7 How to • • • • • • • • • • • • • • • • Graph Equations

Facts to Know

A *graph* is an illustration of an equation. A graph is made up of two number lines that cross (more about this below). A graph shows the relationship of the terms in the equation. The graphs of some equations are straight lines. These are *linear equations.* The graphs of other equations can be curves or other shapes. These are called *nonlinear equations.* Can you tell the difference just by looking at an equation? Yes.

A linear equation contains one or two variables, each to the first power

Examples:	$y = 3b + 5$	$n = 4$	$t = \frac{1}{2}y - 8$

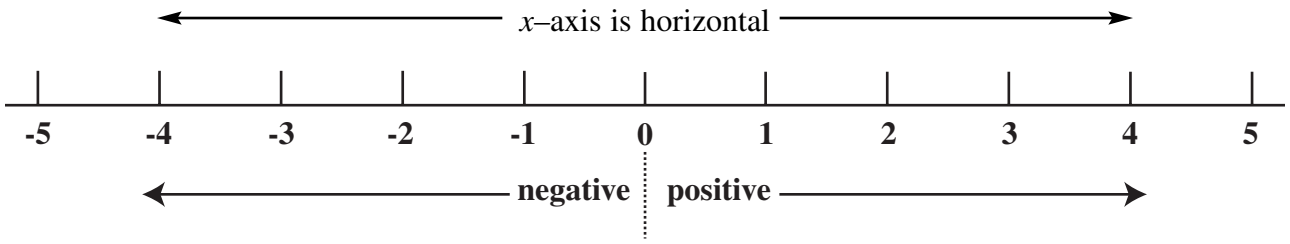
On the other hand, if a variable in an equation is raised to a power other than 0 or 1 —and that includes negative numbers, too—its graph will be nonlinear.

Examples:	$\mathbf{20 = r^2}$	*r is a variable raised to the second power.*
	$\mathbf{t = \frac{3}{x} + 9}$	*$t = \frac{3}{x} + 9$ is the same as $y = 3x^{-1} + 9$, raising x to the -1 power.*

Graphs are often used in engineering and other sciences to show a mathematical statement as a visual piece of information. A shape can be expressed as an equation or as a graph.

Number Lines on Graphs

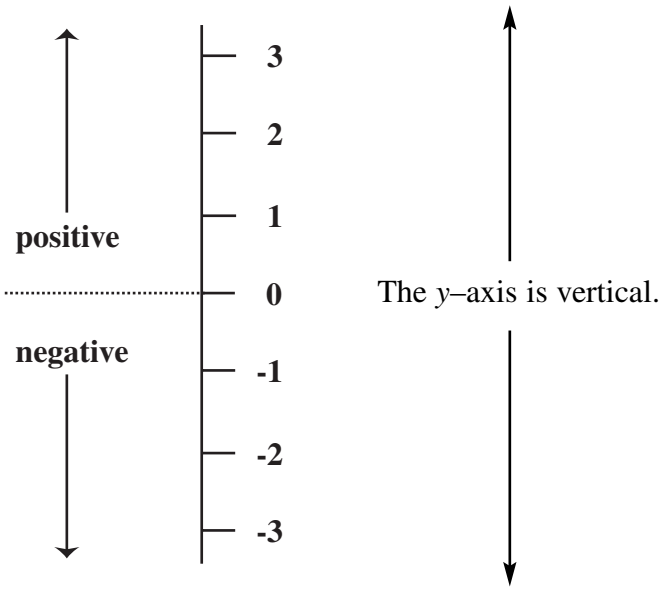
A graph is made up of two number lines that intersect (cross) at right angles. One number line is *horizontal.* It is called the *x–axis.*



The numbers to the *right* of 0 are positive. The numbers to the *left* of 0 are negative.

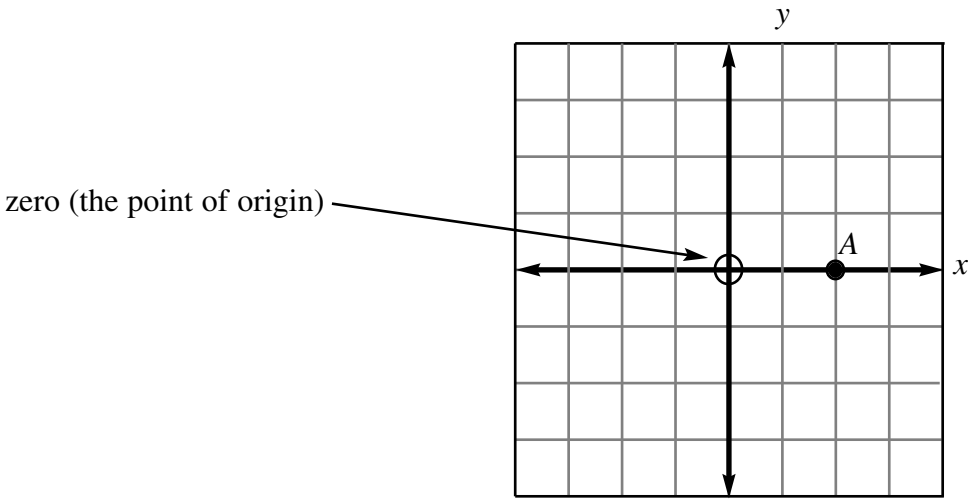
Facts to Know *(cont.)*

The vertical number line is called the *y–axis.*



The numbers *above* zero are positive. The numbers *below* zero are negative.

On a graph, the *x*–axis and *y*–axis cross at 0. The zero is called the *origin*. All other points are counted from zero.



Points on a graph are often named by letters: *A, B, C, D* and so on. To find out what number a point stands for, count the number of lines from 0. What does the *A* stand on the graph above?

A is on the *x*–axis, two places to the right of zero. So, point *A* is at 2 on the *x*–axis. Point *A* is (2, 0).

Facts to Know *(cont.)*

Finding Coordinates for Points

Two numbers are needed to give the location of a point on a graph. The two numbers are the point's *coordinates.* Think of when you use the number scale and letter scale on the sides of a map. A town or landmark may be located at (A, 7), for instance. These are the place's coordinates.

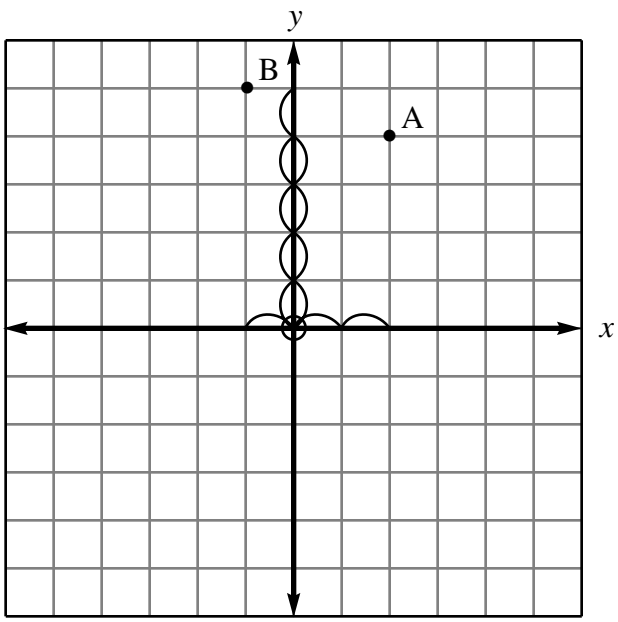
In algebra, the coordinates are always written inside parentheses, like this:

(3, 4)

- refers to a point on the *x*–axis
- tells how far to the *right* or *left* of 0 the point is located

- refers to a point on the *y*–axis
- tells how far *above* or *below* 0 the point is located

Find the coordinates for points *A* and *B* on the graph below.



For Finding Point A

Step 1: Find the *x*–coordinate. Start at 0 and count over right to the line point *A* is on. Point *A* is 2 lines to the right of *0*. So, point *A* is has an *x*-coordinate of 2.

Step 2: Find the *y*–coordinate. Start at 0 and count to the line point *A* is on. Point *A* is 4 lines above 0. Point *A* has a *y*-coordinate of 4.

So, the coordinates for point *A* are (2, 4).

For Finding Point B

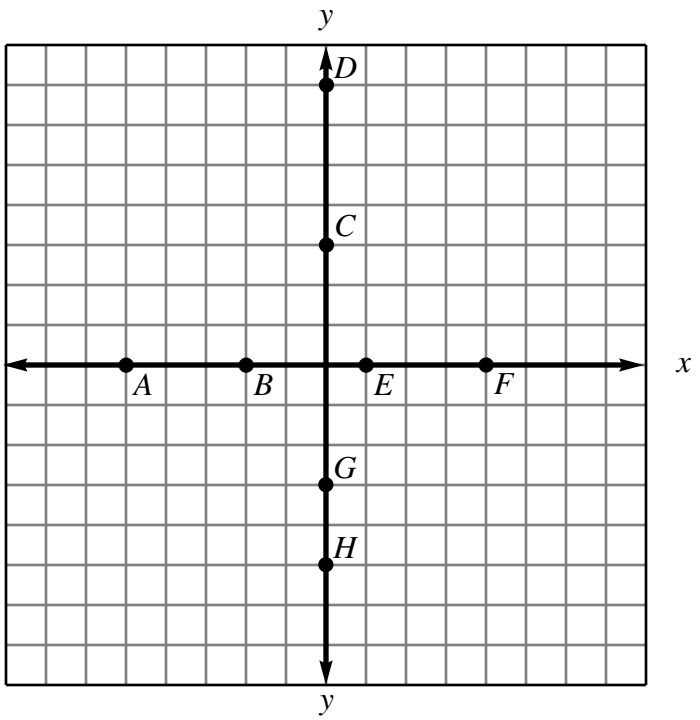
Step 1: Find the *x*–coordinate. Start at 0 and count over left to the line point *B* is on. Point *B* is 1 line to the left of 0. So, point *B* has an *x*-coordinate of -1.

Step 2: Find the *y*–coordinate. Start at 0 and count up to the line point *B* is on. Point *B* is 5 lines above 0. Point *B* has a *y*–coordinate of 5.

So, the coordinates for point *B* are (-1, 5).

Directions: Find the coordinates for the points on the graph.

1. Point A = (,)
2. Point B = (,)
3. Point C = (,)
4. Point D = (,)
5. Point E = (,)
6. Point F = (,)
7. Point G = (,)
8. Point H = (,)



Directions: Find the coordinates for the points on the graph.

9. Point A = (,)
10. Point B = (,)
11. Point C = (,)
12. Point D = (,)
13. Point E = (,)
14. Point F = (,)
15. Point G = (,)
16. Point H = (,)