

Math

Common Core State Standards

High School Algebra 1

Equations, Functions, Sequences, Polynomials, Data Analysis, and More!

ALGEBRAIC EXPRESSIONS & PROPERTIES

A **variable** is a symbol that is used to represent an unknown quantity. An **algebraic expression** is a mathematical expression that contains one or more variables, one or more numbers, and one or more arithmetic operations.

Writing Expressions

Verbal expressions can be translated into algebraic expressions.

Verbal Expression	Algebraic Expression
a number decreased by 15	$n - 15$
8 less than 3 times a number	$3n - 8$
the quotient of a number and 2 plus 5 times the number	$\frac{n}{2} + 5n$
6 more than the cube of a number	$n^3 + 6$
a number increased by 3, quantity squared, divided by 5	$\frac{(n+3)^2}{5}$

Order of Operations

The order of operations is a set of rules that determine which operations to perform first when evaluating a numerical expression.

1. Evaluate within grouping symbols.
2. Evaluate all powers.
3. Multiply and divide from left to right.
4. Add and subtract from left to right.

Properties of Real Numbers

For real numbers a , b , and c , the following properties are true.

Property	Expression
Commutative Property of Addition	$a + b = b + a$
Commutative Property of Multiplication	$a \cdot b = b \cdot a$
Associative Property of Addition	$a + (b + c) = (a + b) + c$
Associative Property of Multiplication	$a \cdot (b \cdot c) = (a \cdot b) \cdot c$
Distributive Property	$a \cdot (b + c) = a \cdot b + a \cdot c$
Additive Identity Property	$a + 0 = a$
Additive Inverse Property	$a + (-a) = 0$
Multiplicative Inverse Property	$a \cdot \left(\frac{1}{a}\right) = 1, a \neq 0$
Multiplicative Property of Zero	$a \cdot 0 = 0$

Properties of Equality & Substitution

For real numbers a , b , and c , the following properties are true.

Property	Description	Symbolic
Reflexive Property	A number or quantity is equal to itself.	$a = a$
Symmetric Property	If a quantity is equal to another quantity, then the second quantity is equal to the first quantity.	If $a = b$, then $b = a$.
Transitive Property	If a quantity equals a second quantity and the second quantity equals a third quantity, then the first quantity equals the third quantity.	If $a = b$ and $b = c$, then $a = c$.
Substitution Property	If two quantities are equal, then one quantity may be substituted for the other in an expression.	If $a = b$, then b can be substituted for a in an expression, and vice versa.

Parts of an Expression

A **term** is a number, variable, or the product of numbers and variables in an expression. **Like terms** are terms that have the same variables raised to the same powers. Two quantities that are being multiplied in an expression are called **factors**. The **coefficient** of a term is the numerical factor of the term. A term that consists of a number and no variables is called a **constant**.

- EX: Identify the terms, factors, and coefficients in the expression $-6n^2 + 4n - 2n$.
1. There are 3 terms: $-6n^2$, $4n$, and $-2n$.
 2. The terms $4n$ and $-2n$ are like terms because they have the same variable raised to the same power.
 3. The factors of the terms are -6 , n , and n for the first term, 4 and n for the second term, and -2 and n for the third term.
 4. The coefficients of the terms are -6 , 4 , and -2 .

EX: To compute annual compound interest, you multiply the principal investment by the quantity of one plus the interest rate, raised to the number of years of compounding. Define quantities and write an expression to model compound interest. Describe the parts of the expression.

1. Define variables.
Let P represent the principal investment, let r represent the interest rate, and let n represent the number of years.
2. Translate the verbal expression into an algebraic expression.
"multiply the principal": P
"quantity of one plus the interest rate, raised to the number of years": $(1 + r)^n$
The expression is $P(1 + r)^n$.
3. Describe the parts of the expression.
The expression contains two factors: P and $(1 + r)^n$. The first factor is the variable P . The second factor contains the variables r and n .

REASONING WITH QUANTITIES

The units of a quantity can help you understand and solve multi-step problems.

Dimensional Analysis

Dimensional analysis is the process of using conversion factors to change from one set of units to another set of units.

EX: Jamie jogged 495 feet in 45 seconds. What was her speed in miles per hour? Write the given information as a ratio. Then use appropriate conversion factors to change units.

$$\frac{495 \cancel{ft}}{45 \cancel{s}} \cdot \frac{1 \cancel{mi}}{5280 \cancel{ft}} \cdot \frac{1 \cancel{hr}}{3600 \cancel{s}} = \frac{1 \cancel{mi}}{480 \cancel{s}} \quad \text{Convert from feet to miles,}$$

$$\frac{1 \cancel{mi}}{480 \cancel{s}} \cdot \frac{60 \cancel{min}}{1 \cancel{min}} \cdot \frac{1 \cancel{hr}}{60 \cancel{min}} = \frac{1 \cancel{mi}}{8 \cancel{min}} \quad \text{Convert from seconds to minutes,}$$

$$\frac{1 \cancel{mi}}{8 \cancel{min}} \cdot \frac{60 \cancel{min}}{1 \cancel{hr}} = \frac{7.5 \cancel{mi}}{1 \cancel{hr}} \quad \text{Convert from minutes to hours.}$$

Jamie's speed was 7.5 miles per hour.

Modeling with Appropriate Units

When modeling with quantities, it is important to choose appropriate units.

Quantity	Common Units
length or distance	millimeter (mm), centimeter (cm), meter (m), kilometer (km), inch (in.), foot (ft), yard (yd), mile (mi)
mass or weight	centigram (cg), gram (g), kilogram (kg), ounce (oz), pound (lb), ton (T)
capacity or volume	milliliter (mL), liter (L), kiloliter (kL), fluid ounce (fl oz), cup (c), pint (pt), quart (qt), gallon (gal), cubic centimeters (cm ³), cubic meters (m ³), cubic inches (in. ³), cubic foot (ft ³), cubic yards (yd ³)
area	square millimeters (mm ²), square centimeters (cm ²), square meters (m ²), square kilometers (km ²), square inches (in. ²), square feet (ft ²), square yards (yd ²), square miles (mi ²)

Accuracy & Precision

Accuracy describes how close a measured value is to the actual value.

EX: Thomas is 5 feet 10.25 inches tall. A measurement of 5 feet 10 inches is more accurate than a measurement of 6 feet when describing his height.

Precision describes the exactness of a measurement and is dependent on the unit of measure. The **precision unit** is the smallest unit on the tool being used to measure. As the units of measurement get smaller, the measurement gets more precise.

EX: A ruler that measures in millimeters is more precise than a ruler that measures in centimeters.

EX: For a scale that gives weight in pounds and ounces, the precision unit is ounces.

Just because a measure is more precise, does not mean it is more accurate.

EX: The actual length of a block of wood is 3 feet. A measurement of 5 feet 3 inches is more precise than a measurement of 4 feet, but it is less accurate than 4 feet which is closer to the actual length of 3 feet.

Math Practice 6: Attend to precision.

When solving real-world problems, it is important to communicate precisely to others. This includes using appropriate units of measure, calculating accurately, and expressing numerical answers with an appropriate degree of precision.



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