

Algebra 1

Chapter 5

Section 5-6

5

May 13-10:02 PM

Concepts

Parallel Lines-- Lines in the same plane that never intersect

Perpendicular Lines -- Lines that intersect to form right angles (90°)

Nov 4-1:12 PM

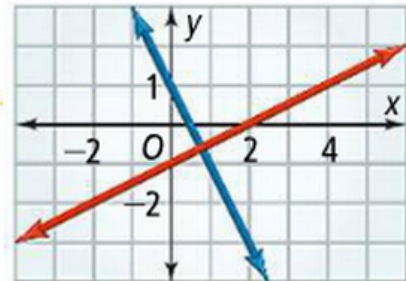
Slopes of Perpendicular Lines

Words

Two nonvertical lines are perpendicular if the product of their slopes is -1 . A vertical line and a horizontal line are also perpendicular.

$$\frac{1}{2} \leftrightarrow -2$$

Graph



Example

The graph of $y = \frac{1}{2}x - 1$ has a slope of $\frac{1}{2}$.

The graph of $y = -2x + 1$ has a slope of -2 .

Since $\frac{1}{2}(-2) = -1$, the lines are perpendicular.

Don't matter

Dec 3-8:34 AM

Horizontal and Vertical Lines

Find the equation of the horizontal line passing through the point $(2, 5)$

$$m = \frac{0}{1} \quad m_{\perp} = \frac{-1}{0} \rightarrow \text{undefined}$$

$$y = 5$$

$$\text{Perp: } x = 2$$

Find the equation of the vertical line passing through the point $(11, -7)$

$$x = 11 \quad \text{perpendicular}$$

$$\text{Perp: } y = -7$$

Dec 3-8:57 AM

Two lines are perpendicular. Line 1 has the given slope. What is the slope of Line 2.

Line 1 slope: $\frac{3}{1}$

$$-\frac{1}{3}$$

Line 1 slope: $-\frac{6}{1}$

$$\frac{1}{6}$$

Line 1 slope: $-\frac{1}{4}$

$$4$$

Line 1 slope: $\frac{9}{21}$

$$-\frac{21}{9} = -\frac{7}{3}$$

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Slopes of Parallel Lines

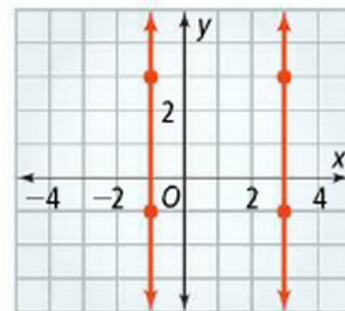
Words

Nonvertical lines are parallel if they have the same slope and different y -intercepts. Vertical lines are parallel if they have different x -intercepts.

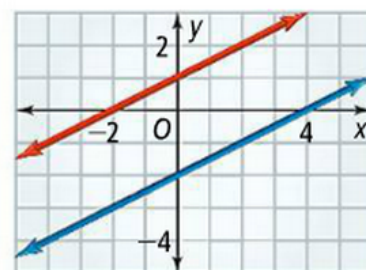
Example

The graphs of $y = \frac{1}{2}x + 1$ and $y = \frac{1}{2}x - 2$ are lines that have the same slope, $\frac{1}{2}$, and different y -intercepts. The lines are parallel.

Graph



Graph



Dec 3-8:32 AM

Are the lines given by the two equations parallel, perpendicular, or neither?

$$y = 2x + 4$$

$$y = 3x - 3$$

neither

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Are the lines given by the two equations parallel, perpendicular, or neither?

$$y = \underline{-\frac{1}{4}}x + 3$$

$$y = \underline{4}x - 312$$

perpendicular

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Are the lines given by the two equations parallel, perpendicular, or neither?

$$\begin{array}{r} 6x + 2y = 14 \\ -6x \quad -6x \end{array}$$

$$y = \underline{-3x}$$

$$\frac{2}{2}y = \frac{-6x + 14}{2}$$

$$y = \underline{-3x + 7}$$

parallel

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Are the lines given by the two equations parallel, perpendicular, or neither?

$$\begin{array}{r} 5x - 7y = -3 \\ -5x \quad -5x \end{array}$$

$$\frac{-7}{-7}y = \frac{-5x - 3}{-7}$$

$$y = \underline{\frac{5}{7}x + \frac{3}{7}}$$

$$\begin{array}{r} 14x + 10y = 1 \\ -14x \quad -14x \end{array}$$

$$\frac{10}{10}y = \frac{-14x + 1}{10}$$

$$y = \underline{-\frac{7}{5}x + \frac{1}{10}}$$

perpendicular

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Review

Find the slope-intercept equation of the line through the given point with the given slope

point: (5, 11) slope: -3

$$y - 11 = -3(x - 5)$$

$$y - 11 = -3x + 15$$

$$y = -3x + 26$$

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Using Parallel Slopes

Find the slope-intercept equation of the line parallel to the given line through the given point.

line: $y = 2x - 12$ point: (3, -6)

↳ slope ↙

$$m = 2$$

$$y + 6 = 2(x - 3)$$

$$y + 6 = 2x - 6$$

$$y = 2x - 12$$

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Using Parallel Slopes

Find the slope-intercept equation of the line parallel to the given line through the given point.

line: $y = 2$

point: $(9, -1)$

$$\underline{\underline{y = -1}}$$

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Using Parallel Slopes

Find the slope-intercept equation of the line parallel to the given line through the given point.

line: $4x + 2y = 2$

point: $(3, -6)$

$$\begin{array}{cc} -4x & -4x \end{array}$$

$$\frac{2y}{2} = \frac{-4x}{2} + \frac{2}{2}$$

$$y = -2x + 1$$

$$m = 2$$

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

$$y + \underset{-6}{6} = 2x - \underset{-6}{6}$$

$$\underline{\underline{y = 2x - 12}}$$

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Using Perpendicular Slopes

Find the slope-intercept equation of the line perpendicular to the given line through the given point.

line: $y = 5x$ point: $(-1, 0)$

perp. Slope $\rightarrow -\frac{1}{5} = m$

$$y - 0 = -\frac{1}{5}(x + 1)$$

$$y = -\frac{1}{5}x - \frac{1}{5}$$

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Using Perpendicular Slopes

Find the slope-intercept equation of the line perpendicular to the given line through the given point.

line: $10x + y = 5x - 1$ point: $(4, 3)$
 $\quad \quad \quad \cancel{-10x} \quad \quad \quad \cancel{-10x}$

$$y = -5x - 1$$

perp $\rightarrow m = \frac{1}{5}$

$$y - 3 = \frac{1}{5}(x - 4)$$

$$y - 3 = \frac{1}{5}x - \frac{4}{5}$$

$$y = \frac{1}{5}x + \frac{11}{5}$$

$\xrightarrow{+3} \frac{15}{5}$

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Using Perpendicular Slopes

Find the slope-intercept equation of the line perpendicular to the given line through the given point.

line: $x = 10$ point: $(0, 13)$

\hookrightarrow vertical

need horizontal line $\rightarrow y = 13$

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Using Perpendicular Slopes

Find the slope-intercept equation of the line perpendicular to the given line through the given point.

line: $7 = y$ point: $(-2, -3)$

horizontal

$x = -2$

need vertical

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