2-3 Graphing Linear Functions

Example 1 Recognizing Linear Functions

Determine whether each data set could represent a linear function.

A.

x	−2	0	2	4
$f(x)$	2	1	0	−1

(+2, +2, +2 over the x row; −1, −1, −1 over the $f(x)$ row)

The rate of change, $\frac{\text{change in } f(x)}{\text{change in } x}$, is constant $-\frac{1}{2}$. So the data set is linear.

B.

x	2	3	4	5
$f(x)$	2	4	8	16

(+1, +1, +1 over the x row; +2, +4, +8 over the $f(x)$ row)

The rate of change, $\frac{\text{change in } f(x)}{\text{change in } x}$, is constant. $\frac{2}{1} \neq \frac{4}{1} \neq \frac{8}{1}$. The data set is not linear.

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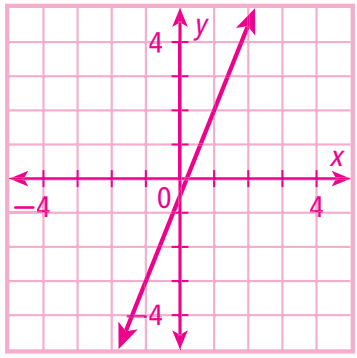
Example 2 Graphing Lines Using Slope and a Point

Graph each line.

A. the line with slope $\frac{5}{2}$ that passes through $(-1, -3)$

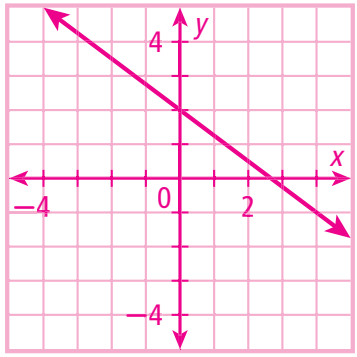
Plot the point $(-1, -3)$. The slope indicates a rise of 5 and a run of 2. Move up 5 and right 2 to find another point. Repeat. Then draw a line through the points.



B. the line with slope $-\frac{3}{4}$ that passes through $(0, 2)$

Plot the point $(0, 2)$. The negative slope can be viewed as $\frac{-3}{4}$ or $\frac{3}{-4}$.

You can move down 3 units and right 4 units, or move up 3 units and left 4 units. Notice that all three points are on the same line.



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Example 3 Graphing Lines Using the Intercepts

Find the intercepts of $4x - 2y = 16$ and graph the line.

Find the x-intercept: $4x - 2y = 16$

$4x - 2(0) = 16$ *Substitute 0 for y.*

$4x = 16$

$x = 4$ *The x-intercept is 4.*

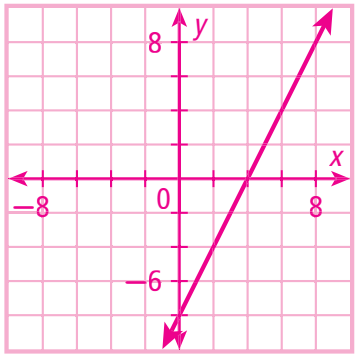
Find the y-intercept: $4x - 2y = 16$

$4(0) - 2y = 16$ *Substitute 0 for x.*

$-2y = 16$

$y = -8$ *The y-intercept is −8.*

Draw the line through $(4, 0)$ and $(0, -8)$.



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Example 4 Graphing Functions in Slope-Intercept Form

Write each function in slope-intercept form. Then graph the function.

A. $-4x + y = -1$

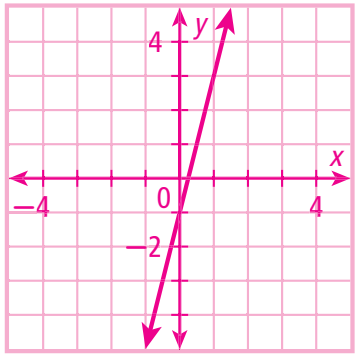
Solve for y first.

$-4x + y = -1$

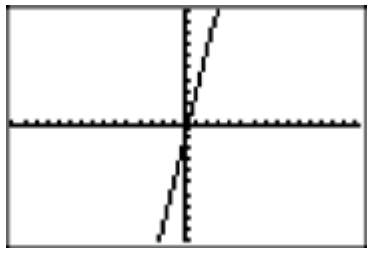
$+4x \qquad +4x$ *Add 4x to both sides.*

$y = 4x - 1$

The line has y-intercept -1 and slope 4, which is $\frac{4}{1}$. Plot the point $(0, -1)$. Then move up 4 and right 1 to find other points.



You can also use a graphing calculator to graph. Choose the **STANDARD SQUARE** window to make your graph look like it would on a regular grid. Press ZOOM, choose **6:ZStandard**, press ZOOM again, and then choose **5:ZSquare.**



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Example 4 Graphing Functions in Slope-Intercept Form (continued)

B. $x + \frac{3}{4}y = 6$

Solve for y first.

$x + \frac{3}{4}y = 6$

$-x \qquad -x$ *Subtract x from both sides.*

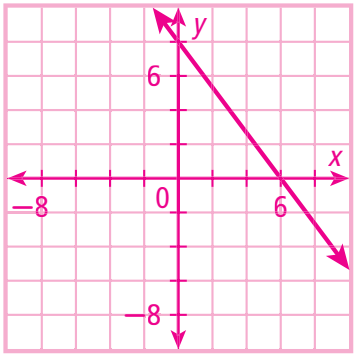
$\frac{3}{4}y = -x + 6$

$\frac{4}{3}\left(\frac{3}{4}y\right) = \frac{4}{3}(-x + 6)$ *Multiply both sides by $\frac{4}{3}$.*

$y = \frac{4}{3}(-x) + \frac{4}{3}(6)$ *Distribute.*

$y = -\frac{4}{3}x + 8$

The graph of the line has y-intercept 8 and slope $-\frac{4}{3}$. Plot the point (0, 8). Then move down 4 and right 3 to find other points.



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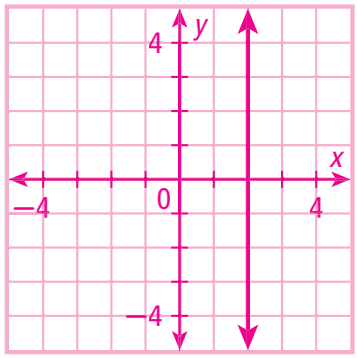
Example 5 Graphing Vertical and Horizontal Lines

Determine if each line is vertical or horizontal. Then graph.

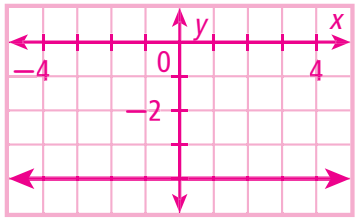


A. $x = 2$

This is a vertical line located at the x-value 2. It is not a function.

B. $y = -4$

This is a horizontal line located at the y-value -4.



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Example 6 Sports Application

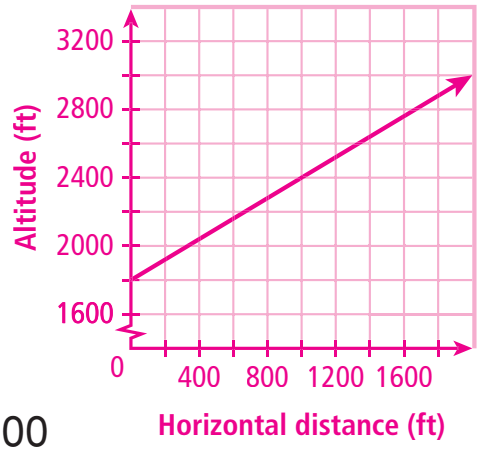
A ski lift carries skiers from an altitude of point 1800 feet up to an altitude of 3000 feet over a horizontal distance of 2000 feet. Find the average slope of this part of the mountain. Graph the elevation against the distance.

Step 1 Find the slope.

The rise is 3000 − 1800, or 1200 ft.

The run is 2000 feet.

The slope is $\frac{1200}{2000} = \frac{3}{5} = 0.6$.



Step 2 Graph the line.

The *y*-intercept is the original altitude, 1800 ft. Use (0, 1800) and (2000, 3000) as two points on the line. Select a scale for each axis that will fit the data, and graph the function.