EQUATION OF A LINE – SUBSTITUTION

Task 1 – For each of the following, write your answer in the form $y = mx + c$.

1) **Work out the equation of the straight line with a gradient of 2 that passes through the point $(0, 8)$.**

$$\boldsymbol{y = 2x + 8}$$

2) **Work out the equation of the straight line with a gradient of 1 that passes through the point $(0, -9)$.**

$$\boldsymbol{y = x - 9}$$

3) **Work out the equation of the straight line with a gradient of 4 that passes through the point $(8, 10)$.**

$$m = 4 \quad (8, 10)$$

$$y = mx + c$$
$$10 = 4(8) + c$$
$$10 = 32 + c$$
$$c = -22$$

$$\boldsymbol{y = 4x - 22}$$

4) **Work out the equation of the straight line with a gradient of 2 that passes through the point $(1, 7)$.**

$$m = 2 \quad (1, 7)$$

$$y = mx + c$$
$$7 = 2(1) + c$$
$$7 = 2 + c$$
$$c = 5$$

$$\boldsymbol{y = 2x + 5}$$

5) **Work out the equation of the straight line with a gradient of $\frac{1}{2}$ that passes through the point $(-5, 6)$.**

$$m = \frac{1}{2} \quad (-5, 6)$$

$$y = mx + c$$
$$6 = \frac{1}{2}(-5) + c$$
$$6 = -\frac{5}{2} + c$$
$$c = \frac{17}{2}$$

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

6) **Work out the equation of the straight line with a gradient of -4 that passes through the point $(-6, -12)$.**

$$m = -4 \quad (-6, -12)$$

$$y = mx + c$$
$$-12 = -4(-6) + c$$
$$-12 = 24 + c$$
$$c = -36$$

$$\boldsymbol{y = -4x - 36}$$

7) **Work out the equation of the straight line with a gradient of $\frac{1}{3}$ that passes through the point $(9, 0)$.**

$$m = \frac{1}{3} \quad (9, 0)$$

$$y = mx + c$$
$$0 = \frac{1}{3}(9) + c$$
$$0 = 3 + c$$
$$c = -3$$

$$\boldsymbol{y = \frac{1}{3}x - 3}$$

8) Work out the equation of the straight line with a gradient of $\frac{3}{2}$ that passes through the point $(14, -6)$.

$$m = \frac{3}{2} \quad (14, -6)$$

$$y = mx + c$$

$$-6 = \frac{3}{2}(14) + c$$

$$-6 = 21 + c$$

$$c = -27$$

$$\boldsymbol{y = \frac{3}{2}x - 27}$$

9) Work out the equation of the straight line with a gradient of -1 that passes through the point $(-10, -4)$.

$$m = -1 \quad (-10, -4)$$

$$y = mx + c$$

$$-4 = -1(-10) + c$$

$$-4 = 10 + c$$

$$c = -14$$

$$\boldsymbol{y = -x - 14}$$

10) Work out the equation of the straight line with a gradient of $-\frac{2}{3}$ that passes through the point $(3, -5)$.

$$m = -\frac{2}{3} \quad (3, -5)$$

$$y = mx + c$$

$$-5 = -\frac{2}{3}(3) + c$$

$$-5 = -2 + c$$

$$c = -3$$

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

Task 2 – For each of the following write your answer in the form $y = mx + c$.

11) Work out the equation of the straight line that passes through the points $(0, 1)$ and $(7, 8)$.

$$m = \frac{8 - 1}{7 - 0} = \frac{7}{7} = 1$$

$$\boldsymbol{y = x + 1}$$

12) Work out the equation of the straight line that passes through the points $(10, 20)$ and $(25, 30)$.

$$m = \frac{30 - 20}{25 - 10} = \frac{10}{15} = \frac{2}{3}$$

$$m = \frac{2}{3} \quad (10, 20)$$

$$y = mx + c$$

$$20 = \frac{2}{3}(10) + c$$

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

$$c = \frac{40}{3}$$

$$\boldsymbol{y = \frac{2}{3}x + \frac{40}{3}}$$

13) Work out the equation of the straight line that passes through the points $(-5, 4)$ and $(-9, 5)$.

$$m = \frac{5 - 4}{-9 - -5} = -\frac{1}{4}$$

$$m = -\frac{1}{4} \quad (-5, 4)$$

$$y = mx + c$$

$$4 = -\frac{1}{4}(-5) + c$$

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

$$c = \frac{21}{4}$$

$$\boldsymbol{y = -\frac{1}{4}x + \frac{21}{4}}$$

14) Work out the equation of the straight line that passes through the points $(2,3)$ and $(4,6)$.

$$m = \frac{6-3}{4-2} = \frac{3}{2}$$

$$m = \frac{3}{2} \quad (2,3)$$

$$y = mx + c$$

$$3 = \frac{3}{2}(2) + c$$

$$3 = 3 + c$$

$$c = 0$$

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

15) Work out the equation of the straight line that passes through the points $(6,-2)$ and $(-8,-12)$.

$$m = \frac{-12--2}{-8-6} = \frac{-10}{-14} = \frac{5}{7}$$

$$m = \frac{5}{7} \quad (6,-2)$$

$$y = mx + c$$

$$-2 = \frac{3}{2}(6) + c$$

$$-2 = 9 + c$$

$$c = -11$$

$$\boldsymbol{y = \frac{5}{7}x - 11}$$

16) Work out the equation of the straight line that passes through the points $(5,2)$ and $(9,-2)$.

$$m = \frac{-2-2}{9-5} = \frac{-4}{4} = -1$$

$$m = -1 \quad (5,2)$$

$$y = mx + c$$

$$2 = -1(5) + c$$

$$2 = -5 + c$$

$$c = 7$$

$$\boldsymbol{y = -x + 7}$$

17) Work out the equation of the straight line that passes through the points $(14,12)$ and $(-6,2)$.

$$m = \frac{2-12}{-6-14} = \frac{-10}{-20} = \frac{1}{2}$$

$$m = \frac{1}{2} \quad (14,12)$$

$$y = mx + c$$

$$12 = \frac{1}{2}(14) + c$$

$$12 = 7 + c$$

$$c = 5$$

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

18) Work out the equation of the straight line that passes through the points $(5,-5)$ and $(9,7)$.

$$m = \frac{7--5}{9-5} = \frac{12}{4} = 3$$

$$m = 3 \quad (5,-5)$$

$$y = mx + c$$

$$-5 = 3(5) + c$$

$$-5 = 15 + c$$

$$c = -20$$

$$\boldsymbol{y = 3x - 20}$$

Task 3

19) Does the straight line with equation $y = 2x + 8$, pass through the point $(4,16)$?

$$y = 2x + 8$$

$$2(4) + 8 = 16 \checkmark$$

Yes

20) Does the straight line with equation $y = -\frac{1}{3}x + 12$, pass through the point $(15,6)$?

$$y = -\frac{1}{3}x + 12$$

$$-\tfrac{1}{3}(15) + 12 = 7 \quad \textbf{(y-coordinate is 6)}$$

No

21) Does the straight line with equation $y = -x + 10$ pass through the point $(10, 0)$?

$$y = -x + 10$$

$$-10 + 10 = 0 \checkmark$$

Yes

22) Does the straight line with equation $y = 12 - 3x$ pass through the point $(5, -6)$?

$$y = 12 - 3x$$

$$12 - 3(5) = -3$$ **(y-coordinate is -6)**

No

Challenge

23) Write down the equation of the straight line that passes through the points $(9, 8)$ and $(-1, 14)$. Give your answer in the form $ax + by + c = 0$, where a, b and c are integers.

$$m = \frac{14 - 8}{-1 - 9} = -\frac{6}{10} = -\frac{3}{5}$$

$$m = -\frac{3}{5} \quad (9, 8)$$

$$y = mx + c$$

$$8 = -\frac{3}{5}(9) + c$$

$$8 = -\frac{27}{5} + c$$

$$c = \frac{67}{5}$$

$$y = -\frac{3}{5}x + \frac{67}{5}$$

$\times 5$ $\times 5$

$$5y = -3x + 67$$

$$\mathbf{3x + 5y - 67 = 0}$$

24) A straight line passes through the points $(4, 2)$ and $(8, 7)$. Work out the coordinates of the x-intercept of the line.

Work out the equation of the line

$$m = \frac{7 - 2}{8 - 4} = \frac{5}{4}$$

$$m = \frac{5}{4} \quad (4, 2)$$

$$y = mx + c$$

$$2 = \frac{5}{4}(4) + c$$

$$2 = 5 + c$$

$$c = -3$$

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

Substitute y = 0 to work out the x-intercept:

$$0 = \frac{5}{4}x - 3$$

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

$$x = \frac{12}{5}$$

$$\mathbf{\left(\frac{12}{5}, 0\right)}$$