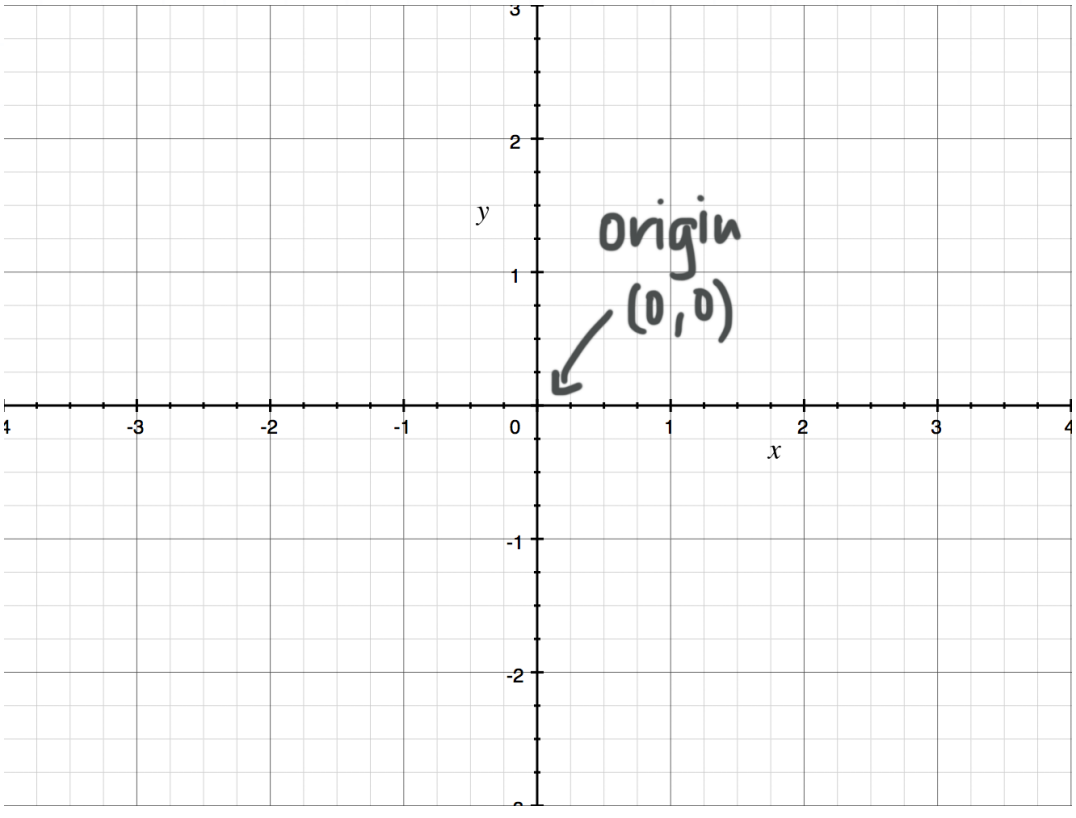
Cartesian coordinate system

The Cartesian coordinate system is the two-dimensional plane in which we graph points and equations. We can think about this plane as a surface, like a piece of paper, that extends forever in all directions.

The plane is defined by the **coordinate axes**, a pair of perpendicular number lines, one horizontal and one vertical. The horizontal axis is the x-axis and the vertical axis is the y-axis, and they meet at the **origin**, which is the point $(0,0)$.

We draw arrows at the ends of the axes to indicate that they extend forever. The horizontal axis is negative on the left and positive on the right, while the vertical axis is negative at the bottom and positive on the top.



We represent every point in the plane by a pair of numbers (x, y), called its **coordinates**, where x (the horizontal coordinate or the x-coordinate) is the

horizontal (left-right) location of the point, and y (the vertical coordinate or the y-coordinate) is the vertical (up-down) location of the point.

So the x-coordinate of a point in the plane is negative to the left of the y-axis, positive to the right of the y-axis, and 0 if it's on the y-axis itself. Similarly, the y-coordinate of a point in the plane is negative below the x-axis, positive above the x-axis, and 0 if it's on the x-axis.

The origin is the center of the coordinate system, so its coordinates are $(x, y) = (0,0)$.

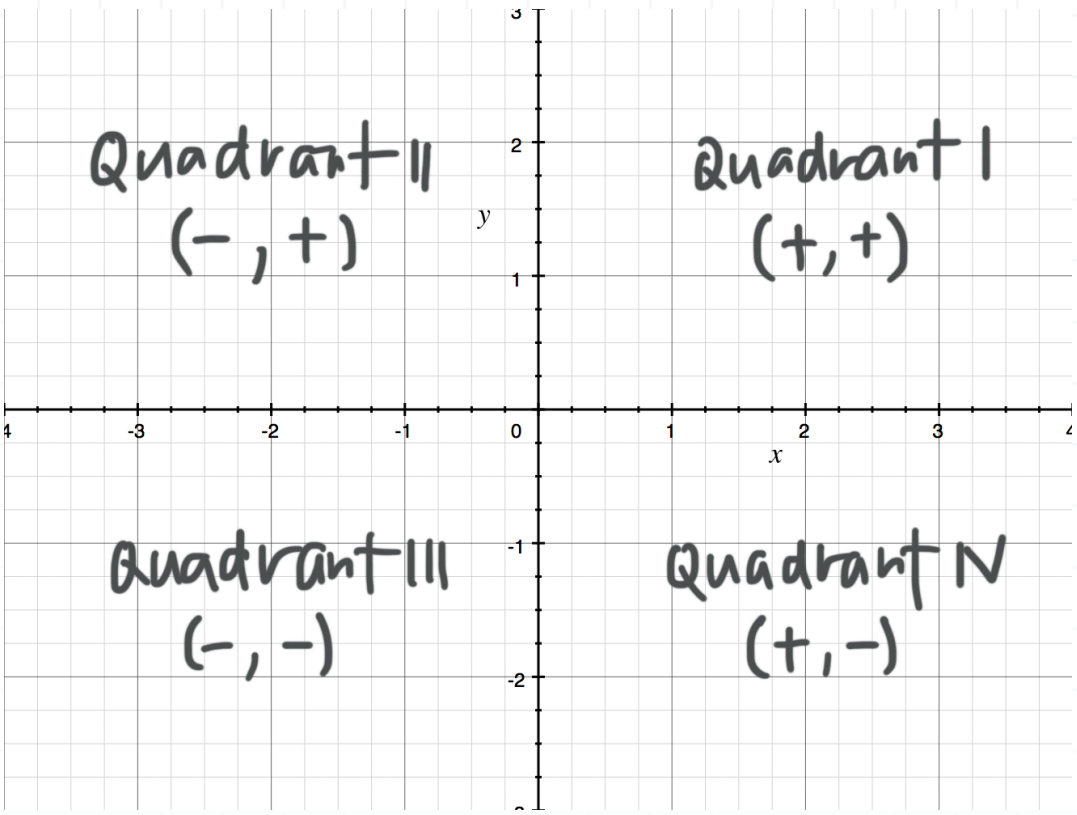
The axes divide the coordinate plane into four **quadrants**. Quadrant I is where x and y are both positive. The other three quadrants are named in counterclockwise order.

Quadrant I: both x and y are positive $(x, y) = (+, +)$

Quadrant II: x is negative and y is positive $(x, y) = (-, +)$

Quadrant III: both x and y are negative $(x, y) = (-, -)$

Quadrant IV: x is positive and y is negative $(x, y) = (+, -)$



Quadrants I, II, III, and IV are also called the first, second, third, and fourth quadrants, respectively.

We graph a point in the plane by placing a dot at its location in the Cartesian coordinate system. We sometimes say that we “plot a point,” which means the same thing.

Let’s do an example where we plot a point in the plane.

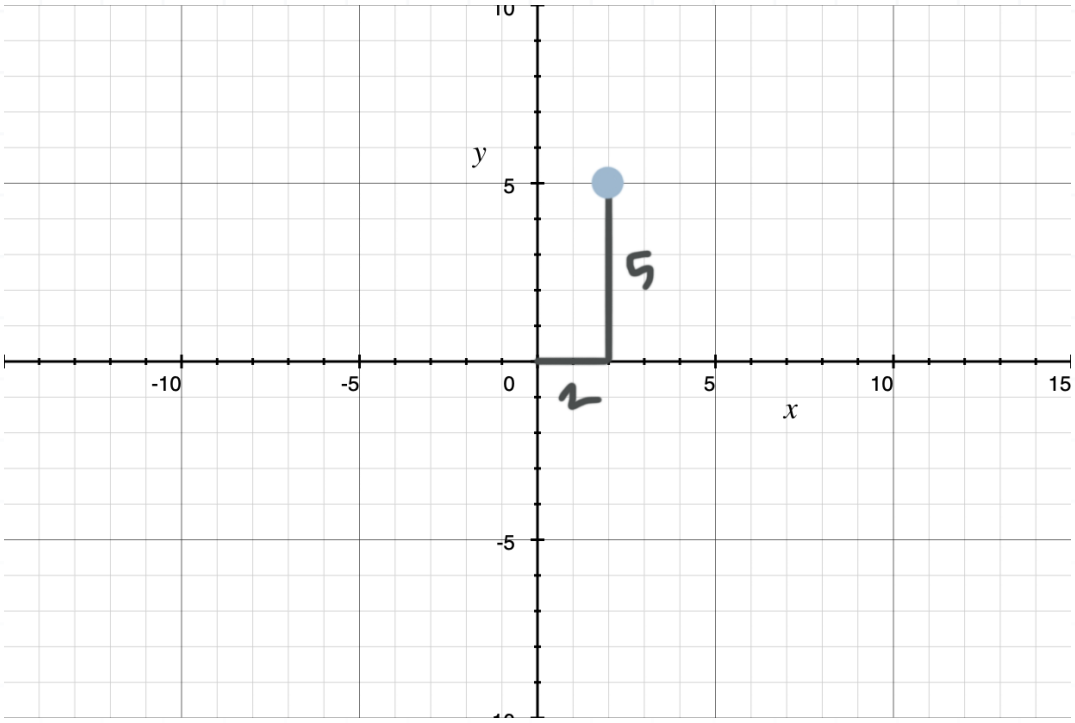
Example

Graph the point in the Cartesian coordinate system.

$$(2,5)$$

Remember that points are in the form (x, y), so the 2 tells us how to move on the x-axis (left or right) and the 5 tells us how to move on the y-axis (up

or down). Since the x-coordinate 2 is positive, we move 2 units from the origin in the direction of the positive x-axis (to the right). And since the y-coordinate 5 is positive, we move 5 units up from there in the direction of the positive y-axis (up).



Let’s try another example of plotting a point in the plane.

Example

In which quadrant should we plot the point?

$$(1, -7)$$

Since the x-coordinate is positive and the y-coordinate is negative, the point should be plotted in the fourth quadrant, Quadrant IV.