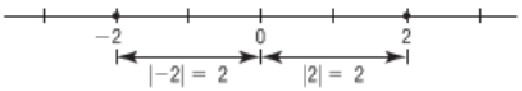
Pre-Calculus 11 Absolute Value of a Real Number

Every real number can be represented as a point on a number line. The sign of the number indicates its position relative to 0. The ***magnitude*** of the number indicates its distance from 0.

Looking at the number line below, each of the numbers –2, 2 is located 2 units from 0. So, each number has an ***absolute value*** of 2. We write this as $|-2| = 2$ *and* $|2| = 2$.



Definition:

$|x| = x \; if \; x \geq 0,$ and $-x \; if \; x < 0$

$|-3| = 3$ (when taking the absolute value of a negative number, the number becomes positive)

$|4| = 4$ (when taking the absolute value of a positive number or 0, the number stays the same)

Ex. 1) Evaluate:

a.) $|4.2|$ b.) $|-6.1|$

4.2 6.1

Absolute value can be used to determine distance between two points. Since distance cannot be negative, you can write it as the absolute value of the difference.

ie. $|3-(-4)| = 7$ or $|-4-3| = 7$

In general the distance between two numbers is given by $d = |a-b|$ or $d = |b-a|$

Ex. 2) Determine the distance between -3.7 and -8.5.

$d = |-8.5-(-3.7)|$

$= |-4.8|$

$= 4.8$ units

Ex. 3) Order the following numbers from least to greatest: $|-5|, |-7.8|, |3.11|, -4, |0|$

1. Evaluate each absolute value. 5, 7.8, 3.11, -4, 0

2. Order numbers least to greatest.

-4, 0, 3.11, 5, 7.8

or

-4, |0|, |3.11|, |-5|, |-7.8|

Principal Square Root – is the non-negative root of a non-negative real number.

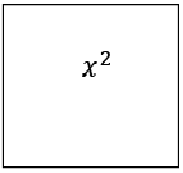
To solve $x^2 = 25$
$x = \pm 5$

$25 = 5^2$ *or* $(-5)^2$, so 25 has two square roots: 5 and -5

but $\sqrt{25} = 5$

5 is the **principal square root**

Consider a square with area x^2. The side length of the square is positive, so it is the principal square root of x^2; that is $\sqrt{x^2}$. Since the principal square root is always positive, $\sqrt{x^2} = |x|$



$\sqrt{x^2}$

When do we use this property?

- When the question starts as a radical, and we are asked to evaluate the radical, we want the principal square root, or the positive root only.
- Think about why the calculator only gives you the positive root.
- If we are solving for x^2 in a quadratic then we know that ~~their~~ there can be two solutions.

When solving an absolute value expression, we treat the absolute value like we would a bracket. We evaluate the numbers inside the absolute value first, then apply any other numbers.

BEDMAS

Evaluate:

a) $|100 - 32| - 2|5 - 6|$

$|-1| = 1$

$68 - 2(1)$

66

b) $|5x^2 + 3x - 4|$ when $x = -3$

$|5(-3)^2 + 3(-3) - 4|$

$|45 - 9 - 4|$

32

Assignment: Pg. 89; #3, 4, 5a, 6a, 7, 8a, 10, 11b 12a, c, e, 14a, d