

Absolute Value

$$|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

$|x|$ represents the distance to the origin from the point x .

Properties of Absolute Value

For all real number a and b

1. $|a| \geq 0$

4. $|ab| = |a||b|$

2. $|-a| = |a|$

5. $\left|\frac{a}{b}\right| = \frac{|a|}{|b|}, b \neq 0$

3. $a \leq |a|$

6. $|a + b| \leq |a| + |b|$

Algebraic Expressions

A combination of variables and numbers using the operation of addition, subtraction, multiplication, or division, as well as powers or roots is called an **algebraic expression**.

Examples of algebraic expressions: $x + 6$, $x - 6$, $6x$, $x/6$, $3x + 5$.

Evaluating Algebraic Expressions

⇒ find the value of the expression for a given value of the variable

The order of Operations Agreement

1. Perform operations within the innermost parentheses and work outward. If the algebraic expression involves division, treat the numerator and the denominator as if they were each enclosed in parentheses.
2. Evaluate all exponential expressions.
3. Perform multiplication or division as they occur, working from left to right.
4. Perform addition or subtraction as they occur, working from left to right.

Example: Evaluate the algebraic expression $2.35x + 179.5$ when

- i) $x = 20$
- ii) $x = 30$

Properties of Real Numbers and Algebraic Expressions

Name	Meaning	Examples
Commutative Property of Addition	Two real numbers can be added in any order. $a + b = b + a$	➤ $13 + 7 = 7 + 13$ ➤ $13x + 7 = 7 + 13x$
Commutative Property of Multiplication	Two real numbers can be multiplied in any order. $ab = ba$	➤ $x \cdot 6 = 6x$
Associative Property of Addition	If 3 real numbers are added, it makes no difference which 2 are added first. $(a + b) + c = a + (b + c)$	➤ $3 + (8 + x)$ = $(3 + 8) + x$ = $11 + x$
Associative Property of Multiplication	If 3 real numbers are multiplied, it makes no difference which 2 are multiplied first. $(a \cdot b) \cdot c = a \cdot (b \cdot c)$	➤ $-2(3x) = (-2 \cdot 3)x = -6x$
Distributive Property of Multiplication over Addition	Multiplication distributes over addition. $a \cdot (b + c) = a \cdot b + a \cdot c$	➤ $5 \cdot (3x + 7)$ = $5 \cdot 3x + 5 \cdot 7$ = $15x + 35$
Identity Property of Addition	Zero can be deleted from a sum. $a + 0 = a$ $0 + a = a$	➤ $5 + 6x = 6x$
Identity Property of Multiplication	One can be deleted from a product. $a \cdot 1 = a$ and $1 \cdot a = a$	➤ $1 \cdot 2x = 2x$
Inverse Property of Addition	The sum of a real number and its additive inverse gives 0, the additive identity. $a + (-a) = 0$ and $(-a) + a = 0$	➤ $(-6x) + 6x = 0$
Inverse Property of Multiplication	The product of a nonzero real number and its multiplicative inverse gives 1, the multiplicative identity. $a \cdot 1/a = 1$ and $1/a \cdot a = 1$	➤ $2 \cdot 1/2 = 1$