

### Exercise 14(D)

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1. Find the slope and y-intercept of the line:

(i)  $y = 4$

(ii)  $ax - by = 0$

(iii)  $3x - 4y = 5$

**Solution:**

(i)  $y = 4$

On comparing the given equation with  $y = mx + c$ , we get

$$\text{Slope} = m = 0$$

$$y\text{-intercept} = c = 4$$

(ii)  $ax - by = 0 \Rightarrow by = ax \Rightarrow y = (a/b)x$

On comparing the above equation with  $y = mx + c$ , we get

$$\text{Slope} = m = a/b$$

$$y\text{-intercept} = c = 0$$

(iii)  $3x - 4y = 5 \Rightarrow 4y = 3x - 5 \Rightarrow y = \frac{3}{4}x - \frac{5}{4}$

On comparing the above equation with  $y = mx + c$ , we get

$$\text{Slope} = m = \frac{3}{4}$$

$$y\text{-intercept} = c = -\frac{5}{4}$$

2. The equation of a line  $x - y = 4$ . Find its slope and y-intercept. Also, find its inclination.

**Solution:**

Given equation of a line:  $x - y = 4$

$$\Rightarrow y = x - 4$$

Comparing the above equation with  $y = mx + c$ , we get

$$\text{Slope} = m = 1$$

$$y\text{-intercept} = c = -4$$

Let the inclination be  $\theta$ .

$$\text{Slope} = 1 = \tan \theta = \tan 45^\circ$$

$$\theta = 45^\circ$$

3. (i) Is the line  $3x + 4y + 7 = 0$  perpendicular to the line  $28x - 21y + 50 = 0$ ?

(ii) Is the line  $x - 3y = 4$  perpendicular to the line  $3x - y = 7$ ?

(iii) Is the line  $3x + 2y = 5$  parallel to the line  $x + 2y = 1$ ?

(iv) Determine  $x$  so that the slope of the line through  $(1, 4)$  and  $(x, 2)$  is 2.

**Solution:**

(i) Given,

$$3x + 4y + 7 = 0$$

$$\Rightarrow 4y = -3x - 7$$

$$\Rightarrow y = (-\frac{3}{4})x - \frac{7}{4}$$

$$\text{Slope of this line} = -\frac{3}{4}$$

And, for

$$28x - 21y + 50 = 0$$

$$\Rightarrow 21y = 28x + 50$$

$$\Rightarrow y = (28/21)x + 50/21$$

$$\Rightarrow y = (4/3)x + 50/21$$

Slope of this line =  $4/3$

As, the product of slopes of the two lines =  $4/3 \times -3/4 = -1$

Therefore, the lines are perpendicular to each other.

(ii) Given,

$$x - 3y = 4$$

$$\Rightarrow 3y = x - 4$$

$$\Rightarrow y = (1/3)x - 4/3$$

So, the slope of this line =  $1/3$

And, for

$$3x - y = 7$$

$$y = 3x - 7$$

So, the slope of this line =  $3$

Now, the slopes of the two lines =  $1/3 \times 3 = 1$  and not equal to  $-1$ .

Hence, the lines are not perpendicular to each other.

(iii) Given,

$$3x + 2y = 5$$

$$2y = -3x + 5$$

$$y = (-3/2)x + 5/2$$

So, the slope of this line =  $-3/2$

And, for

$$x + 2y = 1$$

$$2y = -x + 1$$

$$y = -1/2x + 1/2$$

So, the slope of this line =  $-1/2$

The slopes of the two lines are not equal.

Hence, the lines are not parallel to each other.

(iv) Given, the slope of the line through  $(1, 4)$  and  $(x, 2)$  is  $2$ .

So,

$$\frac{2 - 4}{x - 1} = 2$$

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

$$\frac{-1}{x - 1} = 1$$

$$-1 = x - 1$$

$$x = 0$$

4. Find the slope of the line which is parallel to:

(i)  $x + 2y + 3 = 0$       (ii)  $x/2 - y/3 - 1 = 0$

**Solution:**

(i)  $x + 2y + 3 = 0$

$$2y = -x - 3$$

$$y = -1/2x - 3/2$$

Slope of this line =  $-1/2$

Thus, slope of the line which is parallel to the given line = slope of the given line =  $-1/2$

(ii)  $x/2 - y/3 - 1 = 0$

$$y/3 = x/2 - 1$$

$$y = (3/2)x - 3$$

So, the slope of this line =  $3/2$

Thus, slope of the line which is parallel to the given line = Slope of the given line =  $3/2$

5. Find the slope of the line which is perpendicular to:

(i)  $x - y/2 + 3 = 0$       (ii)  $x/3 - 2y = 4$

**Solution:**

(i)  $x - y/2 + 3 = 0$

$$y/2 = x + 3$$

$$y = 2x + 6$$

So, the slope of this line = 2

We know that,

Slope of the line which is perpendicular to the given line =  $-1/(\text{Slope of the given line}) = -1/2$

(ii)  $x/3 - 2y = 4$

$$2y = x/3 - 4$$

$$y = x/6 - 2$$

So, the slope of this line =  $1/6$

We know that,

Slope of the line which is perpendicular to the given line =  $-1/(\text{Slope of the given line}) = -1/(1/6) = -6$

6. (i) Lines  $2x - by + 3 = 0$  and  $ax + 3y = 2$  are parallel to each other. Find the relation connecting a and b.

(ii) Lines  $mx + 3y + 7 = 0$  and  $5x - ny - 3 = 0$  are perpendicular to each other. Find the relation connecting m and n.

**Solution:**

(i) We know that, if two lines are parallel then, the slopes of the two lines must be equal.

For,  $2x - by + 3 = 0$

$$by = 2x + 3$$

$$y = (2/b)x + 3/b$$

So, the slope of this line =  $2/b$

And,  $ax + 3y = 2$

$3y = -ax + 2$

$y = (-a/3)x + 2/3$

So, the slope of this line =  $-a/3$

Now, equating the slopes we get

$2/b = -a/3$

$ab = -6$

- (ii) We know that, if two lines are perpendicular to each other then, the product of their slopes =  $-1$ .

For,  $mx + 3y + 7 = 0$

$3y = -mx - 7$

$y = -m/3x - 7/3$

Slope of this line =  $-m/3$

And,  $5x - ny - 3 = 0$

$ny = 5x - 3$

$y = (5/n)x - 3/n$

Slope of this line =  $5/n$

Products of slopes is

$(-m/3) \times (5/n) = -1$

$5m = 3n$

- 7. Find the value of p if the lines, whose equations are  $2x - y + 5 = 0$  and  $px + 3y = 4$  are perpendicular to each other.**

**Solution:**

Given line equations,

$2x - y + 5 = 0$  .... (1)

$y = 2x + 5$  ..... (2)

Now,

Slope of line (2) = 2

Then, (2) can be rewritten as

$3y = -px + 4$

$y = (-p/3)x + 4/3$

So, the slope of this line =  $-p/3$

For 2 lines to be perpendicular to each other, the product of their slopes must be  $-1$ .

So,

$(2) \times (-p/3) = -1$

$2p/3 = 1$

$p = 3/2$

- 8. The equation of a line AB is  $2x - 2y + 3 = 0$ .**

**(i) Find the slope of the line AB.**

**(ii) Calculate the angle that the line AB makes with the positive direction of the x-axis.**

**Solution:**

- (i) Given, equation of the line

$$2x - 2y + 3 = 0$$

$$2y = 2x + 3$$

$$y = x + (3/2)$$

So, the slope of the line AB = 1

(ii) Required to find the angle of the line AB =  $\theta$

We have,

$$\text{Slope} = \tan \theta = 1$$

$$\text{And, } \tan 45^\circ = 1$$

$$\text{Hence, } \theta = 45^\circ$$

**9. The lines represented by  $4x + 3y = 9$  and  $px - 6y + 3 = 0$  are parallel. Find the value of p.**

**Solution:**

Given line equations are,

$$4x + 3y = 9$$

$$3y = -4x + 9$$

$$y = (-4/3)x + 3$$

$$\text{Slope of this line} = -4/3$$

And,

$$px - 6y + 3 = 0$$

$$6y = px + 3$$

$$y = (p/6)x + 1/2$$

$$\text{Slope of this line} = p/6$$

For two lines to be parallel, their slopes must be equal.

$$-4/3 = p/6$$

$$-4 = p/2$$

$$p = -8$$

**10. If the lines  $y = 3x + 7$  and  $2y + px = 3$  are perpendicular to each other, find the value of p.**

**Solution:**

Given line equations,

$$y = 3x + 7$$

$$\text{Slope of this line} = 3$$

And,

$$2y + px = 3$$

$$2y = -px + 3$$

$$y = (-p/2) + 3$$

$$\text{So, the slope of this line} = -p/2$$

For these two lines to be perpendicular to each other, the product of their slopes must be -1.

$$(3) \times (-p/2) = -1$$

$$3p/2 = 1$$

$$p = 2/3$$

**11. The line through A(-2,3) and B(4,b) is perpendicular to the line  $2x - 4y = 5$ . Find the value of b.**

**Solution:**

Given,

Points A (-2, 3) and B (4, b)

And, line equation:  $2x - 4y = 5$

$$4y = 2x - 5$$

$$y = (1/2)x - 5/4$$

So, the slope of this line =  $1/2$

From the question, it's said that

The line through A and B is perpendicular to above given line.

We know that, when two lines are perpendicular their product of slopes is -1

Hence, the slope of the line through A and B must be -2.

Now,

The slope of the line through A and B is given by,

$$\begin{aligned} \text{Slope of AB} &= (b - 3) / (4 + 2) \\ &= (b - 3) / 6 \end{aligned}$$

Thus,

$$(b - 3) / 6 = -2$$

$$b - 3 = -12$$

$$b = -9$$

**12. Find the equation of the line through (-5, 7) and parallel to:**

- (i) x-axis      (ii) y-axis

**Solution:**

- (i) We know that, the slope of a line parallel to x-axis is 0.

Here,  $(x_1, y_1) = (-5, 7)$  and  $m = 0$

So, the required line equation is

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

$$y - 7 = 0(x + 5)$$

$$y = 7$$

- (ii) We know that, the slope of a line parallel to y-axis is not defined. ( $\tan 90^\circ$ )

So, the given line is parallel to y-axis.

Here,  $(x_1, y_1) = (-5, 7)$

So, the required equation of the line is

$$x - x_1 = 0$$

$$x + 5 = 0$$