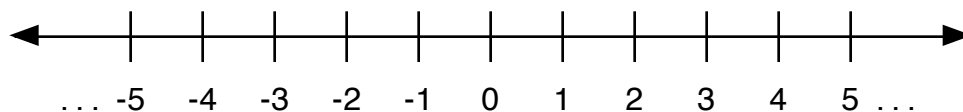


Lesson 5 Number Lines and Cartesian Coordinates

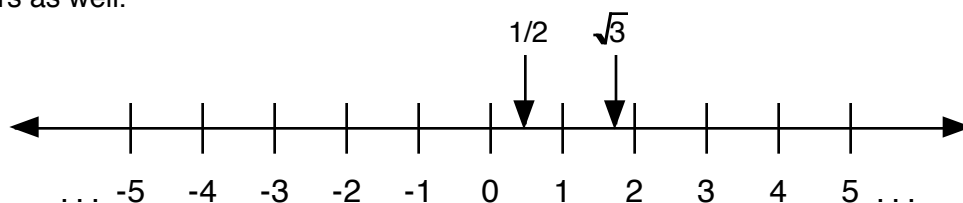
Note: The first part of this lesson is not on the video.

A number line is used to graphically show real number solutions to a problem. It looks like this:



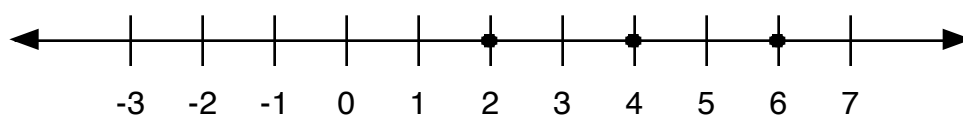
Zero is in the middle of the number line and all the negative numbers extend infinitely to the left. Similarly, the positive numbers extend infinitely to the right.

Notice that even though only integers are labeled on this line, you could show fractions or irrational numbers as well.

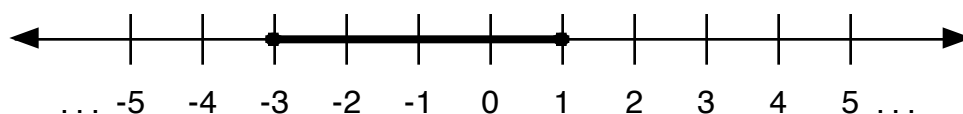


Example 1: Find all even numbers between 1 and 7 and plot your answer on a real number line.

Filled-in dots are used to designate a solution to the problem.

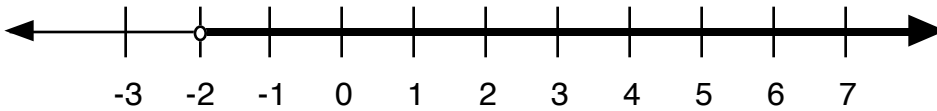


Example 2: Find all numbers between -3 and 1, including the endpoints -3 and 1.



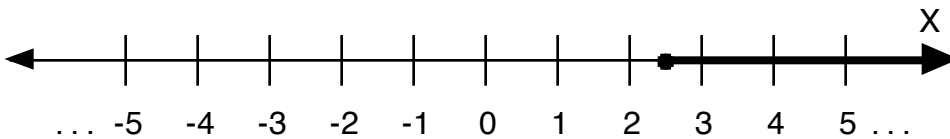
This time we have an infinite range of answers. Therefore, we dot and fill in the endpoints because they are included; and shade in all the numbers in between them.

Example 3: Find all the numbers which are greater than -2. Show your answer on a real number line.



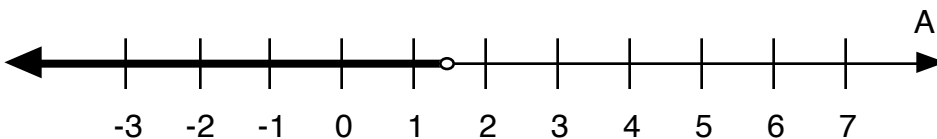
This time we have left -2 as an open hole because it is not a part of the solution. Only numbers greater than -2 comprise the solution. Since the answer includes the numbers that extend infinitely to the right, an arrow is used and shaded as well.

Example 4: Find all $X \geq 5/2$.



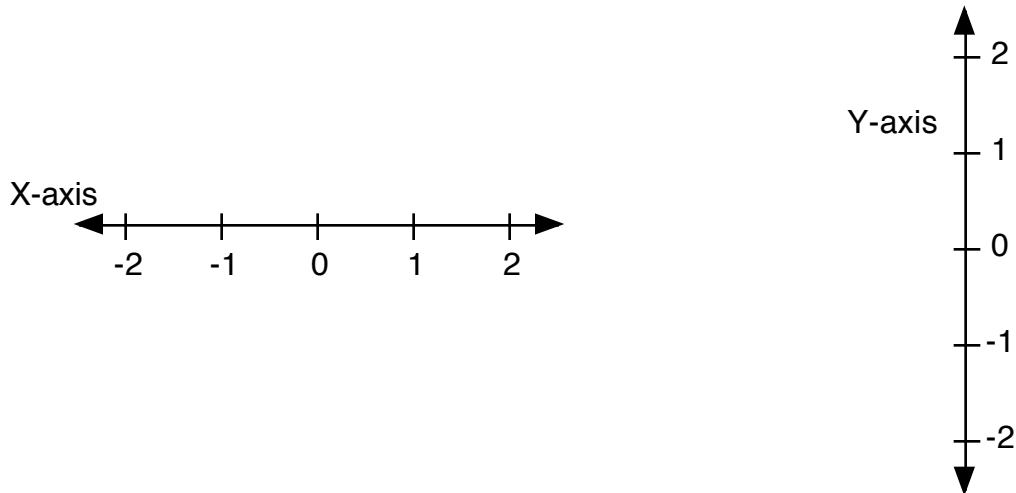
Here, $5/2 = 2\frac{1}{2}$ is shown as filled in. Answers extend infinitely to the right as shown. We are showing here that the real number line can be used to describe the values of the variable, X.

Example 5: Show on a number line where $A < \sqrt{2}$.

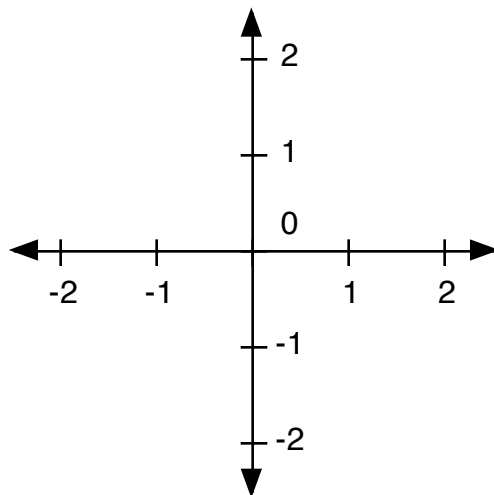


$\sqrt{2}$ 1.4 We are showing the possible values of A on this number line.
(Note that 1.4 is an approximate value)

In the next part of this lesson, we are going to be using a graph of two number lines perpendicular to each other at point “0”. The horizontal number line is labeled as the X-axis and the vertical number line is referred to as the Y-axis.



The X-axis starts at zero and moves to the right for positive numbers and to the left for negative numbers. The Y-axis starts at zero and moves to up for positive numbers and down for negative numbers. If you think of the Cartesian graph as two number lines it should help you in understanding it.



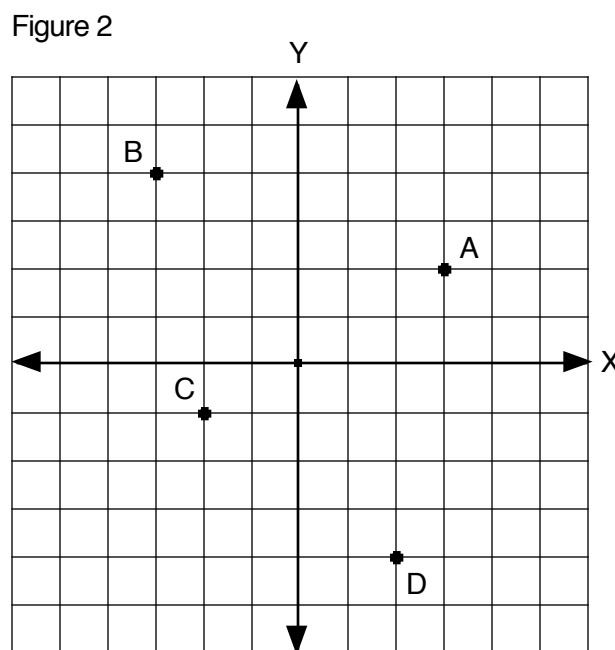
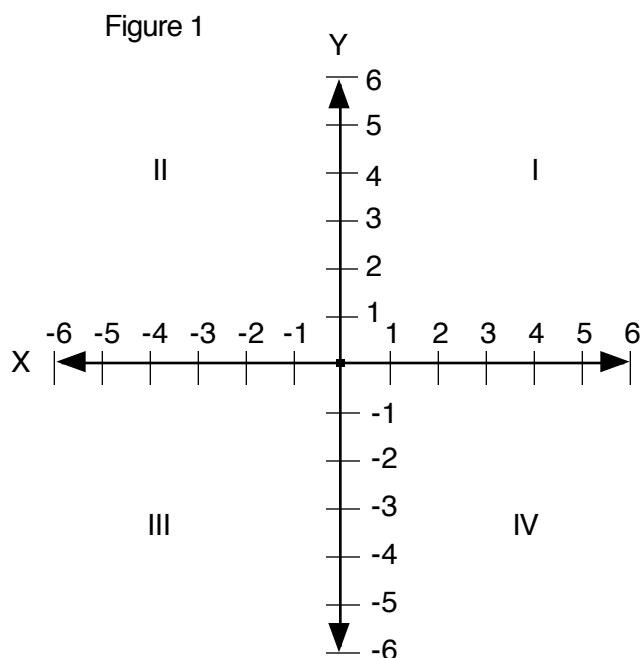
Cartesian Coordinates

Analytic Geometry Since Lesson 3 we've solved equations. This is known as algebra. Another subject, which concerns points, lines, planes, and angles, is geometry. For hundreds of years these two subjects were treated as separate entities. In the early 1600's a young man in his teens, René Descartes, discovered how to "show" algebra geometrically, resulting in what is called "analytic (algebra) geometry." Math-U-See owes a great deal to this mathematician, since our attempt is to "show" all aspects of math with visual, concrete objects. The following coordinate system is named after him. It is the (Des)cartesian coordinate system.

Coordinate System In graphing equations, there are over and up coordinates. The over, or horizontal coordinate, is called the X-coordinate, and the up, or vertical coordinate, is called the Y-coordinate. Think of playing the game Battleship, which has horizontal and vertical coordinates. Instead of numbers and letters, each coordinate is a number. The first number is given is the X-coordinate, the second is the Y-coordinate.

Each axis is a number line with positive and negative numbers. Figure 1 shows the two perpendicular axes as lines which intersect, dividing the plane into four quadrants. These are numbered counterclockwise with Roman numerals. Figure 2 does not have the numbers written, but represents the same graph.

The point where the two lines intersect, (0,0), is called the origin. When counting over and up to find the coordinates of a point, always begin at the origin.



Graphing Points Let's graph a few points and label them as we plot them on the graph.

A = (3, 2). This means over 3 to the right because it is positive, and up 2, since 2 is also positive.

B = (-3, 4), which is over to the left 3 because it is negative, and up 4 (positive).

C = (-2, -1), which is over to the left 2 and down 1.

D = (2, -4). which is right 2 and down 4.