Illustrating Linear Functions

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What is a Linear Function?

A linear function is defined by $f(x) = mx + b$, where m is the slope and b is the y-intercept, $m, b \in \mathbb{R}$ and $m \neq 0$. The degree of the function is one and its graph is a line.

Example 1

Is the function f defined by $f(x) = 2x - 3$ a linear function? If yes, determine the slope m and the y-intercept b.

Example 1

$$f(x) = 2x - 3$$

Example 1

$$f(x) = 2x - 3$$

in the form $f(x) = mx + b$

Example 1

$$f(x) = 2x - 3$$

in the form $f(x) = mx + b$
degree = 1

Example 1

$$f(x) = 2x - 3$$

in the form $f(x) = mx + b$
degree = 1
$\therefore$ yes, it is a linear function

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$$f(x) = 2x - 3$$

in the form $f(x) = mx + b$
degree = 1
$\therefore$ yes, it is a linear function
$m = 2$

Example 1

$$f(x) = 2x - 3$$

in the form $f(x) = mx + b$
degree = 1
$\therefore$ yes, it is a linear function
$m = 2$
$b = -3$

Example 2

Is the function g defined by $g(x) = -x$ a linear function? If yes, determine the slope m and the y-intercept b.

Example 2

$$g(x) = -x$$

Example 2

$$g(x) = -x$$

in the form $f(x) = mx + b$

Example 2

$$g(x) = -x$$

in the form $f(x) = mx + b$
degree = 1

Example 2

$$g(x) = -x$$

in the form $f(x) = mx + b$
degree = 1
$\therefore$ yes, it is a linear function

Example 2

$$g(x) = -x$$

in the form $f(x) = mx + b$
degree = 1
$\therefore$ yes, it is a linear function
$m = -1$

Example 2

$$g(x) = -x$$

in the form $f(x) = mx + b$
degree = 1
$\therefore$ yes, it is a linear function
$m = -1$
$b = 0$

Example 3

Is the function h defined by $h(x) = x^2 - 2$ a linear function? If yes, determine the slope m and the y-intercept b.

Example 3

$$h(x) = x^2 - 2$$

Example 3

$$h(x) = x^2 - 2$$

not in the form $f(x) = mx + b$

Example 3

$$h(x) = x^2 - 2$$

not in the form $f(x) = mx + b$
degree = 2

Example 3

$$h(x) = x^2 - 2$$

not in the form $f(x) = mx + b$
degree = 2
$\therefore$ no, it is not a linear function

Example 4

$$h(x) = -2$$

Example 4

$$h(x) = -2$$

not in the form $f(x) = mx + b$

Example 4

$$h(x) = -2$$

not in the form $f(x) = mx + b$
degree = 0

Example 4

$$h(x) = -2$$

not in the form $f(x) = mx + b$
degree = 0
$\therefore$ no, it is not a linear function

Example 5

Write Yes if the given function is a linear function or No if it is not. If Yes, write the slope and the y-intercept.

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$f(x) = -3x$ Yes, $m = -3, b = 0$

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$g(x) = -3$

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Write Yes if the given function is a linear function or No if it is not. If Yes, write the slope and the y-intercept.

$f(x) = -3x$	Yes, $m = -3, b = 0$
$g(x) = -3$	No

Example 5

Write Yes if the given function is a linear function or No if it is not. If Yes, write the slope and the y-intercept.

$f(x) = -3x$	Yes, $m = -3, b = 0$
$g(x) = -3$	No
$h(x) = x^2$	

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$f(x) = -3x$	Yes, $m = -3, b = 0$
$g(x) = -3$	No
$h(x) = x^2$	No
$f(x) = 2x - 3$	

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$g(x) = -3$	No
$h(x) = x^2$	No
$f(x) = 2x - 3$	Yes,

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$h(x) = x^2$	No
$f(x) = 2x - 3$	Yes, $m = 2,$

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$f(x) = 2x - 3$	Yes, $m = 2, b = -3$

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$g(x) = -3$	No
$h(x) = x^2$	No
$f(x) = 2x - 3$	Yes, $m = 2, b = -3$
$g(x) = -3 + x$	

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$h(x) = x^2$	No
$f(x) = 2x - 3$	Yes, $m = 2, b = -3$
$g(x) = -3 + x$	Yes, $m = 1,$

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$f(x) = -3x$	Yes, $m = -3, b = 0$
$g(x) = -3$	No
$h(x) = x^2$	No
$f(x) = 2x - 3$	Yes, $m = 2, b = -3$
$g(x) = -3 + x$	Yes, $m = 1, b = -3$

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$f(x) = 2x - 3$	Yes, $m = 2, b = -3$
$g(x) = -3 + x$	Yes, $m = 1, b = -3$
$h(x) = \frac{4}{3}x$	

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$f(x) = 2x - 3$	Yes, $m = 2, b = -3$
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$f(x) = 2x - 3$	Yes, $m = 2, b = -3$
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$h(x) = \frac{4}{3}x$	Yes, $m = \frac{4}{3},$

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$f(x) = 2x - 3$	Yes, $m = 2, b = -3$
$g(x) = -3 + x$	Yes, $m = 1, b = -3$
$h(x) = \frac{4}{3}x$	Yes, $m = \frac{4}{3}, b = 0$

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$g(x) = -3 + x$	Yes, $m = 1, b = -3$
$h(x) = \frac{4}{3}x$	Yes, $m = \frac{4}{3}, b = 0$
$h(x) = \frac{1}{2}$	

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$f(x) = -3x$	Yes, $m = -3, b = 0$
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$f(x) = 2x - 3$	Yes, $m = 2, b = -3$
$g(x) = -3 + x$	Yes, $m = 1, b = -3$
$h(x) = \frac{4}{3}x$	Yes, $m = \frac{4}{3}, b = 0$
$h(x) = \frac{1}{2}$	No

How to Describe a Linear Function Using its Graph?

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1. Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

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1. Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.
2. Construct a table of values from the coordinates.
3. Plot the coordinates and connect them.

Example 6

Determine the values of the function f if $f(x) = 2x - 1$ at $x = -3, 0, 2$. Interpret the results, determine the ordered pairs, and graph the function f.

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = -3$$

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Linear function $f(x) = 2x - 1$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = -3$$

Linear function $f(x) = 2x - 1$

Substitute $x = -3$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = -3$$

Linear function	$f(x) = 2x - 1$
Substitute $x = -3$	$f(-3) = 2(-3) - 1$

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Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = -3$$

Linear function	$f(x) = 2x - 1$
Substitute $x = -3$	$f(-3) = 2(-3) - 1$
Simplify	

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = -3$$

Linear function	$f(x) = 2x - 1$
Substitute $x = -3$	$f(-3) = 2(-3) - 1$
Simplify	$f(-3) = -6 - 1$

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Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = -3$$

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Simplify	

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Linear function	$f(x) = 2x - 1$
Substitute $x = -3$	$f(-3) = 2(-3) - 1$
Simplify	$f(-3) = -6 - 1$
Simplify	$f(-3) = -7$

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Linear function	$f(x) = 2x - 1$
Substitute $x = -3$	$f(-3) = 2(-3) - 1$
Simplify	$f(-3) = -6 - 1$
Simplify	$f(-3) = -7$

$\therefore$ the value of f at $x = -3$ is -7 and the ordered pair is $(-3, -7)$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 0$$

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Linear function $\qquad\qquad$ $f(x) = 2x - 1$

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Linear function $f(x) = 2x - 1$

Substitute $x = 0$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 0$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 0$	$f(0) = 2(0) - 1$

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Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 0$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 0$	$f(0) = 2(0) - 1$
Simplify	

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Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 0$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 0$	$f(0) = 2(0) - 1$
Simplify	$f(0) = 0 - 1$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 0$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 0$	$f(0) = 2(0) - 1$
Simplify	$f(0) = 0 - 1$
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Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 0$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 0$	$f(0) = 2(0) - 1$
Simplify	$f(0) = 0 - 1$
Simplify	$f(0) = -1$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 0$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 0$	$f(0) = 2(0) - 1$
Simplify	$f(0) = 0 - 1$
Simplify	$f(0) = -1$

$\therefore$ the value of f at $x = 0$ is -1 and the ordered pair is $(0, -1)$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 2$$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 2$$

Linear function $f(x) = 2x - 1$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 2$$

Linear function $f(x) = 2x - 1$

Substitute $x = 2$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 2$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 2$	$f(2) = 2(2) - 1$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 2$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 2$	$f(2) = 2(2) - 1$
Simplify	

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 2$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 2$	$f(2) = 2(2) - 1$
Simplify	$f(2) = 4 - 1$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 2$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 2$	$f(2) = 2(2) - 1$
Simplify	$f(2) = 4 - 1$
Simplify	

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 2$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 2$	$f(2) = 2(2) - 1$
Simplify	$f(2) = 4 - 1$
Simplify	$f(2) = 3$

Example 6

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$f(x) = 2x - 1 \text{ at } x = 2$$

Linear function	$f(x) = 2x - 1$
Substitute $x = 2$	$f(2) = 2(2) - 1$
Simplify	$f(2) = 4 - 1$
Simplify	$f(2) = 3$

$\therefore$ the value of f at $x = 2$ is 3 and the ordered pair is $(2, 3)$

Example 6

Step 2: Construct a table of values from the coordinates.

Set of ordered pairs: $\{(-3,-7),(0,-1),(2,3)\}$

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Set of ordered pairs: $\{(-3,-7),(0,-1),(2,3)\}$

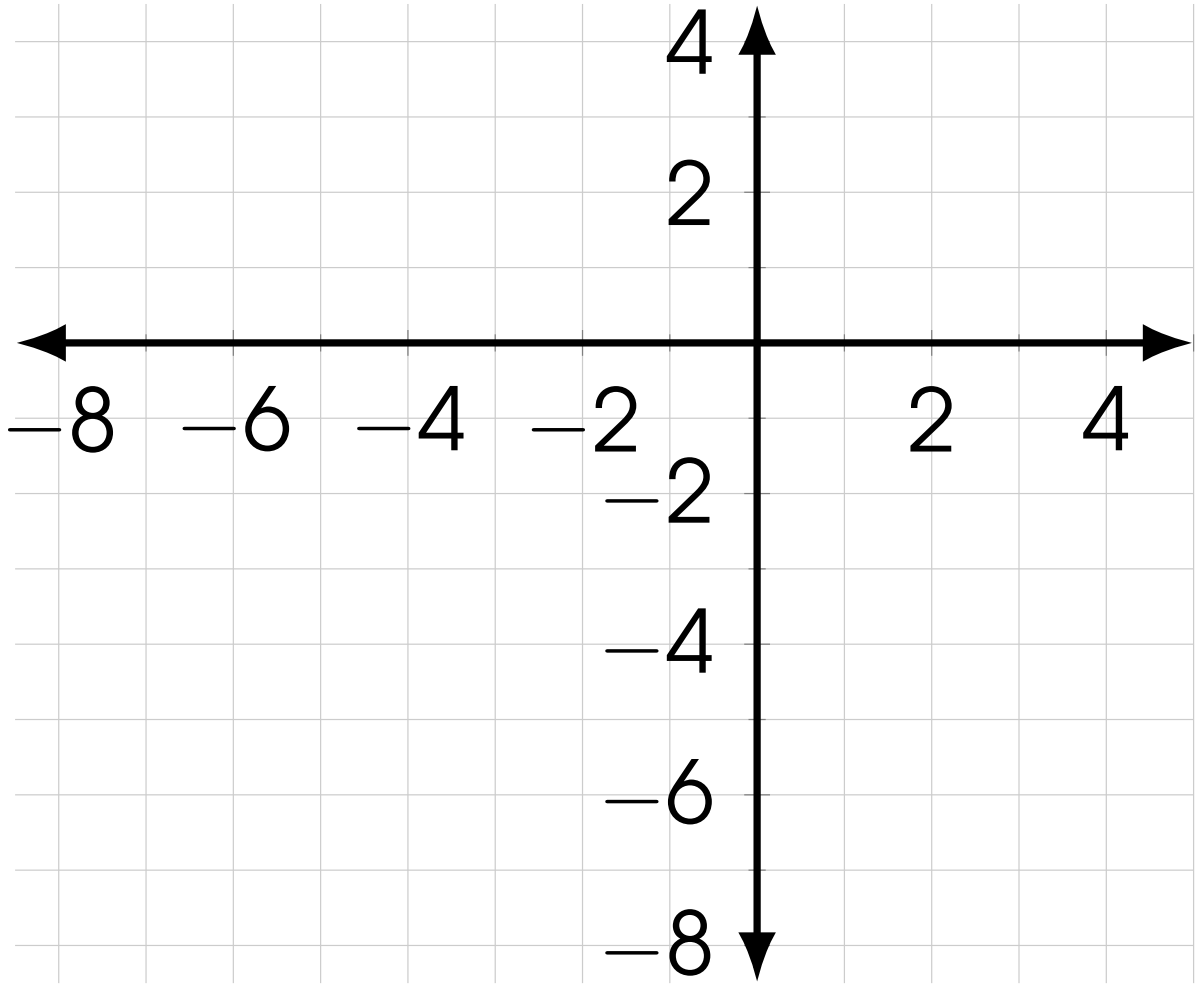
Table of values:

x	-3	0	2
$f(x)$	-7	-1	3

Example 6

Step 3: Plot the coordinates and connect them.

Set of ordered pairs: $\{(-3,-7),(0,-1),(2,3)\}$



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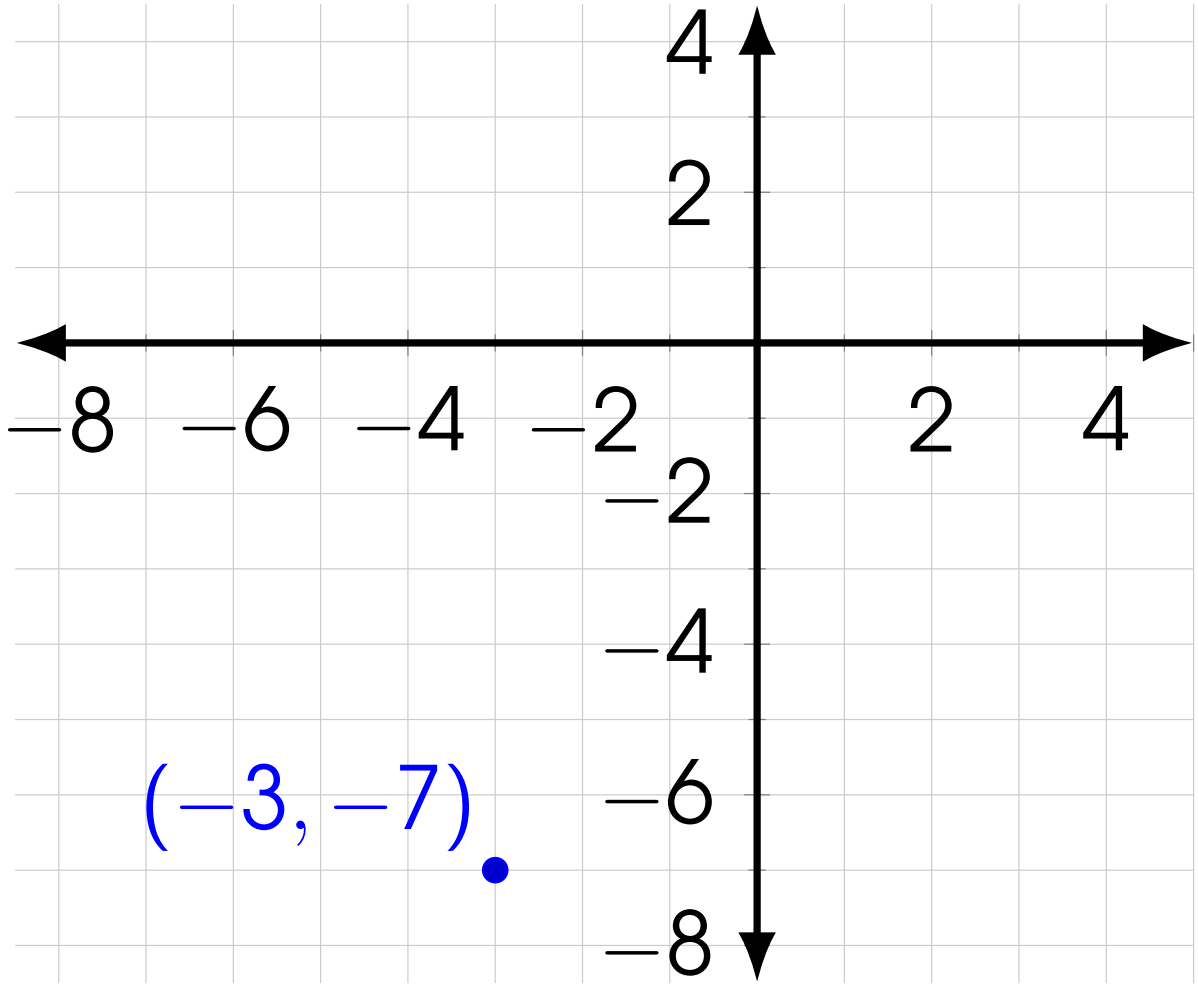

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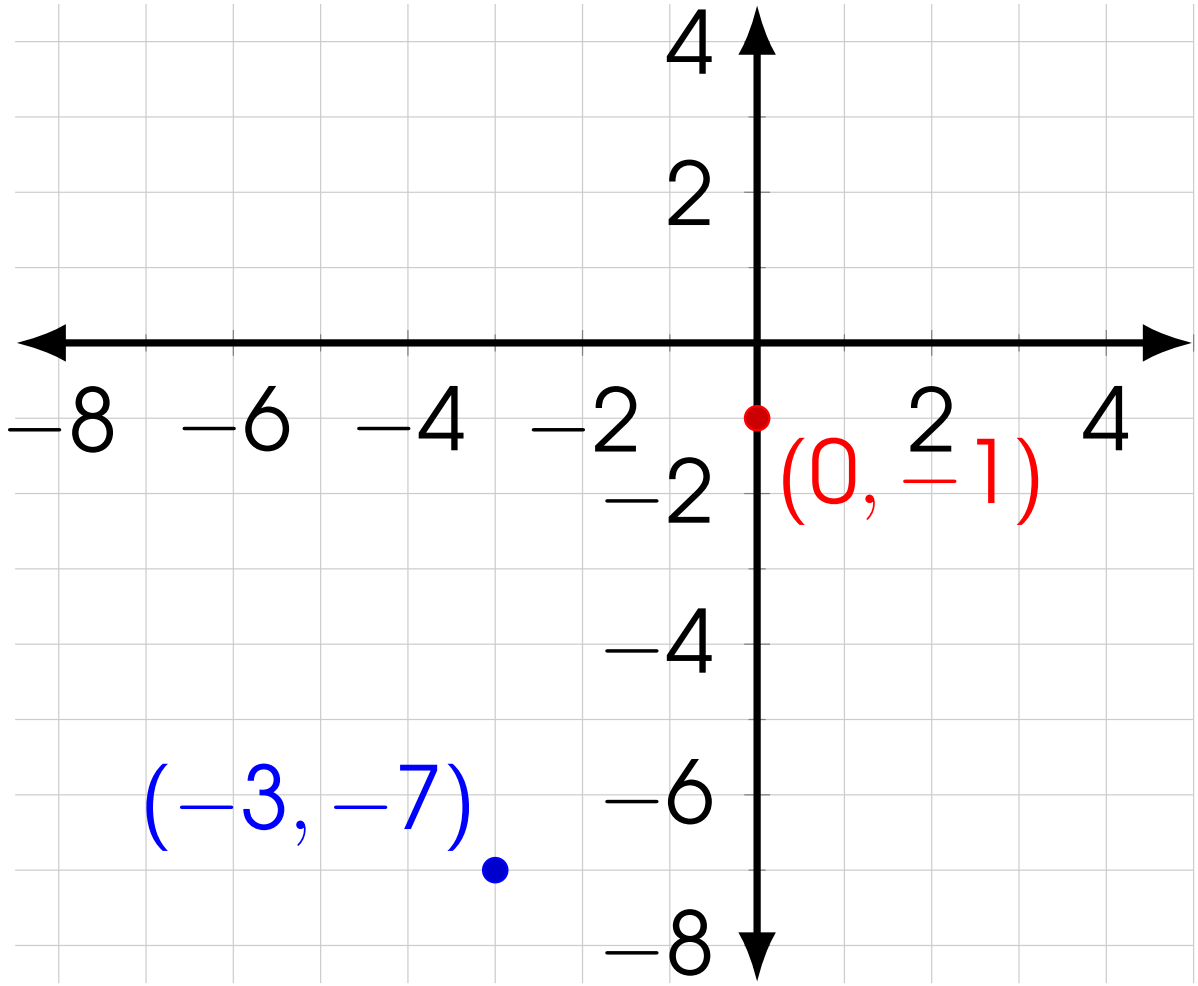

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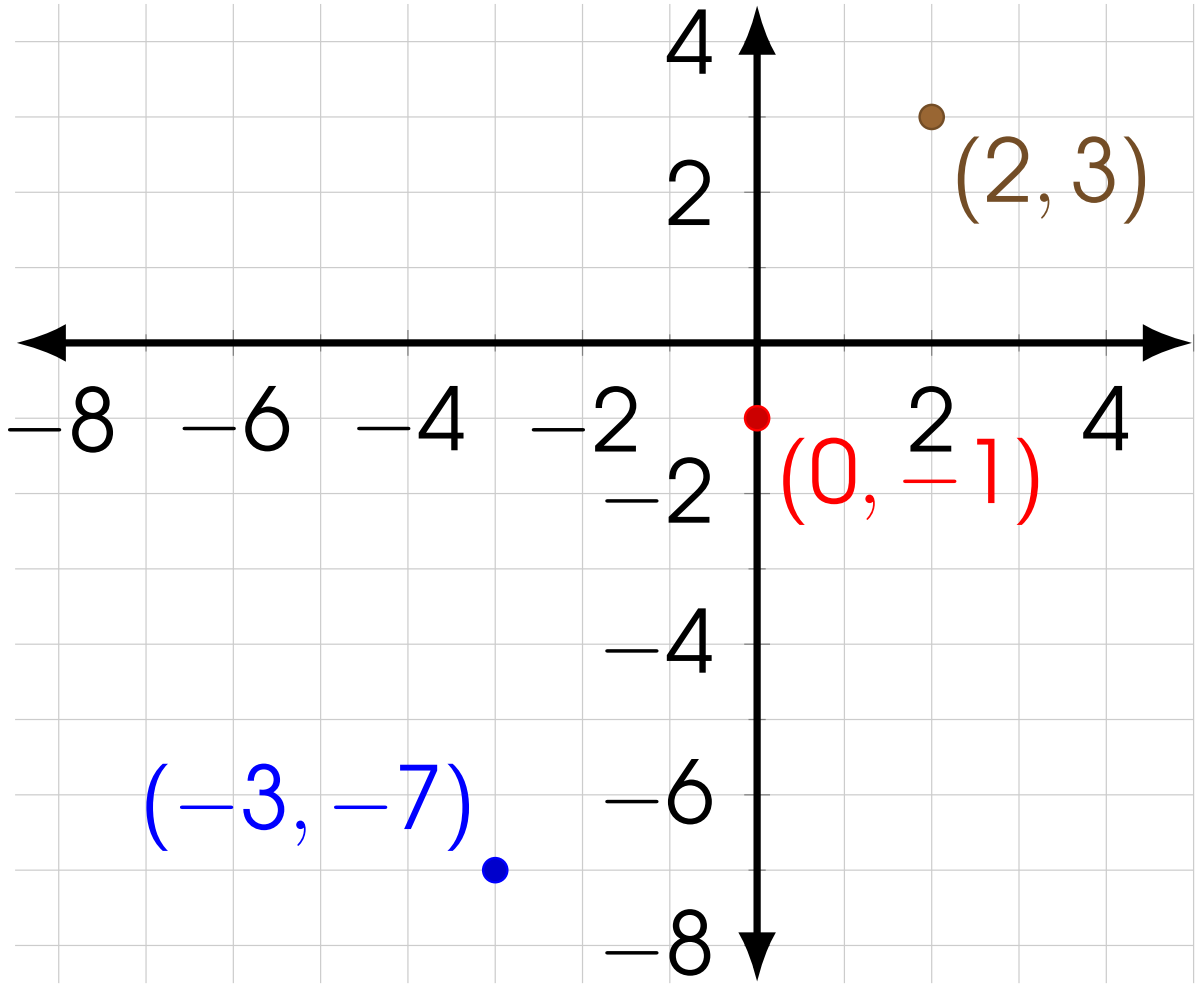

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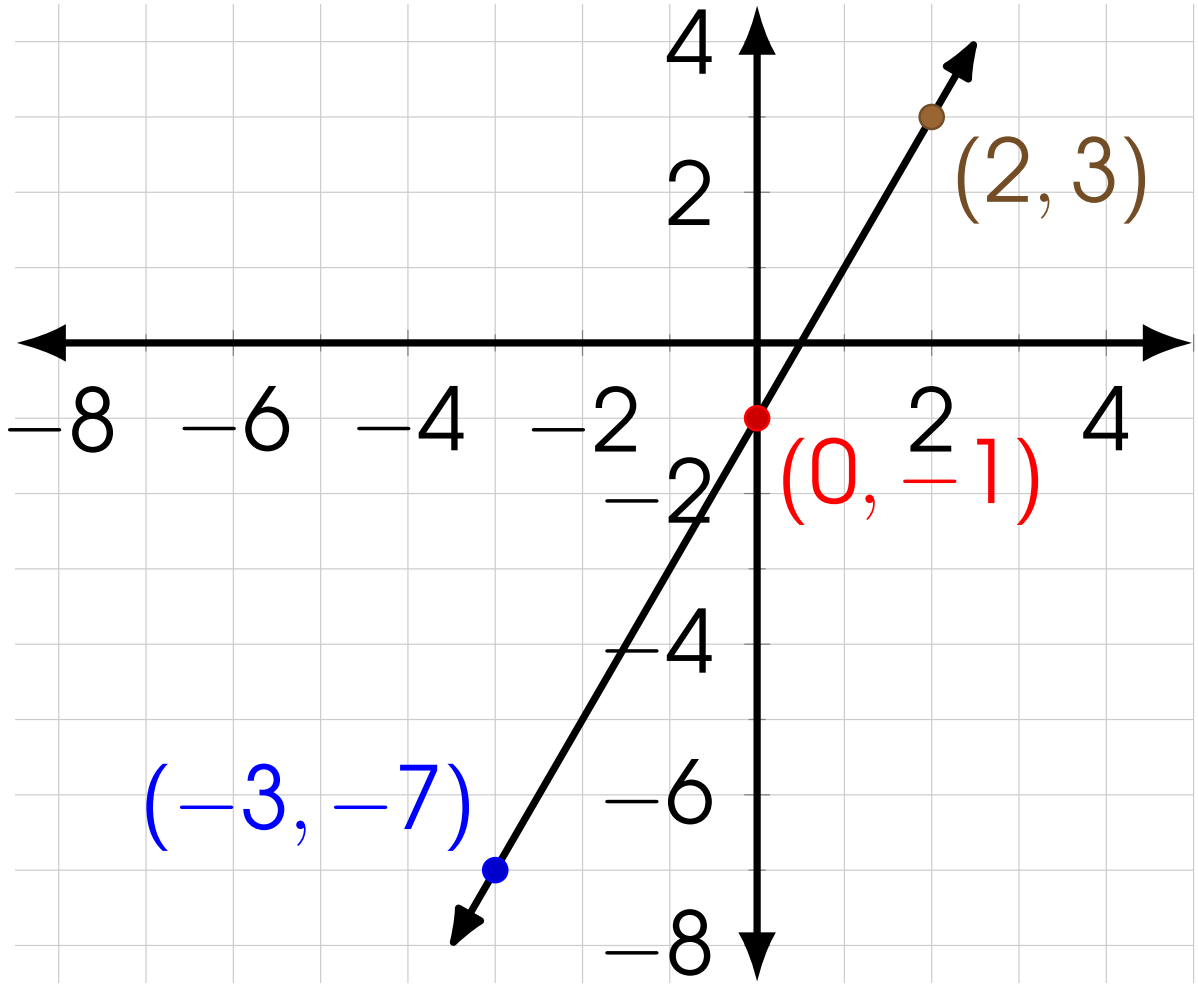
Step 3: Plot the coordinates and connect them.

Set of ordered pairs: $\{(-3,-7),(0,-1),(2,3)\}$



Example 7

Determine the values of the function f if $g(x) = -3x - 4$ at $x = -2, 0, 1$. Interpret the results, determine the ordered pairs, and graph the function f.

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = -2$$

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$$g(x) = -3x - 4 \text{ at } x = -2$$

Linear function $g(x) = -3x - 4$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = -2$$

Linear function $g(x) = -3x - 4$

Substitute $x = -2$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = -2$$

Linear function	$g(x) = -3x - 4$
Substitute $x = -2$	$g(-2) = -3(-2) - 4$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = -2$$

Linear function	$g(x) = -3x - 4$
Substitute $x = -2$	$g(-2) = -3(-2) - 4$
Simplify	

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = -2$$

Linear function	$g(x) = -3x - 4$
Substitute $x = -2$	$g(-2) = -3(-2) - 4$
Simplify	$g(-2) = 6 - 4$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = -2$$

Linear function	$g(x) = -3x - 4$
Substitute $x = -2$	$g(-2) = -3(-2) - 4$
Simplify	$g(-2) = 6 - 4$
Simplify	

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Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

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Linear function	$g(x) = -3x - 4$
Substitute $x = -2$	$g(-2) = -3(-2) - 4$
Simplify	$g(-2) = 6 - 4$
Simplify	$g(-2) = 2$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = -2$$

Linear function	$g(x) = -3x - 4$
Substitute $x = -2$	$g(-2) = -3(-2) - 4$
Simplify	$g(-2) = 6 - 4$
Simplify	$g(-2) = 2$

$\therefore$ the value of g at $x = -2$ is 2 and the ordered pair is $(-2, 2)$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 0$$

Example 7

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Linear function $\qquad g(x) = -3x - 4$

Example 7

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$$g(x) = -3x - 4 \text{ at } x = 0$$

Linear function $g(x) = -3x - 4$

Substitute $x = 0$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 0$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 0$	$g(0) = -3(0) - 4$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 0$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 0$	$g(0) = -3(0) - 4$
Simplify	

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 0$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 0$	$g(0) = -3(0) - 4$
Simplify	$g(0) = 0 - 4$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 0$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 0$	$g(0) = -3(0) - 4$
Simplify	$g(0) = 0 - 4$
Simplify	

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 0$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 0$	$g(0) = -3(0) - 4$
Simplify	$g(0) = 0 - 4$
Simplify	$g(0) = -4$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 0$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 0$	$g(0) = -3(0) - 4$
Simplify	$g(0) = 0 - 4$
Simplify	$g(0) = -4$

$\therefore$ the value of g at $x = 0$ is -4 and the ordered pair is $(0, -4)$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 1$$

Example 7

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$$g(x) = -3x - 4 \text{ at } x = 1$$

Linear function $\qquad g(x) = -3x - 4$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 1$$

Linear function $g(x) = -3x - 4$

Substitute $x = 1$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 1$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 1$	$g(1) = -3(1) - 4$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 1$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 1$	$g(1) = -3(1) - 4$
Simplify	

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 1$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 1$	$g(1) = -3(1) - 4$
Simplify	$g(1) = -3 - 4$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 1$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 1$	$g(1) = -3(1) - 4$
Simplify	$g(1) = -3 - 4$
Simplify	

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 1$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 1$	$g(1) = -3(1) - 4$
Simplify	$g(1) = -3 - 4$
Simplify	$g(1) = -7$

Example 7

Step 1: Determine the values of the function at the given values of x. Then determine the coordinates to be plotted.

$$g(x) = -3x - 4 \text{ at } x = 1$$

Linear function	$g(x) = -3x - 4$
Substitute $x = 1$	$g(1) = -3(1) - 4$
Simplify	$g(1) = -3 - 4$
Simplify	$g(1) = -7$

$\therefore$ the value of g at $x = 1$ is -7 and the ordered pair is $(1, -7)$

Example 7

Step 2: Construct a table of values from the coordinates.

Set of ordered pairs: $\{(-2, 2), (0, -4), (1, -7)\}$

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Table of values:

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x	-2	0	1

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Set of ordered pairs: $\{(-2, 2), (0, -4), (1, -7)\}$

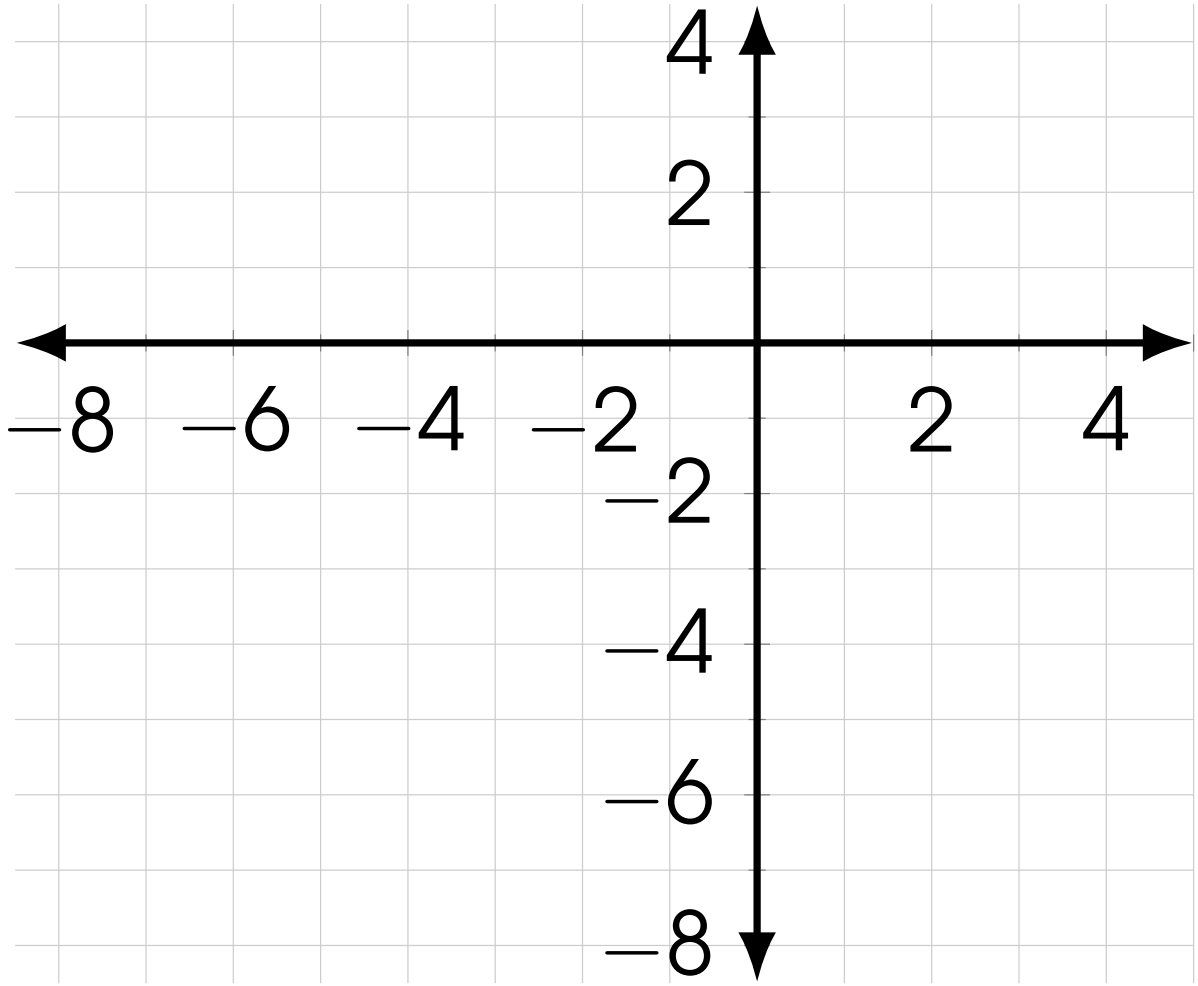
Table of values:

x	-2	0	1
$f(x)$	2	-4	-7

Example 7

Step 3: Plot the coordinates and connect them.

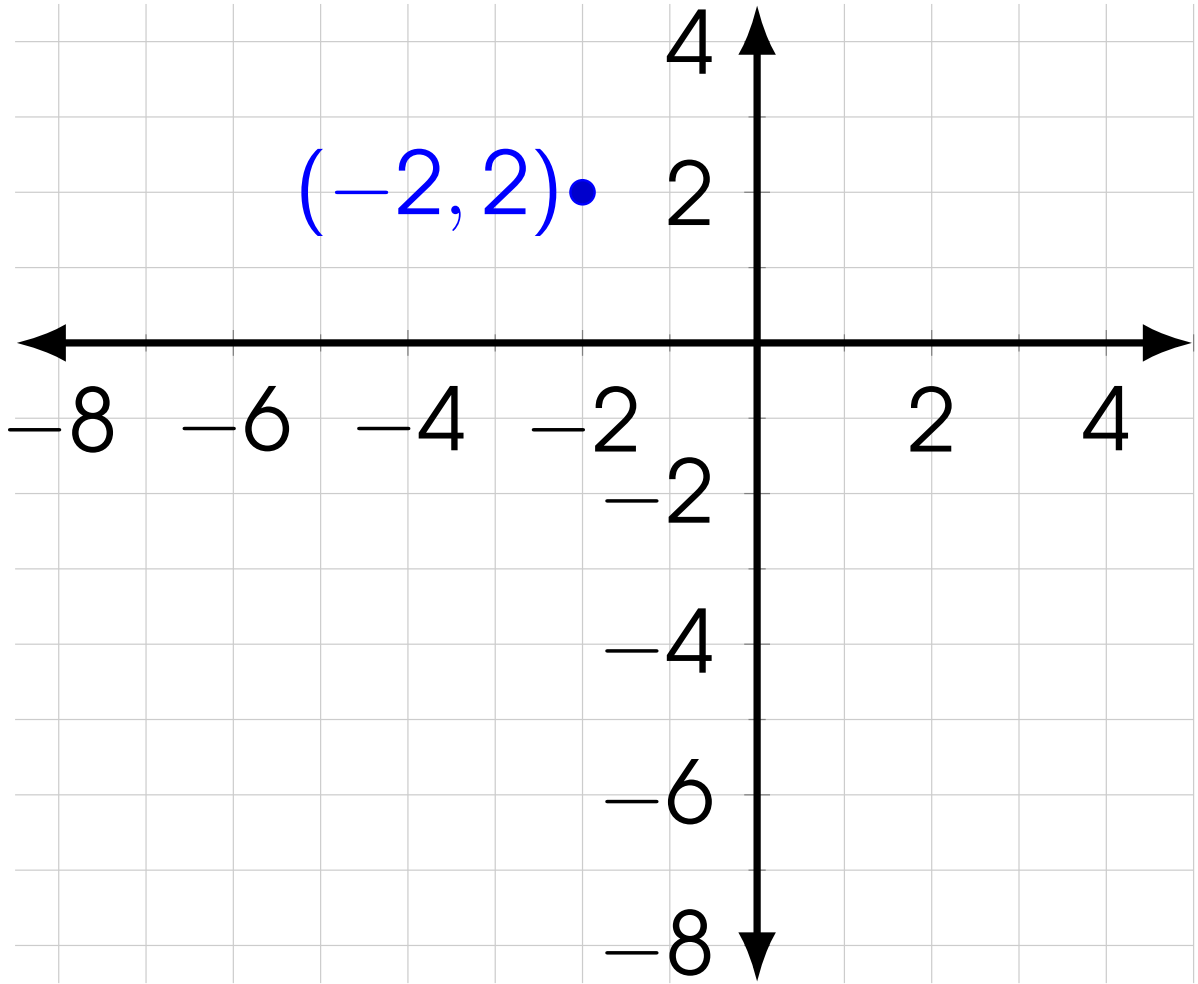
Set of ordered pairs: $\{(-2, 2), (0, -4), (1, -7)\}$



Example 7

Step 3: Plot the coordinates and connect them.

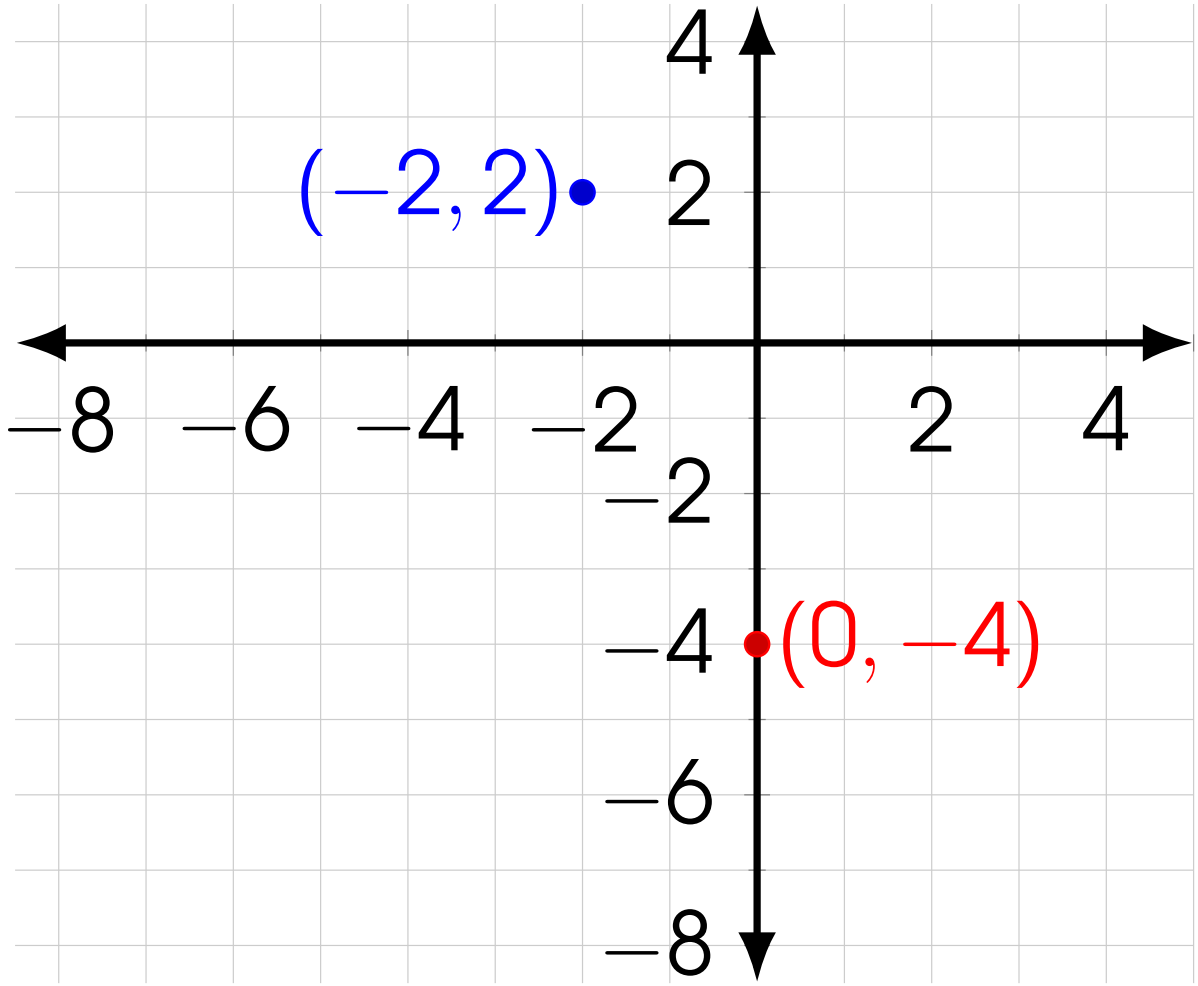
Set of ordered pairs: $\{(-2, 2), (0, -4), (1, -7)\}$



Example 7

Step 3: Plot the coordinates and connect them.

Set of ordered pairs: $\{(-2, 2), (0, -4), (1, -7)\}$



Example 7

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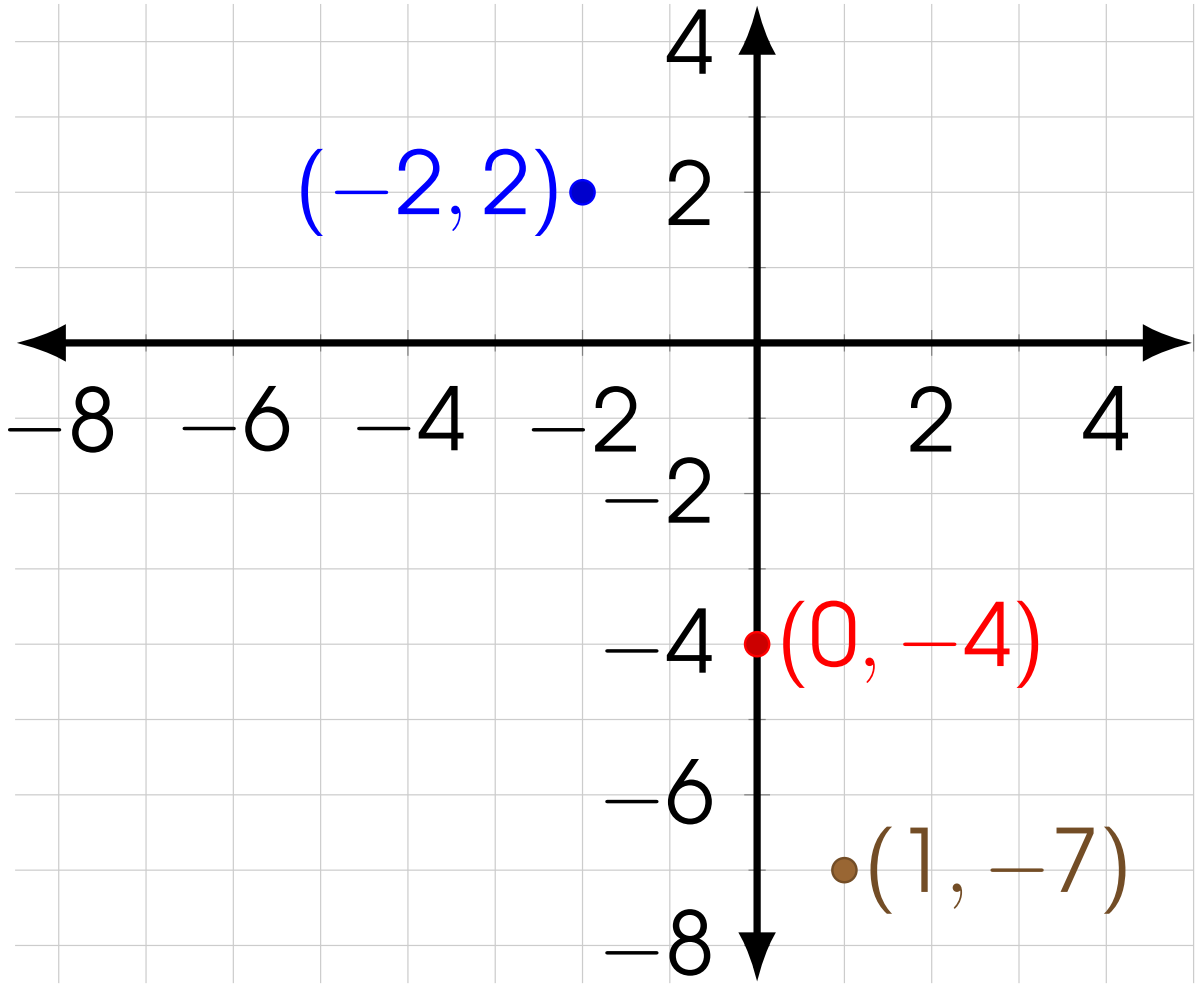

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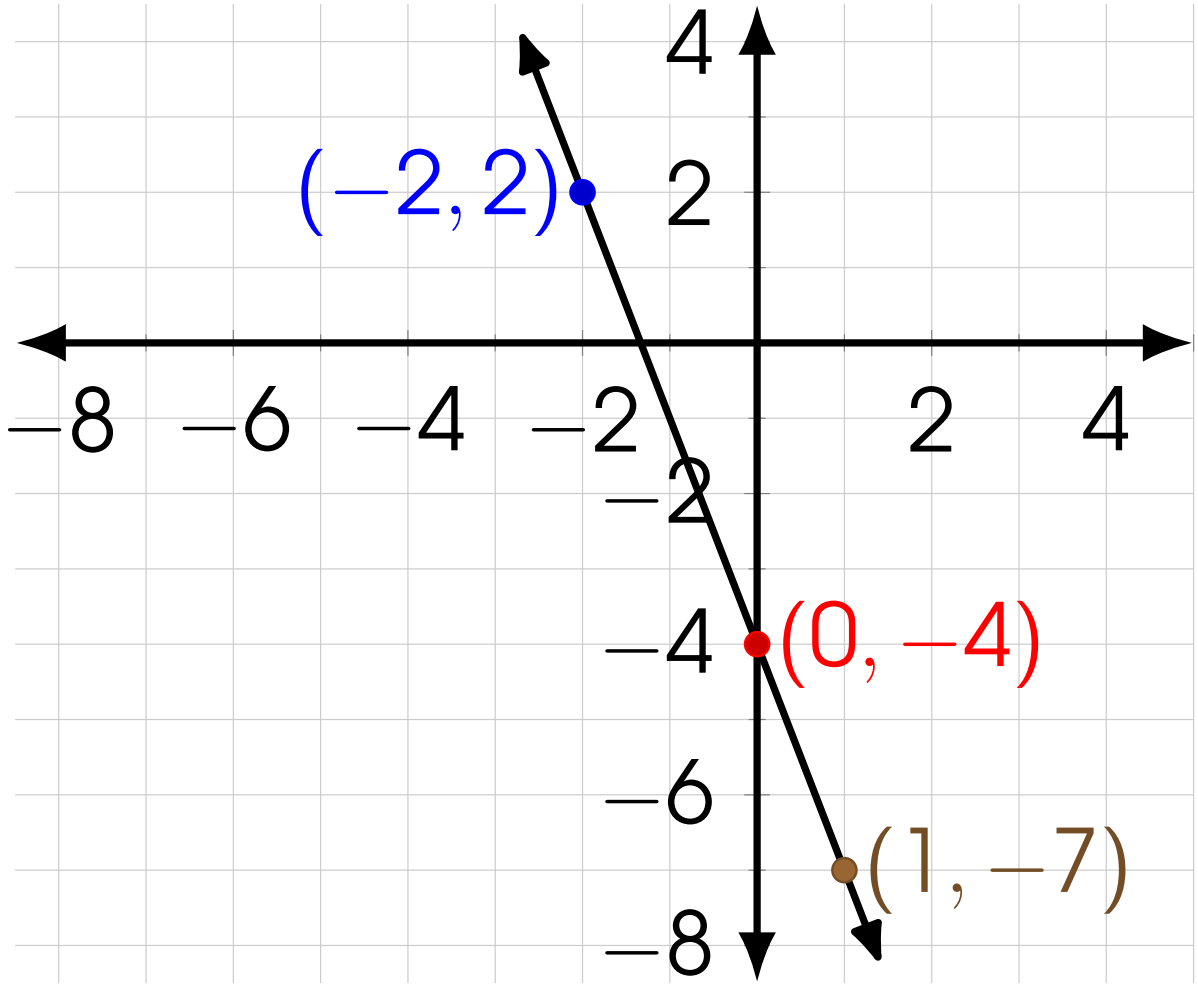

Thank you for watching.