Section 0 – 3: Absolute Value and Powers

The Absolute Value Symbol

The symbol for absolute value is a pair of vertical lines $| \ |$. These **absolute value brackets** act like the parenthesis that we use in order of operation problems. The absolute value brackets have a special purpose that makes them different from a regular set of parenthesis.

The absolute value brackets tell you to
change the single number inside the absolute value brackets to a positive number.

Example 1

$|-5|$

change the single number inside to a positive number

$|-5| = 5$

Example 2

$|-12|$

change the single number inside to a positive number

$|-12| = 12$

Example 3

$|10|$

change the single number inside to a positive number

$|10| = 10$

Note: The absolute value brackets change the negative number to a positive number but have no effect on a positive number.

you must simplify what is inside a parenthesis first

Absolute value brackets act as parenthesis
so they follow the rules for order of operations which states that
you must simplify what is inside a parenthesis first
before you make the **single number remaining positive.**

Example 4

$|3-5|$

simplify inside

$|-2|$

make the single number positive

$|3-5| = 2$

Example 5

$|-7+2|$

simplify inside

$|-5|$

make the single number positive

$|-7+2| = 5$

Example 6

$|-5-9|$

simplify inside

$|-14|$

make the single number positive

$|-5-9| = 14$

Example 7

$|7+3-6|$

simplify inside

$|4|$

make the single number positive

$|7+3-6| = 4$

Simplifying Absolute Value Expressions

If there is a number directly outside the absolute value brackets:

1. Get a **single number inside the brackets** by simplifying the expression.
2, You then **change the single numbe**r inside the brackets **into a positive number.**
3. That result it is then multiplied by the number outside the absolute value brackets.

Example 1

$5|1-7|$

simplify inside

$5|-6|$

make the single number positive

$5(6)$

Multiply

$5|1-7| = 30$

Example 2

$-3|9-2|$

simplify inside

$-3|7|$

make the single number positive

$-3(7)$

Multiply

$-3|9-2| = -21$

Example 3

$4|3-5|$

$4|-2|$

$4(2)$

8

Example 4

$-5|3-8|$

$-5|-5|$

$-5(5)$

-25

Example 5

$-|3-10|$

$-|-7|$

$-(7)$

-7

Exponential Expressions

A number multiplied by itself many times can be written in an abbreviated form using a base and an exponent.

base$^{\textbf{exponent}}$

$81 = 3 \bullet 3 \bullet 3 \bullet 3$ can be written as $81 = 3^4$ where **3 is the base** and **4 is the exponent**

An expression with a base and exponent above the base is called an **exponential expression**. It is also correct to say it is in **exponential form**.

Expressions with a Positives Base

To find the value of an **exponential expression** with **a positive base** you **multiply the positive base times itself the number of times as the exponent.**

$6^2 = (6)(6) = 36$ $\quad$ $3^3 = (3)(3)(3) = 27$ $\quad$ $(5)^2 = (5)(5) = 25$

Expressions with A Negative Base inside a parentheses

If the base is a negative number and **inside a parentheses** then **the negative sign is included with the base.** To find the value of the expression **you multiply the negative base inside the parentheses times itself the number of times as the exponent.**

$(-5)^2 = (-5)(-5) = 25$ $\quad$ $(-3)^2 = (-3)(-3) = 9$ $\quad$ $(-2)^3 = (-2)(-2)(-2) = -8$

Expressions with A Negative Base and NO parentheses

If the base is not inside a parentheses then
a negative sign in front of the base
is not included with the base

The negative sign in front of the base is understood to mean **multiply the base without the negative sign times itself the number of times as the exponent first and then multiply that number by –1.**

$-5^2 = -1(5)^2 = -25$
the – sign is NOT included with the 5

$-3^2 = -1(3)^2 = -9$
the – sign is NOT included with the 3

$-4^2 = -1(4)^2 = -16$
the – sign is NOT included with the 4

This is a very common source for errors in this class.

