Parallel and Perpendicular lines

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Find the equation of line.

// parallel   same slope

⊥ perpendicular $\frac{a}{b} \perp -\frac{b}{a}$ $\frac{a}{b} \times \frac{-b}{a}$ $\frac{-ab}{ab} = -1$

**Eg 1) Find the slope of the line $2x+y-4=0$
Hence find the** ==equation of the line== **through
the point $(2,4)$ which is parallel to the given line.**

when given the equation of the line
use the $y=mx+c$ to find the slope.

$m = $ slope   Point $(\overset{x_1\ y_1}{2, 4})$

$2x+y-4=0$ **Slope = $\overset{m}{-2}$**

$\begin{array}{c|c|c} -2x & y - 4 = -2x & -2x \\ +4 & y = \boxed{-2}x + 4 & +4 \end{array}$

Equation of line
$y - y_1 = m(x - x_1)$

$y = mx + c$

$y - 4 = -2(x - 2)$

$y - 4 = -2x + 4$

$\begin{array}{c|c|c} +2x & 2x + y - 4 = +4 & +2x \\ -4 & 2x + y - 8 = 0 & -4 \end{array}$

Ans = $2x + y - 8 = 0$

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Example 1

Find the equation of the line through the point $(-2, 3)$ which is perpendicular to the line $2x - y + 5 = 0$.

Exercise 11.5

1. Find the slope of the line $2x + y - 4 = 0$.

Now find the equation of the line through the point $(2, 4)$ and which is parallel to the line $2x + y - 4 = 0$.

2. Find the equation of the line through the point $(\overset{x_1 \ \ y_1}{1, \ -6})$ and which is parallel to the line $3x - y + 4 = 0$.

$$\text{Slope} = \quad y = mx + c$$

$$3x - y + 4 = 0$$

$$\overset{+y}{} \Big| \ \underset{m}{3}x + 4 = y \ \Big|^{+y}$$

$$m = 3 \quad \text{slope}$$

$$\text{Equ of line}$$

$$y - y_1 = m(x - x_1)$$

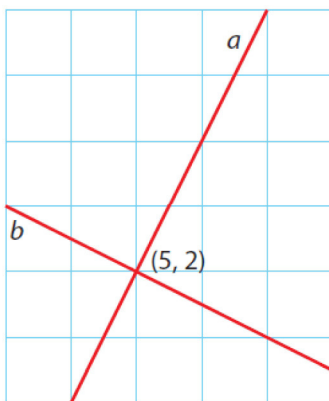**3.** Find the slope of the line $2x - 3y + 1 = 0$.

What is the slope of any line perpendicular to $2x - 3y + 1 = 0$?

Now find the equation of the line through the point $(4, -1)$ and which is perpendicular to the line $2x - 3y + 1 = 0$.

4. Find the equation of the line through $(-2, 1)$ and which is perpendicular to the line $3x + 2y - 4 = 0$.

5. Find the equation of the line through $(-4, 0)$ and which is parallel to the line $y = 3x - 5$.
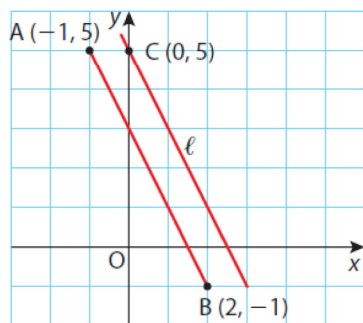
6. The given diagram shows the lines a and b intersecting at the point (5, 2).

(i) Use the grid to find the slopes of a and b.

(ii) Investigate if a and b are perpendicular to each other.

(iii) Find the equation of the line a.

7. The given diagram shows the points A($-1, 5$), B($2, -1$) and C($0, 5$).

The line ℓ is parallel to AB and contains the point C.

Find the equation of ℓ.

8. Which one of the following lines is parallel to $3x + y - 4 = 0$?

A: $y = 3x - 2$ B: $y = \frac{1}{3}x + 4$ C: $6x + 2y + 7 = 0$ D: $x + 3y + 2 = 0$

9. The point A has coordinates $(1, 7)$ and the point B has coordinates $(3, 1)$.
The midpoint of [AB] is P.
Find the coordinates of P.
Now find the equation of the line which passes through P and which is perpendicular to the line $x + 5y - 7 = 0$.

10. The line $y = 2x + 5$ intersects the y-axis at the point P.

    (i) Write down the slope of the line and the coordinates of P.
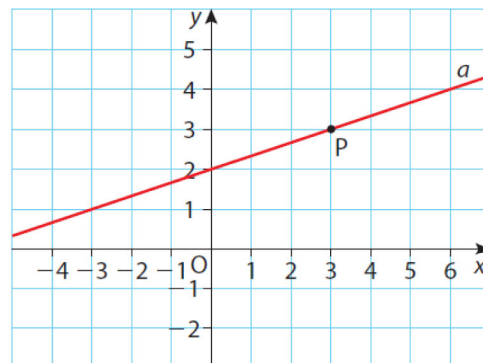
    (ii) Find the equation of the line through P and which is perpendicular to $y = 2x + 5$.

11. Use the grid in the given diagram to write down the slope of the line a. Now write down the equation of a in the form $y = mx + c$.

Write down the coordinates of the point P and hence find the equation of the line through P which is perpendicular to a.

12. The equation of the line AB is $5x - 3y = 26$.

  (i) Find the slope of AB.

  (ii) The point A has coordinates $(4, -2)$ and a point C has coordinates $(-6, 4)$.

    (a) Prove that AC is perpendicular to AB.

    (b) Find the equation of the line AC, expressing your answer in the form $ax + by = c$.

Answers

Exercise 11.5

1. -2; $2x + y - 8 = 0$
2. $3x - y - 9 = 0$
3. $\frac{2}{3}$; $-\frac{3}{2}$; $3x + 2y - 10 = 0$
4. $2x - 3y + 7 = 0$
5. $3x - y + 12 = 0$
6.   (i) Slope a: 2, Slope b: $-\frac{1}{2}$
     (ii) Yes, perpendicular
     (iii) $2x - y - 8 = 0$
7. $2x + y - 5 = 0$
8. C
9. $(2, 4)$; $5x - y - 6 = 0$
10.   (i) Slope: 2, P(0, 5)   (ii) $x + 2y - 10 = 0$
11. $\frac{1}{3}$; $y = \frac{1}{3}x + 2$; P(3, 3); $y = -3x + 12$
12.   (i) $\frac{5}{3}$ (ii) (b) $3x + 5y = 2$