



Concepts and Examples

The Rectangular Coordinate System

Based on power point presentations by Pearson Education, Inc.
Revised by Ingrid Stewart, Ph.D.

Learning Objectives

1. Construct a rectangular coordinate system.
2. Plot points in the rectangular coordinate system.

1. Construct a Rectangular Coordinate System (1 of 6)

We already discussed equations in which one variable was used. For example, $6x + 3 = 0$.

Soon, we will discuss equations in which two variables are used, often x and y . For example, $6x + 3y = 0$.

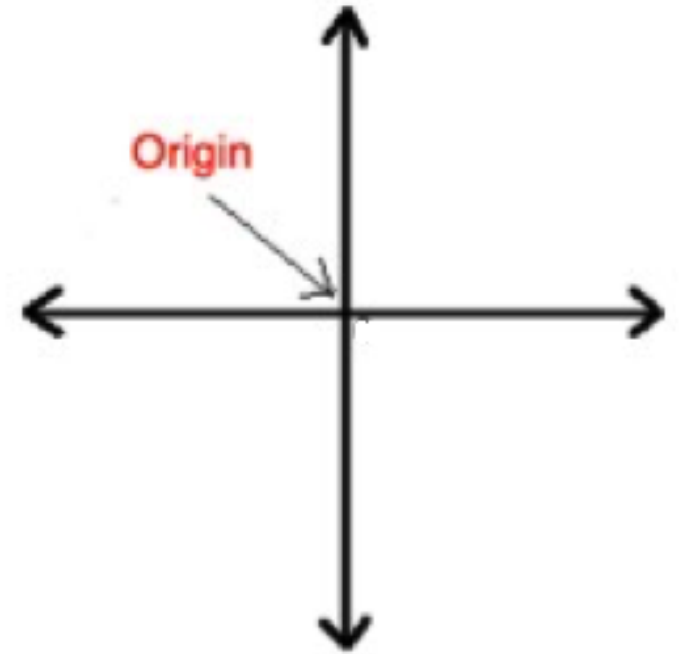
We will learn that we can actually make pictures of equations in two variables to give us a better understanding of some of the characteristics of the equation.

We will do this with the help of the **Rectangular Coordinate System**.

Construct a Rectangular Coordinate System (2 of 6)

The **Rectangular Coordinate System** is also called the *Cartesian Coordinate System*. It was invented in the 17th century by the French mathematician René Descartes.

- We draw a horizontal line and a vertical line that intersect at 90° angles. We call each line an **axis**. Incidentally, the plural is axes.
- The point of intersection of these axes is called the **Origin**.
- Sometimes arrows are placed at the ends of the axes to indicate that they are infinitely long.



Construct a Rectangular Coordinate System (4 of 6)

Each individual axis must be partitioned into units of identical length using hash marks, which are short vertical line segments. They are typically seen on rulers. The marks are parallel to each other in an evenly-spaced manner. The distance between adjacent marks is one unit.



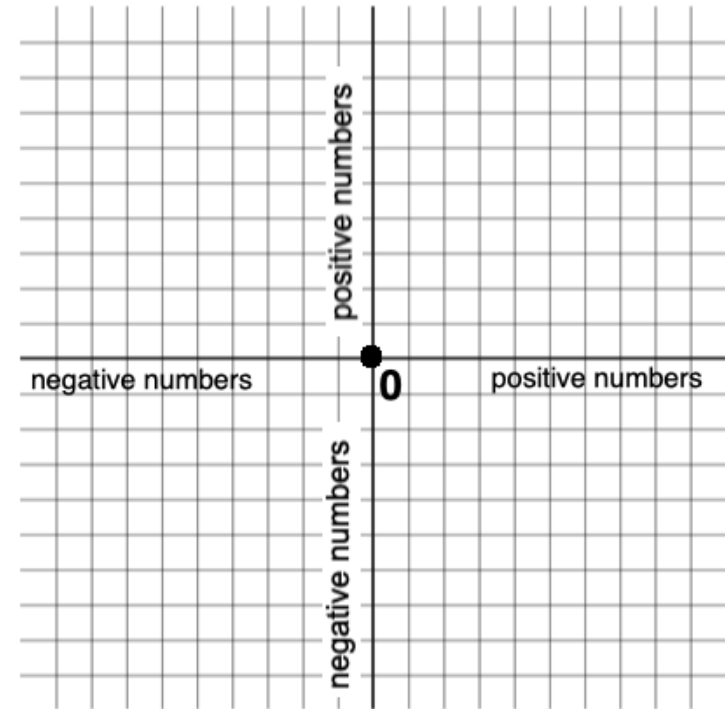
NOTE: The partitioning of the vertical axis does not need to be the same as that of the horizontal axis.

Construct a Rectangular Coordinate System (3 of 6)

All hash marks MUST be numbered to indicate the "scale" of each axis.

- The number 0 is at the origin.
- Positive numbers are shown to the right of the origin and above the origin.
- Negative numbers are shown to the left of the origin and below the origin.

NOTE: The numbers on the vertical axis do not need equal those on the horizontal axis.



Construct a Rectangular Coordinate System (5 of 6)

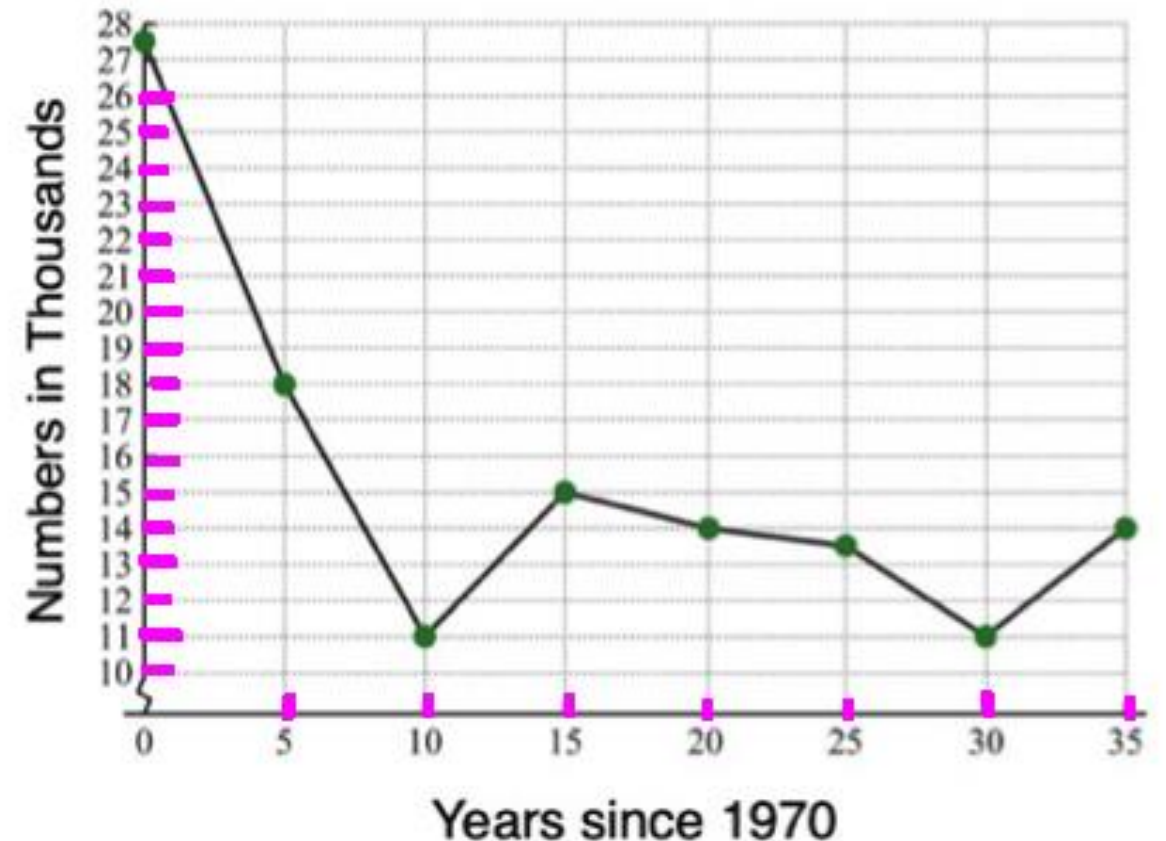
Let's look at an application problem.

Note the **hashmarks** and the numbers next to them!

Note that the difference in the partitioning of the axes!

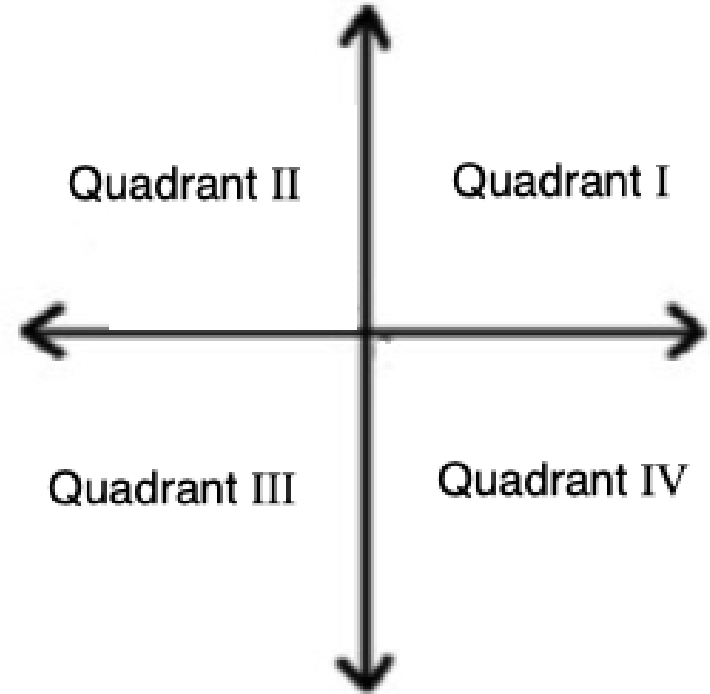
Given limited graphing space, it is often necessary and desirable to have differing scales along the vertical and horizontal axis.

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Construct a Rectangular Coordinate System (6 of 6)

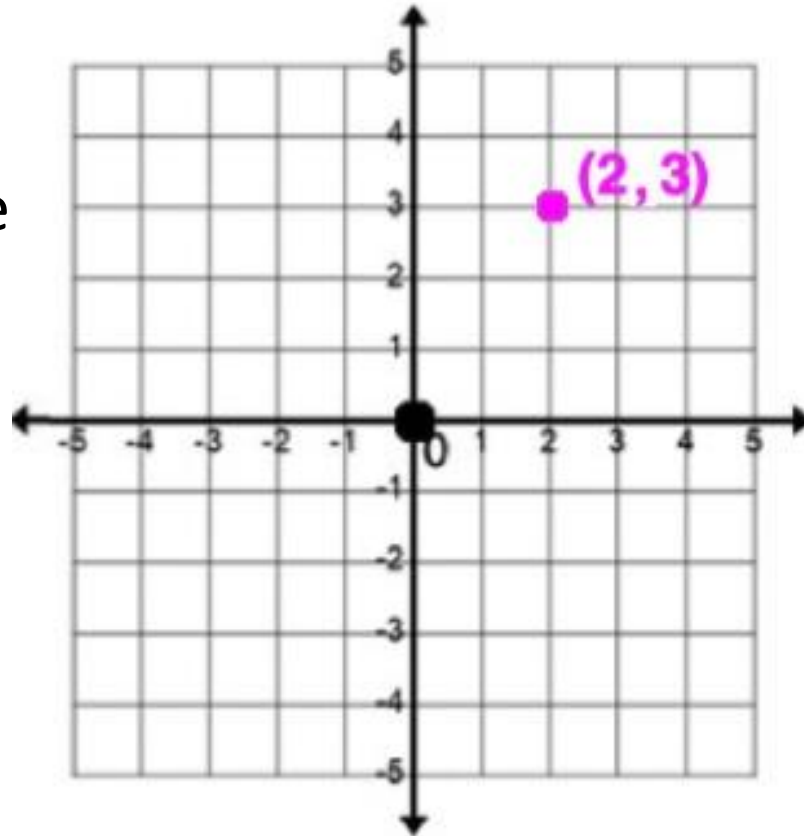
The two axes divide the coordinate system into four areas. We use Roman numerals and call them Quadrant I, Quadrant II, Quadrant III, and Quadrant IV.



2. Plot Points in the Rectangular Coordinate System (1 of 9)

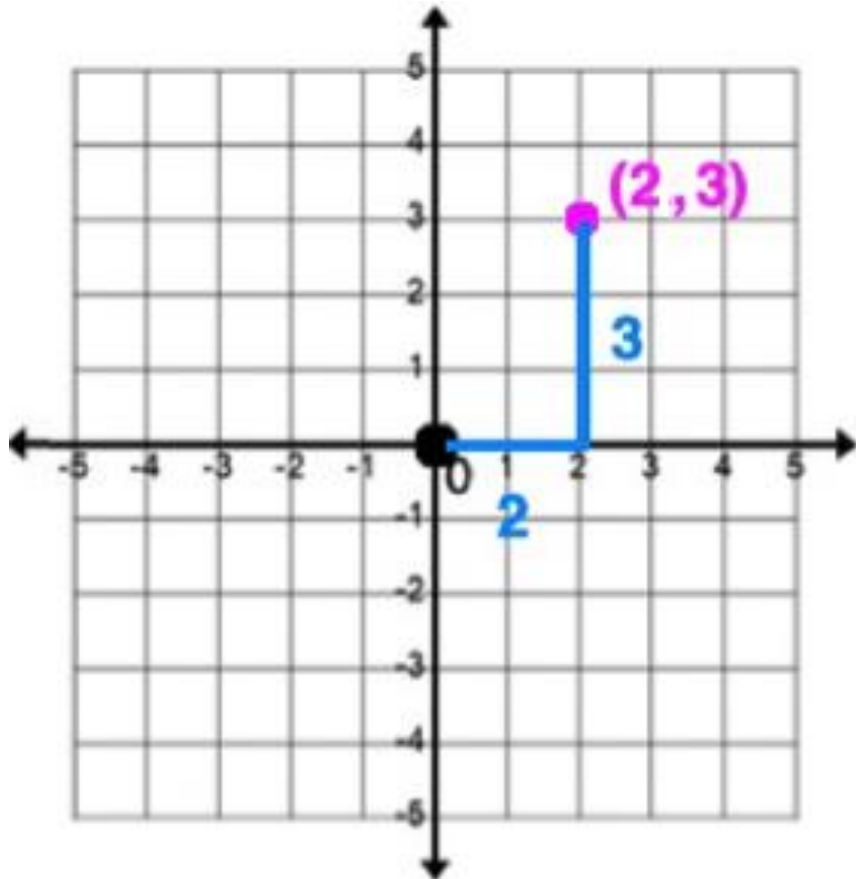
The rectangular coordinate system allows us to plot points. Each point corresponds to two numbers separated by a comma. We call this an **ordered pair**. ALL ordered pairs MUST be enclosed in parentheses! The numbers in an ordered pair are often called **coordinates**.

For example



Plot Points in the Rectangular Coordinate System (2 of 9)

Given an ordered pair in a rectangular coordinate system, the first number **ALWAYS** denotes a distance along the horizontal axis. The second number **ALWAYS** denotes a distance parallel to (or along) the vertical axis.

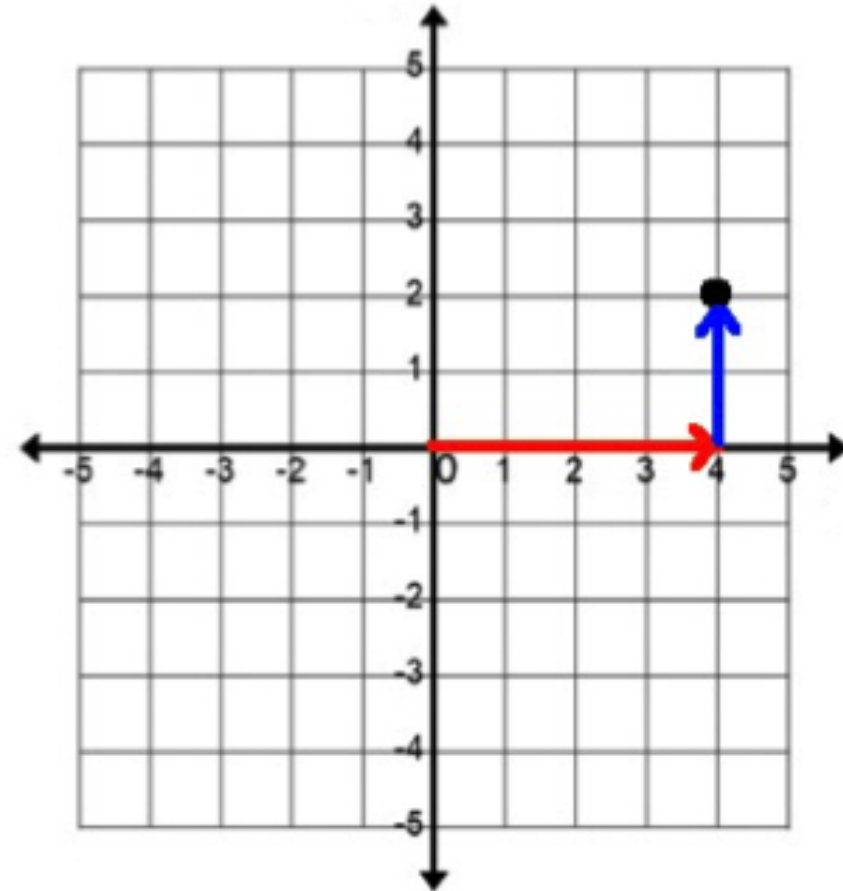


Plot Points in the Rectangular Coordinate System (3 of 9)

Example 1:

Plot the ordered pair $(4, 2)$ in a rectangular coordinate system.

We start at the origin and move 4 units to its right along the horizontal axis. From there, we move 2 units up and parallel to the vertical axis.

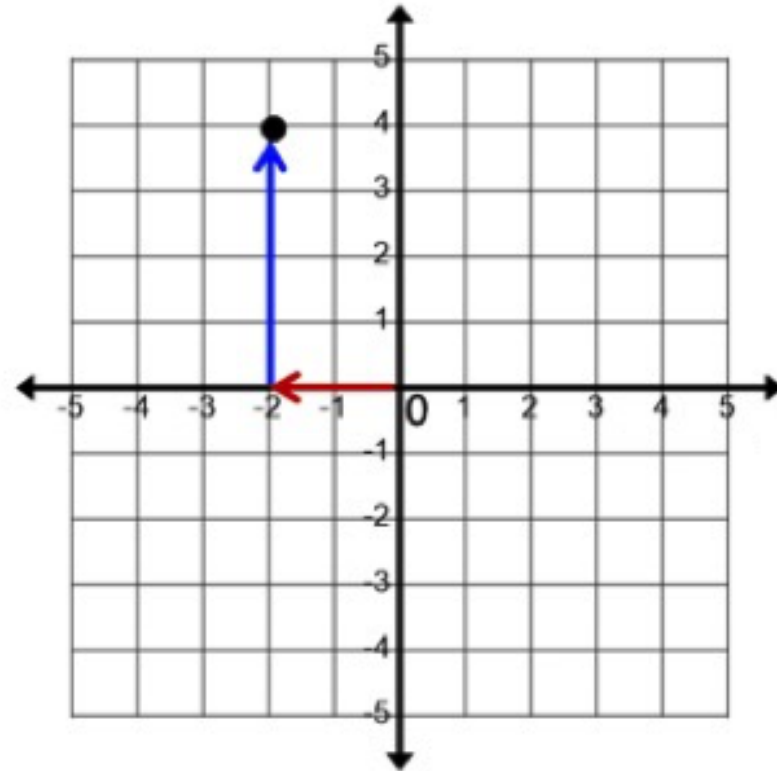


Plot Points in the Rectangular Coordinate System (4 of 9)

Example 2:

Plot the ordered pair $(-2, 4)$ in a rectangular coordinate system.

We start at the origin and move 2 units to its left along the horizontal axis. From there, we move 4 units up and parallel to the vertical axis.



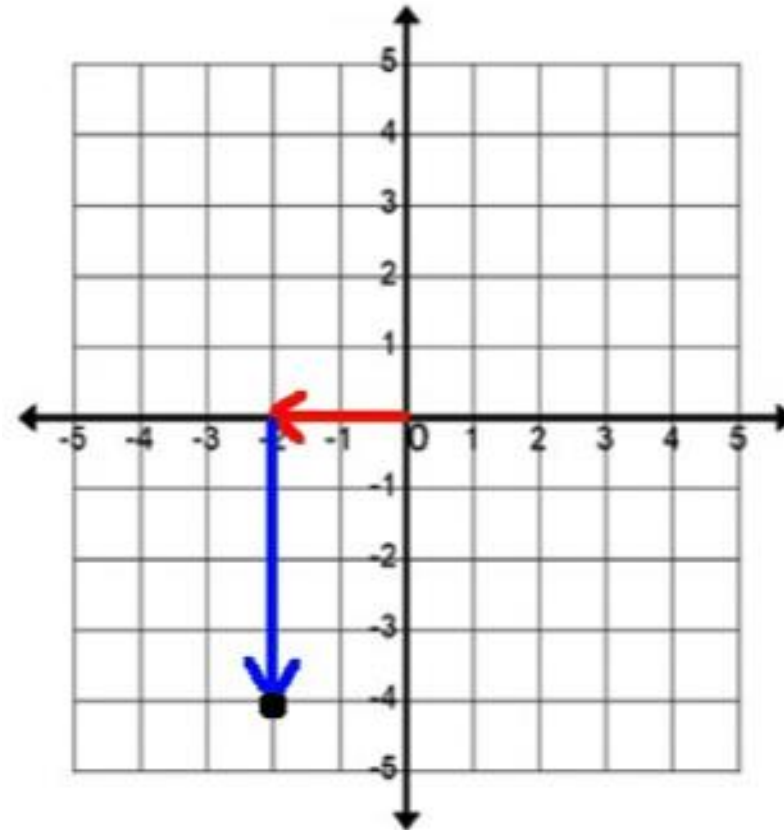
Please note that we always move from the origin along the x -axis FIRST, and from there we move along or parallel to the y -axis.

Plot Points in the Rectangular Coordinate System (5 of 9)

Example 3:

Plot the ordered pair $(-2, -4)$ in a rectangular coordinate system.

We start at the origin and move 2 units to its left along the horizontal axis. From there, we move 4 units down and parallel to the vertical axis.

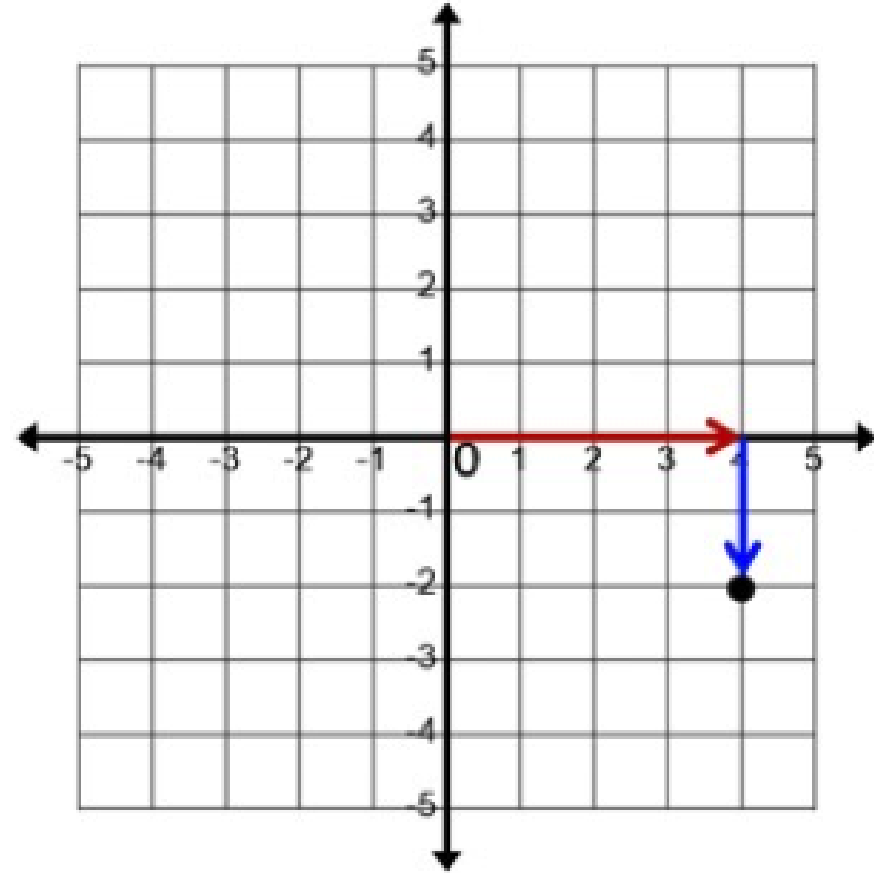


Plot Points in the Rectangular Coordinate System (6 of 9)

Example 4:

Plot the ordered pair $(4, -2)$ in a rectangular coordinate system.

We start at the origin and move 4 units to its right along the horizontal axis. From there, we move 2 units down and parallel to the vertical axis.



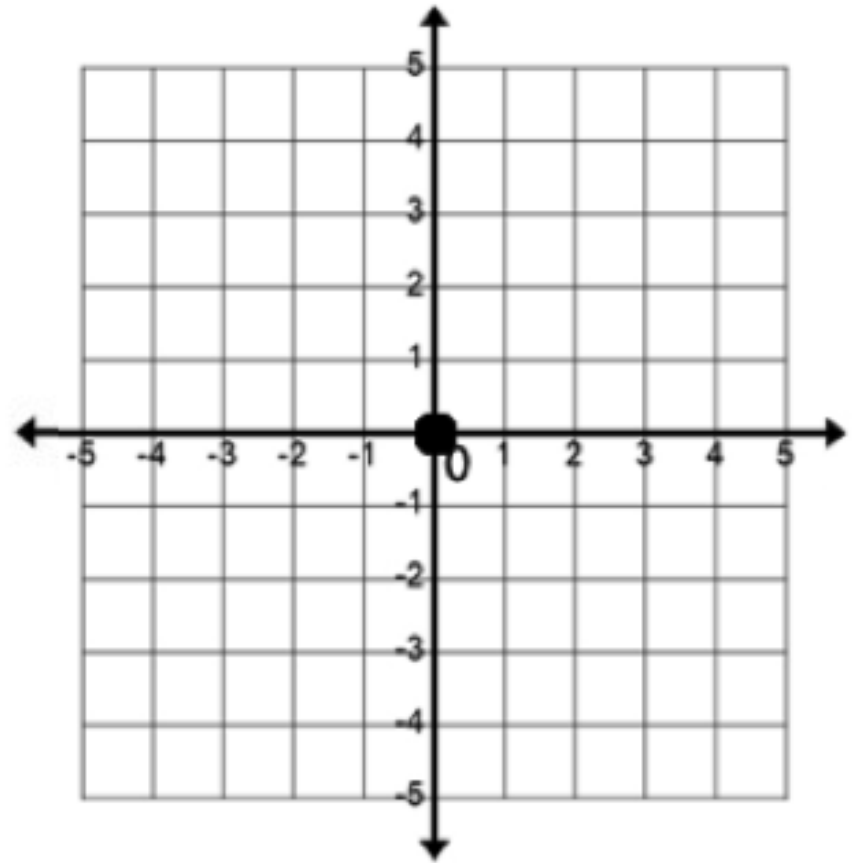
Plot Points in the Rectangular Coordinate System (7 of 9)

Example 5:

Plot the ordered pair $(0, 0)$ in a rectangular coordinate system.

We start at the origin, but we move NO distance in the horizontal direction and in the vertical direction. That is, we stay at the origin.

We just found that the coordinates of the origin is the ordered pair $(0, 0)$.

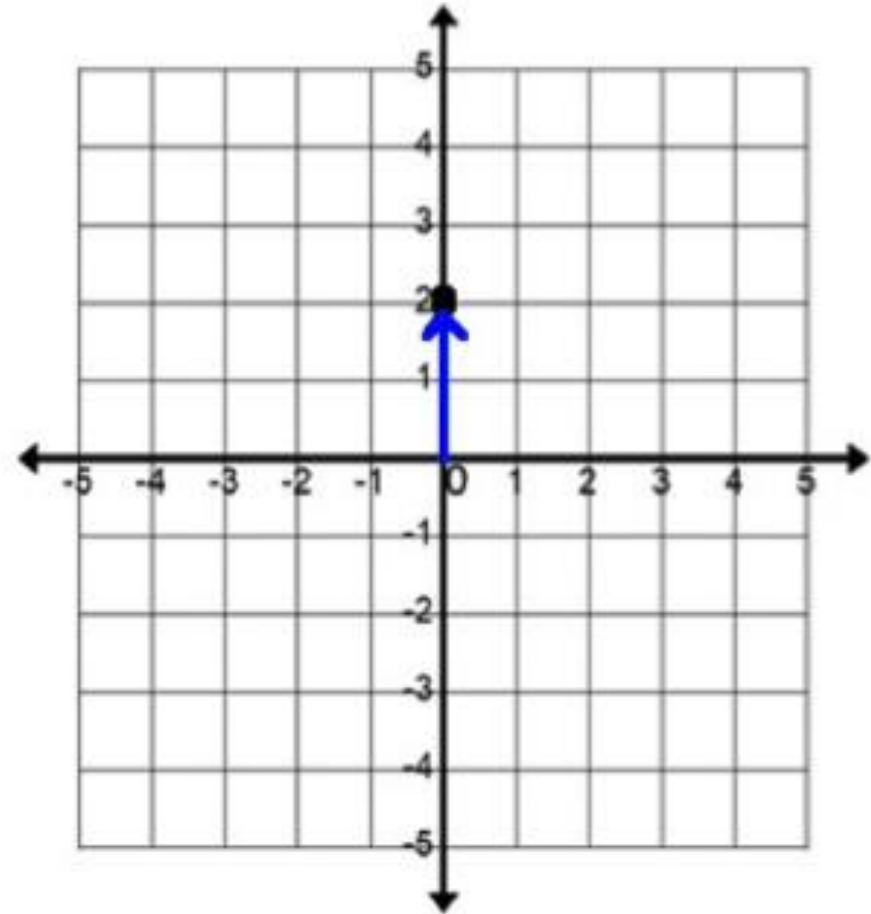


Plot Points in the Rectangular Coordinate System (8 of 9)

Example 6:

Plot the ordered pair $(0, 2)$ in a rectangular coordinate system.

We start at the origin, but we move NO distance in the horizontal direction. That is, we stay at the origin. But from there, we move 2 units up along the vertical axis.



Plot Points in the Rectangular Coordinate System (9 of 9)

Example 7:

Plot the ordered pair $(4, 0)$ in a Rectangular Coordinate System.

We start at the origin and move 4 units to its right along the horizontal axis. But from there, we move NO distance in the vertical direction.

