

6-5 Parallel & Perpendicular Lines

Parallel lines are lines in the same plane that never intersect.

Any two lines with the **same slope** and different y-intercepts are parallel

- all vertical lines are parallel
- all horizontal lines are parallel

Examples: $y = 3x + 5$ OR $y = -1/2x + 3$ OR $y = -7$
 $y = 3x - 7$ OR $y = -1/2x - 8$ OR $y = 1/2$

Lines with **different slopes intersect**

Perpendicular lines are lines in the same plane that intersect to form right or 90 degree angles

Any two lines with slopes which are negative reciprocals of each other (**product of the two slopes is -1**) are perpendicular

- all horizontal and vertical lines are perpendicular

Examples: $y = -2x + 3$ OR $x = 7$ OR $y = 2/5x + 3$
 $y = 1/2x + 8$ OR $y = 3$ OR $y = -5/2x + 5$

Lines with the **same slope and same y-intercept** are the **same line** with a different name

6-5 Parallel & Perpendicular Lines

To determine if two lines intersect, are parallel, are perpendicular or are the same line:

1. convert them to slope-intercept form
2. compare their "m" values (slopes)
3. compare their "b" values (y-intercepts)
4. decide what relationship exists between the two lines based on:
 - if both the slope and y-intercepts are the same they are the same line
 - if only their slopes are the same they are parallel
 - if their slopes are different they intersect in a non-specific way
 - if their slopes are different and their product is -1, they intersect and are perpendicular
 - if their y-intercepts only are the same, they intersect at the y-intercept

Determine whether each pair of lines are parallel, perpendicular, the same or intersect in a non-specific way:

• $2x + 6y = 12$ AND $y - 2/3x = 1$
 $\frac{6y}{6} = \frac{-2x+12}{6}$ $y = 2/3x + 1$
 $y = -1/3x + 2$ intersect ; not \perp

• $x = 2$ AND $y = 9$



• $3x - 5y = 15$ AND $4y + 6x = 12$
 $\frac{-5y}{-5} = \frac{-3x+15}{-5}$ $\frac{4y}{4} = \frac{-6x+12}{4}$
 $y = 3/5x - 3$ intersect not \perp $y = -3/2x + 3$

• $2x - 4y = 14$ AND $-6x + 12y = -42$
 $\frac{-4y}{-4} = \frac{-2x+14}{-4}$ $\frac{12y}{12} = \frac{6x-42}{12}$
 $y = \frac{1}{2}x - \frac{7}{2}$ $y = \frac{1}{2}x - \frac{7}{2}$
 Same line

6-5 Parallel & Perpendicular Lines

Write an equation for the line that contains (5,1) and is parallel to $y = \frac{3}{5}x - 4$

$$m = \frac{3}{5} \quad (5,1) \quad y - 1 = \frac{3}{5}(x - 5)$$

Write an equation for the line that contains (5,1) and is perpendicular to $y = \frac{3}{5}x - 4$

$$(5,1) \quad \perp m = -\frac{5}{3} \quad y - 1 = -\frac{5}{3}(x - 5)$$

Find an equation for a line that contains the point (0,-2) and is parallel to $3x - 5y = -15$

$$\boxed{(0, -2)} \quad \perp m = \frac{3}{5} \quad \begin{aligned} -5y &= -3x - 15 \\ y &= \frac{3}{5}x + 3 \end{aligned} \quad y + 2 = \frac{3}{5}(x - 0)$$

Find an equation for a line that contains the point (-10,6) and is perpendicular to $4x + 3y = 24$

$$m = -\frac{4}{3} \quad \begin{aligned} 3y &= -4x + 24 \\ y &= -\frac{4}{3}x + 8 \end{aligned} \quad \boxed{\perp m = \frac{3}{4}} \quad \begin{aligned} (-10, 6) \\ y - 6 &= \frac{3}{4}(x + 10) \end{aligned}$$

Find an equation for a line that contains the point (-4,-8) and is parallel to $y = 3$

$$y = -8$$

Find an equation for a line that contains the point (5,9) and is perpendicular to $y = 7$

$$x = 5$$

6-5 Parallel & Perpendicular Lines