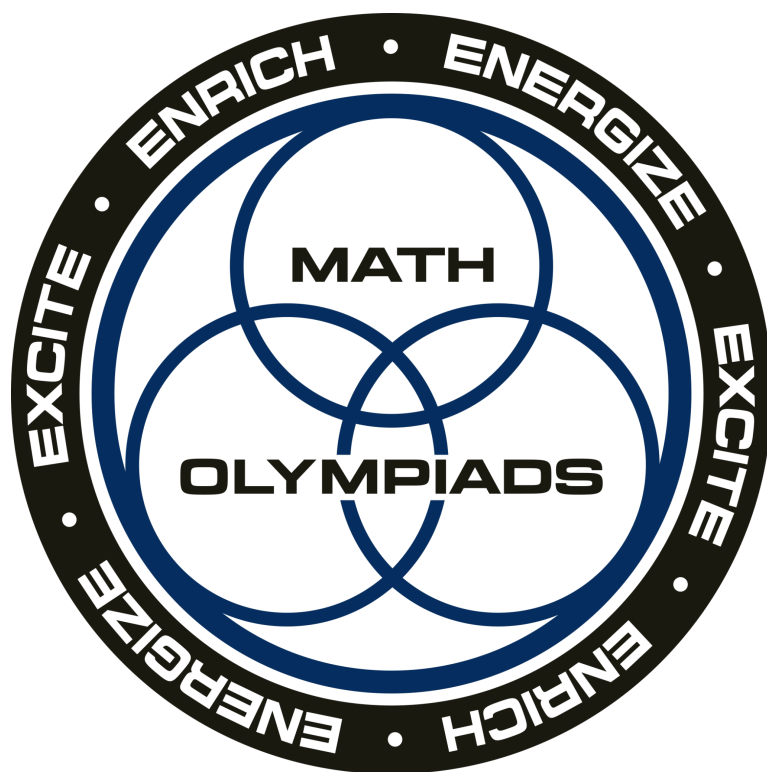# What Every Young Mathlete Should Know

For a Math Olympian to be successful, proficiency in computation as well as mathematical language is essential. The following explains, defines, or lists some words that may be used in Olympiad problems. Also included are some useful Theorems and general strategies for problem-solving. To be accepted, an answer must be consistent with this document and the wording of the problem.

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What Every Young Mathlete Should Know

Vocabulary
Division E/M

Sum	The result of addition
Difference	The result of subtraction
Product	The result of multiplication
Quotient	The result of division
Remainder	The value left over when a dividend is not completely divisible by a divisor
Or	Or is inclusive. ("*a or b"* means "*a or b*" or both)
Ratio	The comparison of 2 values which may be written as *a to b*, *a:b*, or $\frac{a}{b}$
Perfect Square/Square Number	A number that results from multiplying an integer by itself • Example: 16 is a perfect square because 4 x 4 = 16.
Factor	A whole number that divides **exactly** into another number
Multiple	A sequence of products using the same base number multiplied by different numbers (Zero is considered a multiple of every whole number)
Prime Number	A number that has exactly 2 factors Note: 1 is not a prime number because it only has one factor
Composite Number	A number that has more than two factors
Greatest Common Factor (GCF)	The highest common factor that will divide two or more other counting numbers exactly
Least Common Multiple (LCM)	The smallest number that is the multiple of two or more counting numbers
Set	A collection of items with one of each member. • Example: {1,2,3} {3,1,2} are all ways of writing the same set
Counting Numbers	{1, 2, 3, ...}
Whole Numbers	{0, 1, 2, 3, ...}

Integers	{..., -3, -2, -1, 0, 1, 2, 3, …}
Positive Numbers	Numbers greater than zero
Negative Numbers	Numbers less than zero
Consecutive Numbers	Counting numbers that differ by one
Consecutive Even Numbers	Multiples of 2 that differ by two • Example: {12,14,16} are consecutive even integers
Consecutive Odd Numbers	Non multiples of 2 that differ by 2 • Example: {15,17,19} are consecutive odd integers
Palindromic Number	Number that reads the same forward or backwards
Ordered list (sequence) vs Set	A set is an unordered collection of members. The sets {1,2,3} {1,3,2} {2,1,3} {2,3,1} {3,1,2} and {3,2,1} are all ways of writing the same set. Whereas the ordered lists {1,2,3} and {1,3,2} are different.
Divisible	Can be divided evenly without leaving a remainder
Digit	Any of the numerals from 0 to 9; {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}
Common Fraction	A fraction where both the numerator and denominator are integers Note: The denominator can not be 0.
Unit Fraction	A fraction with a numerator of 1
Proper Fraction	A fraction where the numerator is smaller than the denominator, and whose value is less than 1
Improper Fraction	A fraction where the numerator is larger than the denominator, and whose value is greater than 1
Complex Fraction	A fraction in which the numerator, the denominator, or both contain a fraction
Simplest Form	A fraction where the only common factor of the numerator and denominator is 1 Division M only: the denominator of a fraction in simplest form cannot be negative
Percent	A fraction expressed as a number out of 100 followed by the % symbol
Order of Operations	The order in which mathematical operations must be done • Do operations in parentheses, braces, or brackets first, working from the inside out • Do multiplication and division from left to right, and then • Do addition and subtraction from left to right
Mean (average)	The total of all scores or amounts divided by how many scores there were

Median	The middle value of an ordered set of numbers
Mode	In a set of scores, values or numbers, the one that occurs most frequently
Probability	The likelihood that a particular outcome will occur found by dividing the number of times an event *does* occur by the total number of times the event *can* possibly occur
Angle	A geometric figure formed when two rays meet at a common point called a vertex ● Angles are represented in units called degrees. ● An acute angle measures less than 90 degrees. ● A right angle measures exactly 90 degrees. ● An obtuse angle measures between 90 and 180 degrees. ● A straight angle measures exactly 180 degrees. ● A reflex angle measures between 180 and 360 degrees.
Polygon	A closed figure with 3 or more straight sides ● The interior region is the space within a polygon. ● The exterior region is the space outside of the polygon.
Triangle	A 3-sided polygon ● The sum of the angles in every triangle is 180 degrees. ● An acute triangle has 3 acute angles. ● A right triangle has one right angle. ● An obtuse triangle has one obtuse angle. ● An equilateral triangle has three congruent sides. ● An isosceles triangle has exactly two congruent sides. ● A scalene triangle has no congruent sides.
Quadrilateral	A 4-sided polygon ● The sum of the angles in every quadrilateral is 360 degrees. ● A diagonal is a line segment that connects two opposite vertices. ● A trapezoid has at least one pair of parallel sides. ● A parallelogram has exactly two pairs of parallel,congruent sides. ● A rhombus is a parallelogram with 4 congruent sides. ● A rectangle is a parallelogram with 4 right angles. ● A square is a parallelogram with 4 congruent sides and 4 right angles.
Circle	A plane shape bounded by a continuous line which is always the same distance from the center
Geometric Solid	Three-dimensional object or shape
Vertex	The point where two or more line segments or edges meet
Perimeter	The distance around the outside of a figure (unit length)
Area	The amount of space covered by a figure (square units)
Circumference	The perimeter of a circle

Congruent	Having the same shape and size
Similar	Having the same shape but not necessarily the same size
Volume	The amount of space occupied by an object (cubic units)
Surface Area	The sum of the areas of all the faces of a geometric solid

Vocabulary
Division M Only

Square root	A number (factor) that when squared yields the original number. • Ex: The square root of 9 is 3 because 3 x 3 = 9.
Cube root	A number (factor) that when cubed yields the original number. • Ex: The cube root of 8 is 2 because 2 x 2 x 2 = 8.
Perfect cube	The result of a integer being multiplied by itself three times • Ex: 64 is a perfect cube because 4 x 4 x 4 = 64.
Relatively prime **Co-prime**	Describes a relationship between two numbers Two integers are relatively prime when the only positive common integer divisor is 1. Example: 5 and 12 are relatively prime.
Right circular cylinder	A three-dimensional solid shape with two parallel, circular bases that are connected by a curved surface
Face	A flat surface that forms part of the boundary of a solid object
Edge	A type of line segment joining two vertices in a polygon or polyhedron
Vertex (plural: vertices)	A point on a polygon where the sides or edges of the object meet or where two rays or line segments meet. A polyhedron will consist of faces which are polygons and contain vertices.

Fundamental Language
In Order of Progression

Place Value	
Place Value	• The standard form of a number refers to a number written using digits • The lead digit (leftmost digit) of a number is not counted as a digit if it is 0 • Terminal zeros of a number are the zeros to the right of the last non-zero digit • The number 0 is a one-digit number • If the digits of a number are in increasing order, when reading the number from left to right, each digit with the higher place value is less than and **not** equal to any other digit of a lesser place value • The digit sum of a whole number is the total of its individual digits • A decimal is a fraction whose denominator is a power of ten written using decimal point notation
Measurement	• Students should be familiar with units of measurement in both customary and metric systems • Students should be able to convert from one unit to another WITHIN a system of measurement
Divisibility Rule	• An integer is divisible by 2 if the last digit is even • An integer is divisible by 3 if the sum of the digits is divisible by 3 • An integer is divisible by 4 if the last two digits are divisible by 4 • An integer is divisible by 5 if the last digit is a 0 or 5 • An integer is divisible by 6 if it divisible by 2 and 3 • An integer is divisible by 9 if the sum of the digits is divisible by 9

Strategies

Answers	
Answers	• Unless otherwise specified in a problem, equivalent numbers or expressions should be accepted • Units of measure generally are not required in answers but must be correct if given • An answer in which in any part is incorrect is not acceptable
Problem Solving Strategies	• Draw a picture or diagram • Solve a simpler problem • Make an organized list • Work backwards • Make a table • Use reasoning or logic • Guess, check and revise