

A Parent's Guide To Eighth Grade Mathematics

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Mathematics is the science of patterns and relationships. It is the language and logic of our technological world,. Mathematical power is the ability to explore, to imagine, to reason logically and to use a variety of mathematical methods to solve problems; all important tools for children's futures. A mathematically powerful person should be able to:

- Reason mathematically,
- Communicate mathematically,
- Solve problems using mathematics and
- Make connections within mathematics and between Mathematics and other fields.



Purpose of this Parent Document

This document is intended to give parents and overview of the Grade Level Content Expectations. It's intent is to provide an explanation of why students are doing particular homework assignments. It is a tool to facilitate communication between parents and teachers as parents become partners in their student's education.

NUMBER AND OPERATIONS

Understand real number concepts

- Understand the meaning of a square root of a number and its connection to the square whose area is the number ; understand the meaning of a cube root and its connection to the volume of a cube.
- Understand meanings for zero and negative integer exponents.
- Understand that in decimal form, rational numbers either terminate or eventually repeat, and that calculators truncate or round repeating decimals; locate rational numbers on the number line; know fraction forms of common repeating decimals, e.g., $0.1 = \frac{1}{10}$; $0.3 = \frac{3}{10}$.
- Understand that irrational numbers are those that cannot be expressed as
- the quotient of two integers, and cannot be represented by terminating or repeating decimals; approximate the position of familiar irrational numbers, e.g., $\sqrt{2}$, $\sqrt{3}$, π , on the number line.
- Estimate and solve problems with square roots and cube roots using calculators.
- Find square roots of perfect squares and approximate the square roots of non-perfect squares by locating between consecutive integers, e.g., $\sqrt{130}$ is between 11 and 12.

Solve problems

- Understand percent increase and percent decrease in both sum and product form, e.g., 3% increase of a quantity x is $x + .03x = 1.03x$.
- Solve problems involving percent increases and decreases.
- Solve problems involving compounded interest or multiple discounts.
- Calculate weighted averages such as course grades, consumer price indices, and sports ratings.
- Solve problems involving ratio units, such as miles per hour, dollars per pound, or persons per square mile.*



ALGEBRA

Understand the concept of non-linear functions using basic examples

- Identify and represent linear functions, quadratic functions, and other simple functions including inversely proportional relationships ($y = k/x$); cubics ($y = ax^3$); roots ($y = \sqrt{x}$); and exponentials ($y = a^x$, $a > 0$); using tables, graphs, and equations.*
- For basic functions, e.g., simple quadratics, direct and indirect variation, and population growth, describe how changes in one variable affect the others.
- Recognize basic functions in problem context, e.g., area of a circle is πr^2 , volume of a sphere is $\frac{4}{3}\pi r^3$, and represent them using tables, graphs, and formulas.
- Use the vertical line test to determine if a graph represents a function in one variable.

Understand and represent quadratic functions

- Relate quadratic functions in factored form and vertex form to their graphs, and vice versa; in particular, note that solutions of a quadratic equation are the x-intercepts of the corresponding quadratic function.
- Graph factorable quadratic functions, finding where the graph intersects the
- x-axis and the coordinates of the vertex; use words "parabola" and "roots"; include functions in vertex form and those with leading coefficient -1, e.g., $y = x^2 - 36$, $y = (x - 2)^2 - 9$; $y = -x^2$; $y = -(x - 3)^2$.

Recognize, represent, and apply common formulas

- Recognize and apply the common formulas: $(a + b)^2 = a^2 + 2ab + b^2$
- $(a - b)^2 = a^2 - 2ab + b^2$
- $(a + b)(a - b) = a^2 - b^2$; represent geometrically.
- Factor simple quadratic expressions with integer coefficients, e.g.,
- $x^2 + 6x + 9$, $x^2 + 2x - 3$, and $x^2 - 4$; solve simple quadratic equations, e.g., $x^2 = 16$ or $x^2 = 5$ (by taking square roots); $x^2 - x - 6 = 0$, $x^2 - 2x = 15$ (by factoring); verify solutions by evaluation.
- Solve applied problems involving simple quadratic equations.

Understand solutions and solve equations, simultaneous equations, and linear inequalities

- Understand that to solve the equation $f(x) = g(x)$ means to find all values of x for which the equation is true, e.g., determine whether a given value, or values from a given set, is a solution of an equation (0 is a solution of $3x^2 + 2 = 4x + 2$, but 1 is not a solution).
- Solve simultaneous linear equations in two variables by graphing, by substitution, and by linear combination; estimate solutions using graphs; include examples with no solutions and infinitely many solutions.
- Solve linear inequalities in one and two variables, and graph the solution sets.
- Set up and solve applied problems involving simultaneous linear equations and linear inequalities.

GEOMETRY

Understand and use the Pythagorean Theorem

- Understand at least one proof of the Pythagorean Theorem; use the Pythagorean Theorem and its converse to solve applied problems including perimeter, area, and volume problems.
- Find the distance between two points on the coordinate plane using
- the distance formula; recognize that the distance formula is an application of the Pythagorean Theorem.

Solve problems about geometric figures

- Understand the definition of a circle; know and use the formulas for circumference and area of a circle to solve problems.
- Find area and perimeter of complex figures by subdividing them into basic shapes (quadrilaterals, triangles, circles).
- Solve applied problems involving areas of triangles, quadrilaterals, and circles.

Understand concepts of volume and surface area, and apply formulas

- Know the volume formulas for generalized cylinders ((area of base) \times height), generalized cones and pyramids ($\frac{1}{3}$ (area of base) \times height), and spheres ($\frac{4}{3}\pi$ (radius)³) and apply them to solve problems.
- Understand the concept of surface area, and find the surface area of prisms, cones, spheres, pyramids, and cylinders.

Visualize solids

- Sketch a variety of two-dimensional representations of three-dimensional solids including orthogonal views (top, front, and side), picture views (projective or isometric), and nets; use such two-dimensional representations to help solve problems.

Understand and apply concepts of transformation and symmetry

- Understand the definition of a dilation from a point in the plane, and relate it to the definition of similar polygons.
- Understand and use reflective and rotational symmetries of two-dimensional shapes and relate them to transformations to solve problems.

DATA AND PROBABILITY

Draw, explain, and justify conclusions based on data

- Determine which measure of central tendency (mean, median, mode) best represents a data set, e.g., salaries, home prices, for answering certain questions; justify the choice made.
- Recognize practices of collecting and displaying data that may bias the presentation or analysis.

Understand probability concepts for simple and compound events

- Compute relative frequencies from a table of experimental results for a repeated event. Interpret the results using relationship of probability to relative frequency.*
- Apply the Basic Counting Principle to find total number of outcomes possible for independent and dependent events, and calculate the probabilities using organized lists or tree diagrams.
- Find and/or compare the theoretical probability, the experimental probability, and/or the relative frequency of a given event.*
- Understand the difference between independent and dependent events, and recognize common misconceptions involving probability, e.g., Alice rolls a 6 on a die three times in a row; she is just as likely to roll a 6 on the fourth roll as she was on any previous roll.

