  $(20, -11)$ . Find its equation.

$$y = \frac{2}{5}x + c$$

Sub.  $(20, -11)$   $\therefore -11 = \frac{2}{5} \times 20 + c$

$$-11 = 8 + c$$

$$\therefore c = -19$$

$$y = \frac{2}{5}x - 19$$

### Question 6

Find the equation of a line which is parallel to the line  $y = 4x + 9$ , and which passes through the point  $(-1, 2)$ .

$$m = 4$$

$$y = 4x + c$$

Sub.  $(-1, 2)$   $2 = 4 \times -1 + c$

$$c = 6$$

$$y = 4x + 6$$

### Question 7

a. Let  $A = (2, 11)$  and  $B = (-1, 5)$ . Use the gradient formula to find the gradient of the line segment connecting A and B.

$$m = \frac{5 - 11}{-1 - 2} = \frac{-6}{-3} = 2$$

Gradients are negative reciprocals

b. Let  $C = (6, 9)$ . Prove that the line segment connecting A to C is perpendicular to the line segment AB.  $A = (2, 11), C = (6, 9)$

$$\frac{9 - 11}{6 - 2} = \frac{-2}{4} = -\frac{1}{2}$$

$\therefore$  Line AC is perpendicular to AB.