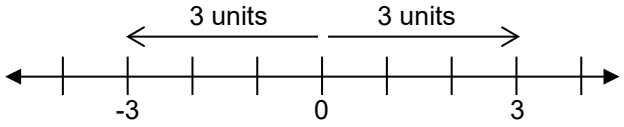
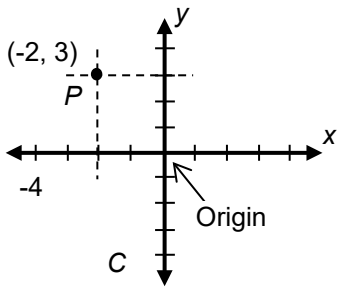
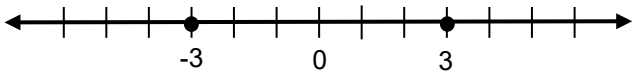
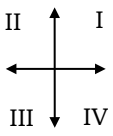
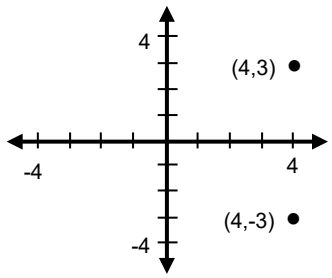
STUDENT RESOURCES

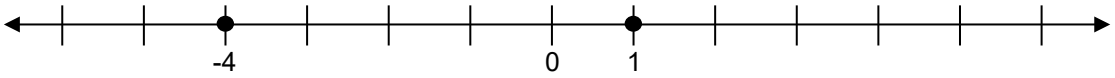
Word or Phrase	Definition
absolute value	The absolute value $\lvert x \rvert$ of a number x is the distance from x to 0 on the number line. $\lvert 3 \rvert = 3$ and $\lvert -3 \rvert = 3$, because both 3 and -3 are 3 units from 0 on the number line. 
coordinate plane	A coordinate plane is a plane with two perpendicular number lines (coordinate axes) meeting at a point (the origin). Each point P of the coordinate plane corresponds to an ordered pair (a, b) of numbers, called the coordinates of P. The point P may be denoted $P(a, b)$. The coordinate axes are often referred to as the x-axis and the y-axis respectively. The origin has coordinates (0, 0). The x-coordinate of P is -2, and the y-coordinate of P is 3. Point P (-2, 3) is an ordered pair. 
integers	The integers are the whole numbers and their opposites. They are the numbers 0, 1, 2, 3, … and -1, -2, -3, … .
opposite of a number	The opposite of a number n, written $-n$, is its additive inverse. Algebraically, the sum of a number and its opposite is zero. Geometrically, the opposite of a number is the number on the other side of zero at the same distance from zero.  The opposite of 3 is -3, because $3 + (-3) = -3 + 3 = 0$. The opposite of -3 is $-(-3) = 3$. Thus, the opposite of a number does not have to be negative.
quadrants	The coordinate axes of a coordinate plane separate the plane into four regions, called quadrants. The quadrants are labeled I – IV starting from the upper right region and going counterclockwise. 

Word or Phrase	Definition
reflection	The reflection of a plane through a line refers to the transformation that takes a point on one side of the line to its mirror image on the other side of the line. When the plane is reflected through the *x*-axis, the point (4,3) is taken to the point (4,-3).



Integers on the Number Line

Integers (whole numbers and their opposites) may be represented on a horizontal or vertical number line.



On the number line above, points are graphed at -4 and 1. While 0 is labeled, it is not graphed.

Two Uses of the Minus Sign

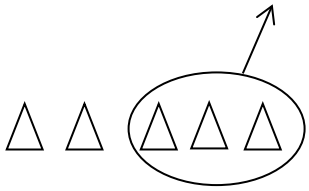
Here are two ways to interpret the minus sign, along with some examples.

When the minus sign is between two expressions, it means "subtract the second expression from the first."

Example: 5 – 3

The phrase "5 minus 3" can be read:

- 5 take away 3
- The difference between 5 and 3
- Subtract 3 from 5



In front of a number, a minus sign can mean "negative" or "opposite."

-3 is 3 units less than zero on the number line.

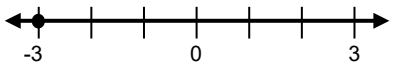
-3 is also the opposite of 3.

"Minus" can be thought of as a reflection or mirror image. In this case, we are reflecting the number line through zero.

Example: -3

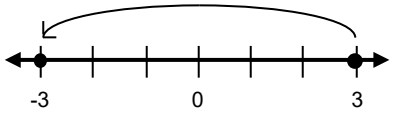
The phrase "minus 3" can be read:

- Negative 3



Pictorially, this is a location on the number line that is 3 units left of zero.

- Opposite of 3



This is the value you get by first locating 3 on the number line, and then locating that same distance on the opposite side of zero. Geometrically, minus can be thought of as a reflection or mirror image. In this case, the reflection of 3 through zero is -3.

Distance and Absolute Value

The absolute value of a number is its distance from zero on the number line.

A distance 25 units in the positive direction from zero is written $|+25| = 25$.

A distance 25 units in the negative direction from zero is written $|-25| = 25$.

The absolute value of a positive number is equal to the number itself. The absolute value of a negative number is the opposite of the number. The absolute value of zero is simply zero.

Distance is always greater than or equal to zero.

Elevation relative to sea level is measured vertically from sea level. Sea level is typically represented as elevation = 0. Therefore, elevation may be positive, negative, or zero.

The vertical number line below represents some people and animals at elevations from 25 meters below sea level (-25 m) to 25 meters above sea level (+25 m).

What	Elevation	Distance from zero (sea level)	Absolute value equation for Distance from sea level
crow	+25 m	25 m	$\|25\| = 25$
gull	+15 m	15 m	$\|15\| = 15$
swimmer	0 m	0 m	$\|0\| = 0$
dolphin	-25 m	25 m	$\|-25\| = 25$

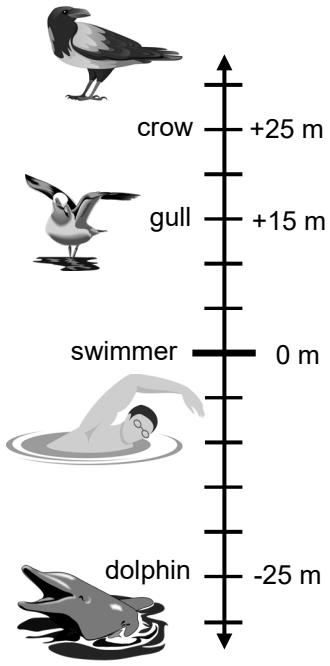
Here are some true statements about elevation:

- The gull is at a higher elevation than the dolphin: $15 > -25$
- The swimmer is at a lower elevation than the crow: $0 < 25$

Here are some true statements about absolute value:

- The dolphin and the crow are the same distance from 0: $|-25| = |25|$
- The dolphin and the crow are both 25 meters from sea level: $|-25| = |25|$

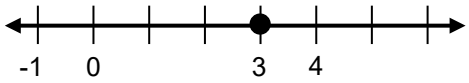
The dolphin is farther from sea level than the gull: $|-25| > |15|$



Graphing Inequalities on the Number line

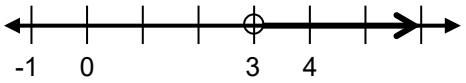
Here are some ways to represent solutions to inequalities on a number line.

Values on the number line that satisfy the equation $x = 3$.



The dots represents that a number is graphed.

Values on the number line that satisfy the inequality $x > 3$.



The "open dot" indicates that $x = 3$ is not included in the solution set. That is, it is not a solution to the inequality $x > 3$. The arrow indicates that all numbers to the right on the number line are solutions.

The Coordinate Plane

A coordinate plane is determined by a horizontal number line (the *x*-axis) and a vertical number line (the *y*-axis) intersecting at the zero on each line. The point of intersection (0, 0) of the two lines is called the origin.

Points are located using ordered pairs (*x*, *y*).

- The first number (*x*-coordinate) indicates how far the point is to the right or left of the *y*-axis.
- The second number (*y*-coordinate) indicates how far the point is above or below the *x*-axis.

The axes (plural of axis) divide the plane into four regions, called quadrants. By convention, we number the quadrants using Roman numerals I-IV, starting with the upper right quadrant (first quadrant) and moving counterclockwise to the lower right quadrant (fourth quadrant). The axes may be considered as boundary lines and are not part of any quadrant.

Point and Coordinates	Interpretation	Location
O (0, 0)	At the intersection of the axes.	origin
P (1, 3)	Start at the origin, move 1 unit right, then 3 units up.	Quadrant I
Q (2, -1)	Start at the origin, move 2 units right, then 1 unit down.	Quadrant IV
R (0, -2)	Start at the origin, move 0 units right or left, then 2 units down.	*y*-axis