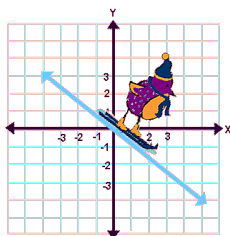


## The Cartesian Plane

J. Garvin



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## The Cartesian Plane

The Cartesian Plane (named after René Descartes) is a two-dimensional grid upon which points can be *plotted*. It is separated into four separate *quadrants* (ordered counter-clockwise) by two *axes*, the *x*-axis and the *y*-axis. The point where the two axes meet is called the *origin*.

A point on the Cartesian plane is an ordered pair of *coordinates* of the form  $(x, y)$ , where  $x$  and  $y$  are real numbers. The origin has coordinates  $(0, 0)$ .

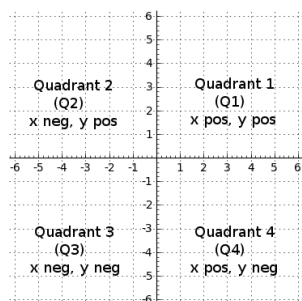
Older texts may refer to the  $x$ -coordinate as the *abscissa* and the  $y$ -coordinate as the *ordinate*, but these terms are not commonly used nowadays.

Coordinates are positive moving up and right from the origin, and negative moving left and down from it.

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## The Cartesian Plane

The Cartesian Plane is below, illustrating the quadrants in which the  $x$ - and  $y$ -coordinates are positive or negative.



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## The Cartesian Plane

### Example

In which quadrant is the point  $(5, -1)$ ?

Since the  $x$ -coordinate is positive and the  $y$ -coordinate is negative,  $(5, -1)$  is in Quadrant 4.

### Example

The  $x$ -coordinate of a point on the Cartesian Plane is negative. What quadrant(s) might it be in?

Since the  $x$ -coordinate is negative, the point could be in either Quadrant 2 or Quadrant 3.

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## The Cartesian Plane

Sometimes, a point may lie on one axis, or even on both. Such a point does not belong to a specific quadrant, as it would be in two quadrants at the same time.

For any given point,  $(x, y)$ :

- if  $x = 0$  and  $y \neq 0$ , the point is on the  $y$ -axis,
- if  $x \neq 0$  and  $y = 0$ , the point is on the  $x$ -axis, and
- if  $x = 0$  and  $y = 0$ , the point is at the origin,  $(0, 0)$ .

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## The Cartesian Plane

### Example

On which axis is the point  $(0, -5)$ , and between which two quadrants does it lie?

Since the  $x$ -coordinate is 0, and the  $y$ -coordinate is non-zero, the point lies on the  $y$ -axis.

Since the  $y$ -value is negative, the point is between Quadrant 3 and Quadrant 4.

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## The Cartesian Plane

When identifying or plotting points, it is important to move in the correct directions relative to the origin.

Given a point, the  $x$ -coordinate is *always* the first of the two values, while the  $y$ -coordinate is second.

If the value of the  $x$ -coordinate is positive, then the point lies to the right of the origin, whereas if it is negative, the point lies to the left.

Similarly, if the value of the  $y$ -coordinate is positive, then the point is located upward from the origin, whereas if it is negative, the point is located downward.

## The Cartesian Plane

### Example

Plot the points  $A(-2, 3)$ ,  $B(1, -4)$  and  $C(3, 0)$  on the Cartesian Plane.

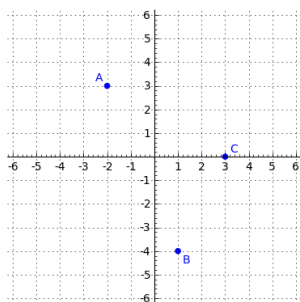
Point  $A$  is in Quadrant 2 ( $x$  negative,  $y$  positive), at a location 2 units left and 3 units up from the origin.

Point  $B$  is in Quadrant 4 ( $x$  positive,  $y$  negative), at a location 1 unit right and 4 units down from the origin.

Point  $C$  is on the positive  $x$ -axis ( $y = 0$ ), at a location 3 units right of the origin.

## The Cartesian Plane

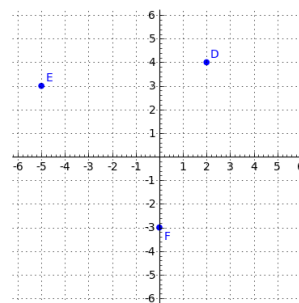
The plot below shows points  $A$ ,  $B$  and  $C$ .



## The Cartesian Plane

### Example

State the coordinates of points  $D$ ,  $E$  and  $F$  on the grid.



## The Cartesian Plane

Remember that for all points, the  $x$ -coordinate is the first value and the  $y$ -coordinate the second.

Therefore, point  $D$  is at  $(2, 4)$ , point  $E$  is at  $(-5, 3)$ , and point  $F$  is at  $(0, -3)$ .

A common mistake among students is to reverse the values; for example, listing the coordinates of point  $D$  as  $(4, 2)$ .

Much of the work that we will do over the next few units will involve plotting points on the Cartesian Plane, so be sure that you can properly identify and label points.

## Questions?

