# ABSOLUTE VALUE

**OBJECTIVES:**
1) Evaluate expressions containing absolute values
2) Rewrite expressions to eliminate absolute value
3) Simplify an expression containing absolute values
4) Use absolute value to rewrite statements regarding distance
5) Display intervals defined by absolute value inequalities

**ABSOLUTE VALUE:** The absolute value of a real number, x, denoted by $|x|$ is the distance from x to the origin.

Algebraic definition: $|x| = \begin{cases} x & \text{when } x \geq 0 \text{ (x is positive) (or zero)} \\ -x & \text{when } x<0 \text{ (x is negative)} \end{cases}$

**ABSOLUTE VALUE ONLY CHANGES A VALUE TO ITS OPPOSITE, IF THE INSIDE IS NEGATIVE.**

**IN OTHER WORDS:** If the quantity inside the absolute value bars is positive (or zero), DO NOTHING.
If the quantity inside the absolute value bars is negative, then you must TAKE THE OPPOSITE.

## REWRITING EXPRESSIONS TO ELIMINATE ABSOLUTE VALUE

Simplify and give an EXACT answer.

1) $|1-\sqrt{3}|+2$

$-(1-\sqrt{3})+2$

$-1+\sqrt{3}+2$

$\boxed{\sqrt{3}+1}$

2) $|-\sqrt{2}-3|$

$-(-\sqrt{2}-3)$

$\boxed{\sqrt{2}+3}$

3) $|-x^4-6|$

$-(-x^4-6)$

$\boxed{x^4+6}$

4) $|\pi-5|+2$

$-(\pi-5)+2$

$-\pi+5+2$

$\boxed{-\pi+7}$

5) Find: $|x-6|$ if $x<6$.

$-(x-6)$

$\boxed{-x+6}$

6) Find: $|x-3|$ if $x \geq 3$.

$\boxed{x-3}$

## SIMPLIFYING EXPRESSIONS CONTAINING ABSOLUTE VALUE

7) Find: $|x+1|+|x-3|$ *on* $(-1,3)$

$x+1-(x-3)$

$x+1-x+3$

$\boxed{4}$

8) Find: $|x+1|+|x-3|$ *on* $(-\infty,-1)$

$-(x+1)-(x-3)$

$-x-1-x+3$

$\boxed{-2x+2}$

**DISTANCE:** Absolute value is used in distance calculations.

The distance between two numbers a and b is defined as: $|a-b|$ or $|b-a|$

Rewrite the statement using absolute value notation:

a) The distance between x and 3 is 6.

$x-3| = 6$

$|3-x| = 6$

b) The distance between x and -4 is no more than 2.

$|x+4| \le 2$

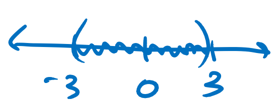
$|-4-x| \le 2$

c) Write a sentence **using the word distance** to express $|x+2| \ge 1$.

The distance between x & -2 is at least 1.

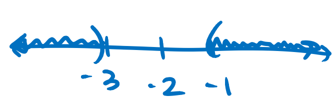
**Directions: The set of real numbers satisfying the given inequality is one or more intervals on the number line. Show the intervals on a number line.**

9) $|x| < 3$



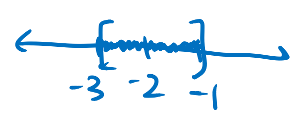

$(-3, 3)$

10) $|x+2| > 1$




$(-\infty, -3) \cup (-1, \infty)$

11) $|x+2| \le 1$




$[-3, -1]$

## ABSOLUTE VALUE PROPERTIES:

For all real numbers x, we have:

a) $|x| \ge 0$

b) $x \le |x|$ and $-x \le |x|$

c) $|x|^2 = x^2$

d) $\sqrt{x^2} = |x|$

For all real numbers a and b, we have:

a) $|ab| = |a| \cdot |b|$

b) $|a/b| = |a|/|b| \quad (b \ne 0)$

c) $|a+b| \le |a| + |b|$ **THE TRIANGLE INEQUALITY**

**DO NOT DISTRIBUTE A NEGATIVE INTO ABSOLUTE VALUES!** $-2|x+4| \ne |-2x-8|$