



Date: 10/23/20

Lesson 3.5 Equations of Parallel & Perpendicular Lines

Learning Intent (Target): Today I will be able to discover properties of parallel & perpendicular lines.

Success Criteria: I'll know I'll have it when I'll be able to use properties about parallel & perpendicular lines to write equations of parallel & perpendicular lines.

Accountable Team Task: Therefore, I can practice from interactive flip charts and matching card sort activities.



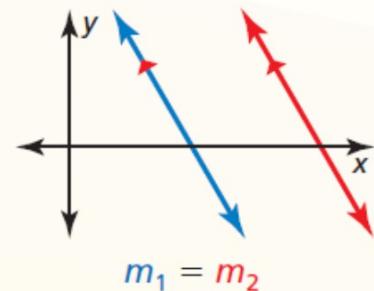
Theorems

Theorem 3.13 Slopes of Parallel Lines

In a coordinate plane, two nonvertical lines are parallel if and only if they have the same slope.

Any two vertical lines are parallel.

Proof p. 439; Ex. 41, p. 444

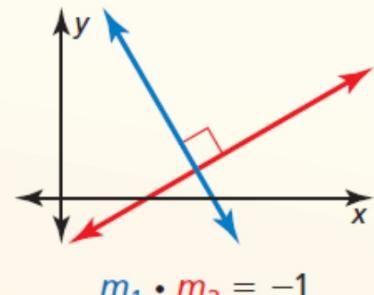


Theorem 3.14 Slopes of Perpendicular Lines

In a coordinate plane, two nonvertical lines are perpendicular if and only if the product of their slopes is -1 .

Horizontal lines are perpendicular to vertical lines.

Proof p. 440; Ex. 42, p. 444



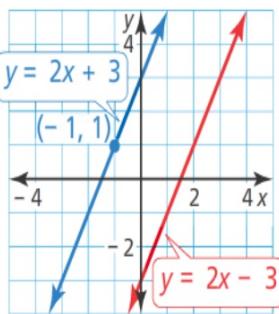
Write an equation of the line passing through the point $(-1, 1)$ that is parallel to the line $y = 2x - 3$.

SOLUTION

Step 1 Find the slope m of the parallel line. The line $y = 2x - 3$ has a slope of 2.

By the Slopes of Parallel Lines Theorem, a line parallel to this line also has a slope of 2. So, $m = 2$.

Check



Step 2 Find the y -intercept b by using $m = 2$ and $(x, y) = (-1, 1)$.

$$y = mx + b \quad \text{Use slope-intercept form.}$$

$$1 = 2(-1) + b \quad \text{Substitute for } m, x, \text{ and } y.$$

$$3 = b \quad \text{Solve for } b.$$

► Because $m = 2$ and $b = 3$, an equation of the line is $y = 2x + 3$. Use a graph to check that the line $y = 2x - 3$ is parallel to the line $y = 2x + 3$.

Write an equation of the line passing through the point $(2, 3)$ that is perpendicular to the line $2x + y = 2$.

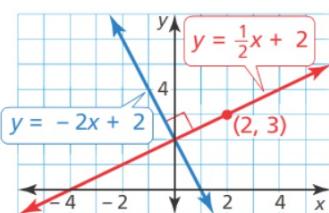
SOLUTION

Step 1 Find the slope m of the perpendicular line. The line $2x + y = 2$, or $y = -2x + 2$, has a slope of -2 . Use the Slopes of Perpendicular Lines Theorem.

$$-2 \cdot m = -1 \quad \text{The product of the slopes of } \perp \text{ lines is } -1.$$

$$m = \frac{1}{2} \quad \text{Divide each side by } -2.$$

Check



Step 2 Find the y -intercept b by using $m = \frac{1}{2}$ and $(x, y) = (2, 3)$.

$$y = mx + b \quad \text{Use slope-intercept form.}$$

$$3 = \frac{1}{2}(2) + b \quad \text{Substitute for } m, x, \text{ and } y.$$

$$2 = b \quad \text{Solve for } b.$$

► Because $m = \frac{1}{2}$ and $b = 2$, an equation of the line is $y = \frac{1}{2}x + 2$. Check that the lines are perpendicular by graphing their equations and using a protractor to measure one of the angles formed by their intersection.

4. Write an equation of the line that passes through the point $(1, 5)$ and is (a) parallel to the line $y = 3x - 5$ and (b) perpendicular to the line $y = 3x - 5$.

5. How do you know that the lines $x = 4$ and $y = 2$ are perpendicular?

4. Write an equation of the line that passes through the point $(1, 5)$ and is (a) parallel to the line $y = 3x - 5$ and (b) perpendicular to the line $y = 3x - 5$.

- a.** $y = 3x + 2$
- b.** $y = -\frac{1}{3}x + \frac{16}{3}$

5. How do you know that the lines $x = 4$ and $y = 2$ are perpendicular?

Line $x = 4$ is a vertical line, and
line $y = 2$ is a horizontal line. So,
they are perpendicular by the Slopes
of Perpendicular Lines Theorem
(Thm. 3.14).