



FIFTH GRADE – EIGHTH GRADE

GRADE 5 MATHEMATICS

I. Numbers and Number Sense

- A. Read and write numbers (in digits and words) up to the billions.
- B. Recognize place value up to the billions.
- C. Order and compare number to 999,999,999 using the signs $<$, $>$, and $=$.
- D. Write numbers in expanded form.
- E. Integers
 - i. Locate positive and negative integers on a number line.
 - ii. Compare integers using the symbols $<$, $>$, and $=$.
 - iii. Know the sum of an integer and its opposite is 0.
 - iv. Add and subtract positive and negative integers.
- F. Using a number line, locate positive and negative whole numbers.
- G. Round to the nearest ten; to the nearest hundred; to the nearest thousand; to the nearest hundred thousand.
- H. Exponents
 - i. Review perfect squares and square roots to 144; recognize the square root sign, $\sqrt{\quad}$
 - ii. Using the terms *squared* and *cubed* and *to the n th power*, read and evaluate numerical expressions with exponents.
 - iii. Identify the powers of ten up to 10^6 .
- I. Identify a set and the members of a set as indicated by $\{ \}$.
- J. Identify numbers under 100 as prime or composite.
- K. Identify prime factors of numbers to 100 and write exponential notation for multiple primes.
- L. Determine the greatest common factor (GCF) of given numbers.
- M. Determine the least common multiples (LCM) of given numbers.

II. Ratio and Percent

- A. Ratio
 - i. Determine and express simple ratios.
 - ii. Use ratio to complete a simple scale drawing.
 - iii. Ratio and rate: solve problems on speed as ratio using the formula $S=D/T$ (or $D = R \times T$)
- B. Percent
 - i. Recognize the percent sign (%) and under percent as “per hundred.”
 - ii. Find the given percent of a number.
 - iii. Express equivalences between fractions, decimals, and percents, and know common equivalences:
 - 1. $1/10 = 10\%$
 - 2. $1/4 = 25\%$
 - 3. $1/2 = 50\%$
 - 4. $3/4 = 75\%$

III. Fractions and Decimals

- A. Fractions
 - i. Determine the least common denominator (LCD) of fractions with unlike denominators.

- ii. Recognize equivalent fractions (for example, $\frac{1}{2} = \frac{3}{6}$).
- iii. Put fractions in lowest terms.
- iv. Compare fractions with like and unlike denominators, using the signs $<$, $>$, and $=$.
- v. Identify the reciprocal of a given fraction; know that the product of a given number and its reciprocal = 1.
- vi. Add and subtract mixed numbers and fractions with like and unlike denominators.
- vii. Multiply and divide mixed numbers and fractions.
- viii. Round fractions to the nearest whole number.
- ix. Write fractions as decimals (e.g. $\frac{1}{4} = 0.25$).

B. Decimals

- i. Read, write, and order decimals to the nearest ten thousandth.
- ii. Write decimals in expanded form.
- iii. Read and write decimals on a number line.
- iv. Round decimals (and decimal quotients) to the nearest tenth; to the nearest hundredth; to the nearest thousandth.
- v. Estimate decimal sums, differences, and products by rounding.
- vi. Add and subtract decimals through ten-thousandths.
- vii. Multiply decimals: by 10, 100, and 1,000; by another decimal.
- viii. Divide decimals by whole numbers and decimals.

IV. Computation

A. Addition

- i. Commutative and associative properties: know the names and understand the properties.

B. Multiplication

- i. Commutative, associative, and distributive properties: know the names and understand the properties.
- ii. Multiply two factors of up to four digits each.
- iii. Write numbers in expanded form using multiplication.
- iv. Estimate a product.
- v. Solve word problems involving multiplication.

C. Division

- i. Understand multiplication and division as inverse operations.
- ii. Know what it means for one number to be "divisible" by another number.
- iii. Know that you cannot divide by 0; that any number divided by 1 = that number.
- iv. Estimate the quotient.
- v. Know how to move the decimal point when dividing by 10, 100, or 1,000.
- vi. Divide dividends up to four digits by one-digit, two-digit, and three-digit divisors.
- vii. Solve division problems with remainders; round a repeating decimal quotient.
- viii. Check division by multiplying (and adding remainder).

D. Solving Problems and Equations

- i. Solve word problems with multiple steps.

- ii. Solve problems with more than one operation.

V. Measurement

- A. Review linear measurement, weight, and capacity (volume).
- B. Review equivalences (e.g., 1hr = 60min, 1 minute = 60 seconds, 1yd = 3ft, 1 dozen =12)
- C. Convert to common units in problems involving addition and subtraction of different units.
- D. Time: Solve problems on elapsed time; regroup when multiplying and dividing amounts of time.

VI. Geometry

- A. Identify and draw points, segments, rays, lines.
- B. Identify and draw lines: horizontal; vertical; perpendicular; parallel; intersecting.
- C. Measure the degrees in an angle, and know that:
 - i. Right angle = 90 degrees
 - ii. Acute angle = Less than 90 degrees
 - iii. Obtuse angle = Greater than 90 degrees
 - iv. Straight angle = 180 degrees
- D. Identify and construct different types of triangles: equilateral, right, isosceles.
- E. Know what it means for triangles to be congruent.
- F. Identify polygons:
 - i. Triangle
 - ii. Quadrilateral
 - iii. Pentagon
 - iv. Hexagon
 - v. Octagon
 - vi. Parallelogram
 - vii. Trapezoid
 - viii. Rhombus
 - ix. Rectangle
 - x. Square
- G. Know that regular polygons have sides of equal length and angles of equal measure.
- H. Circles
 - i. Identify radius (plural: radii) and diameter (radius = $\frac{1}{2}$ diameter).
 - ii. Using a compass, draw circles with a given diameter or radius.
 - iii. Find the circumference of a circle using the formula $C = \pi d$, and $C = 2\pi r$, using 3.14 as the value of pi.
- I. Area
 - i. Review the formula for the area of a rectangle (Area=length x width) and solve problems involving finding area in a variety of square units.
 - ii. Find the area of triangles, using the formula $A = \frac{1}{2} (bh)$.
 - iii. Find the area of a parallelogram using the formula $A=bh$.
 - iv. Find the area of an irregular figure (such as a trapezoid) by dividing into regular figures which you know how to find the area.
 - v. Compute volume of rectangular prisms in cubic units using the formula $V=lwh$.

vi. Find the surface area of a rectangular prism.

VII. Probability and Statistics

- A. Understand probability as a measure of the likelihood that an event will happen; using simple models, express probability of a given event as a fraction, as a percent, and as a decimal between 0 and 1.
- B. Collect and organize data in graphic form (bar, line, and circle graphs).
- C. Solve problems requiring interpretation and application of graphically displayed data.
- D. Find the average (mean) of a given set of numbers.
- E. Plot points in a coordinate plane, using ordered pairs of positive and negative whole numbers.
- F. Graph simple functions.

VIII. Pre-Algebra

- A. Recognize variables and solve basic equations using variables.
- B. Write and solve equations for word problems.
- C. Find the value of an expression given the replacement values for the variables, for example: What is $7 - c$ if c is 3.5?

GRADE 6 MATHEMATICS

I. Numbers and Number Sense

- a. Read and write numbers (in digits and words) up to the trillions.
- b. Recognize place value up to hundred-billions.
- c. Integers (review):
 - i. Locate positive and negative integers on a number line.
 - ii. Compare integers using, =.
 - iii. Know that the sum of an integer and its opposite is 0.
 - iv. Add and subtract positive and negative integers.
- d. Determine whether a number is a prime number or composite number.
- e. Round to the nearest ten; to the nearest hundred; to the nearest thousand; to the nearest hundred thousand; to the nearest million.
- f. Compare and order whole numbers, mixed numbers, fractions, and decimals, using the symbols, =.
- g. Determine the greatest common factor (GCF) of given numbers.
- h. Determine the least common multiple (LCM) of given numbers.
- i. Exponents:
 - i. Review squares and square roots.
 - ii. Using the terms squared and cubed and to the nth power, read and evaluate numerical expressions with exponents.
 - iii. Review powers of ten.
 - iv. Write numbers in expanded notation using exponents.

II. Ratio, Percent, and Proportion

- a. Ratio and proportion
 - i. Solve proportions, including word problems involving proportions with one unknown.
 - ii. Use ratios and proportions to interpret map scales and scale drawings.
 - iii. Set up and solve proportions from similar triangles.
 - iv. Understand the justification for solving proportions by cross-multiplication.
- b. Percent
 - i. Convert between fractions, decimals, and percents.
 - ii. Find the given percent of a number and find what percent a given number is of another number.
 - iii. Solve problems involving percent increase and decrease.
 - iv. Find an unknown number when a percent of the number is known.
 - v. Use expressions with percents greater than 100% and less than 1%.

III. Computation

- a. Addition
 - i. Addition, commutative and associative properties: know the names and understand the properties.
 - ii. Understand addition and subtraction as inverse operations.
 - iii. Add and subtract with integers, fractions and decimals, both positive and negative.
- b. Multiplication
 - i. Commutative, associative, and distributive properties: know the names and understand the properties.
 - ii. Multiply multi-digit factors, with and without a calculator.
 - iii. Estimate a product.
 - iv. Multiply with integers, fractions, and decimals, both positive and negative.

- v. Distributive property for multiplication over addition or subtraction, that is, $A \times (B+C)$ or $A \times (B-C)$: understand its use in procedures such as multi-digit multiplication.
- c. Division
 - i. Understand multiplication and division as inverse operations.
 - ii. Estimate the quotient.
 - iii. Divide multi-digit dividends by up to three-digit divisors, with and without a calculator.
 - iv. Divide with integers, fractions, or decimals, both positive and negative.
- d. Solving problems and equations
 - i. Solve word problems with multiple steps.
 - ii. Solve problems with more than one operation, according to order of operations (with and without a calculator).

IV. Measurement

- a. Solve problems requiring conversion of units within the U. S. Customary System, and within the metric system.
- b. Associate prefixes used in metric system with quantities:
 - i. kilo = thousand
 - ii. hecto = hundred
 - iii. deka = ten
 - iv. deci = tenth
 - v. centi = hundredth
 - vi. milli = thousandth
- c. Time: solve problems on elapsed time; express parts of an hour in fraction or decimal form.

V. Geometry

- a. Identify and use signs that mean
 - i. congruent \cong
 - ii. similar \sim
 - iii. parallel \parallel
 - iv. perpendicular \perp
- b. Construct parallel lines and a parallelogram.
- c. Construct a perpendicular bisector.
- d. Know that if two lines are parallel, any line perpendicular to one is also perpendicular to the other; and, that two lines perpendicular to the same line are parallel. 166
- e. Angles:
 - i. Identify and measure the degrees in angles (review terms: right, acute, obtuse, straight).
 - ii. Bisect an angle.
 - iii. Construct an angle congruent to a given angle.
 - iv. Construct a figure congruent to a given figure, using reflection over a line of symmetry, and identify corresponding parts.
 - v. Show how congruent plane figures can be made to correspond through reflection, rotation, and translation.
- f. Triangles:
 - i. Know that the sum of the measures of the angles of a triangle is 180° .
 - ii. Construct different kinds of triangles.
 - iii. Know terms by which we classify kinds of triangles: by length of sides: equilateral, isosceles, scalene by angles: right, acute, obtuse
- g. Identify congruent angles and sides, and axes of symmetry, in parallelograms, rhombuses, rectangles, and squares.

h. Find the area (A) and perimeter (P) of plane figures, or given the area or perimeter find the missing dimension, using the following formulas:

i. rectangle

$$A = lw$$

$$P = 2(l + w)$$

ii. square

$$A = s^2$$

$$P = 4s$$

iii. triangle

$$A = \frac{1}{2}bh$$

$$P = s_1 + s_2 + s_3$$

iv. parallelogram

$$A = bh$$

$$P = 2(b + s)$$

i. Circles:

i. Identify arc, chord, radius (plural: radii), and diameter; know that radius = $\frac{1}{2}$ diameter.

ii. Using a compass, draw circles with a given diameter or radius.

iii. Solve problems involving application of the formulas for finding the circumference of a circle: $C = \pi d$, and $C = 2\pi r$, using 3.14 as the value of π .

iv. Find the area of a circle using the formula $A = \pi r^2$

j. Find volume of rectangular solids, or given the volume find a missing dimension, using the formulas $V = lwh$, or $V = bh$ (in which $b =$ area of base).

VI. Probability and Statistics

- Find the range and measures of central tendency (mean, median, and mode) of a given set of numbers.
- Understand the differences among the measures of central tendency and when each might be used.
- Understand the use of a sample to estimate a population parameter (such as the mean), and that larger samples provide more stable estimates.
- Represent all possible outcomes of independent compound events in an organized way and determine the theoretical probability of each outcome.
- Compute the probability of any one of a set of disjoint events as the sum of their individual probabilities.
- Solve problems requiring interpretation and application of graphically displayed data.
- Given a set of data, find the mean, median, range, and mode.
- Construct a histogram; a tree diagram.
- Coordinate plane: Plot points on a coordinate plane, using ordered pairs of positive and negative whole numbers. Use the terms origin (0,0), x-axis, and y-axis. Graph simple functions and solve problems involving use of a coordinate plane.

VII. Pre-Algebra

- Recognize uses of variables and solve linear equations in one variable.
- Solve word problems by assigning variables to unknown quantities, writing appropriate equations, and solving them.

- c. Find the value for an expression, given replacement values for the variables; for example, what is $7/x - y$ when x is 2 and y is 10?
- d. Simplify expressions with variables by combining like terms.
- e. Understand the use of the distributive property in variable expressions such as $2x(2y + 3)$.

GRADE 7 MATHEMATICS

I. Pre-Algebra

- a. Properties of The Real Numbers
 - i. Know and use the associative, commutative, and distributive properties by name and in
 - ii. simplifying expressions involving numbers and variables.
 - iii. Understand absolute value and evaluate expressions such as $|2x - 3| + 3x$.
- b. Linear Applications and Proportionality
 - i. Know the concept of slope.
 - ii. Translate situations of proportionality into equations of the form $y = mx$, where m is the constant of proportionality or slope; specifically know and understand $d = rt$ and $i = prt$.
 - iii. Show situations of constant proportionality as a line on the coordinate plane.
 - iv. Introduce the concept of a function and determine the equation of a linear function given its slope and intercepts in the form $y = mx + b$.
 - v. Estimate the values of b and m from a given linear graph.
- c. Polynomial Arithmetic
 - i. Add, subtract, multiply, and divide monomials and polynomials (divide polynomials by monomials only).
 - ii. by monomials only).
 - iii. Factor binomials that have a common monomial factor.
- d. Equivalent Equations and Inequalities
 - i. Review equality properties for equations.
 - ii. Know that addition or subtraction of the same value from both sides of an inequality maintains the inequality.
 - iii. Know that multiplying or dividing both sides of an inequality by a positive number maintains the inequality, but multiplying or dividing by a negative number reverses the inequality; show why using a number line.
 - iv. Simplify and solve linear equations in one variable such as $3(2x - 5) + 4x = 12(x + 5)$.
 - v. Simplify and graph solutions to linear inequalities in one variable such as $3(2x - 5) + 4x \leq 12(x + 5)$.
- e. Integer Exponents
 - i. Know the meaning of an exponent n when n is positive or negative.
 - ii. Know that a non-zero number to the zero power is one.
 - iii. Understand why a negative number to an even power is positive and a negative number to odd power is negative.
 - iv. Know the multiplication properties of exponents:
 1. Product of powers: $(a^m)(a^n) = a^{(m+n)}$
 2. Power of a power: $(a^m)^n = a^{mn}$
 3. Power of a product: $(ab)^m = (a^m)(b^m)$.
 - v. Convert decimal numbers to and from scientific notation.
 - vi. Know the proper order of operations with exponents.

II. Geometry

- a. Three-Dimensional Objects
 - i. Describe and construct simple right prisms, cylinders, cones, and spheres using the concepts of parallel and perpendicular; calculate the surface areas and volumes of these objects.
 - ii. Know that the section created by the intersection of a plane and a sphere is a circle.

- iii. Calculate the surface area of a sphere using the equation $SA = 4 \pi r^2$.
- iv. Calculate the volume of a sphere using the equation $V = (4/3) \pi r^3$
- b. Angle Pairs
 - i. Construct parallel lines and a transversal using a compass and straight edge.
 - ii. Understand congruent angles, vertical angles, complementary angles, supplementary angles, adjacent angles, corresponding angles, and alternate interior and alternate exterior angles.
- c. Triangles
 - i. Know that a triangle is determined by its three sides or by two sides and the included angle (SSS and SAS triangle congruence) and solve problems.
 - ii. Use SSS to prove that the construction of the bisector of an angle is valid.
 - iii. Use SSS to prove that the construction of the perpendicular bisector of a segment is valid.
 - iv. Prove that the base angles of an isosceles triangle are congruent.
 - v. Demonstrate that the sum of the interior angles of a triangle equals 180 degrees.
 - vi. Know that the shape of a triangle is determined by two (hence all three) of its angles (AA(A) triangle similarity) and solve related problems.
 - vii. Construct a circle that circumscribes a triangle using compass and straight edge.
 - viii. Know and understand the Pythagorean Theorem and its converse and use it to find the length of the missing side of a right triangle and lengths of other line segments and, in some situations, empirically verify the Pythagorean theorem by direct measurement and a calculator.
 - ix. Use the Pythagorean Theorem to determine the exact ratios of the sides in 30-60-right triangles and isosceles right triangles.
 - x. Determine the image of a triangle under translations, rotations, and reflections.
- d. Measurement
 - i. Choose appropriate units of measure and use ratios to convert within and between measurement systems to solve problems.
 - ii. Compare weights, capacities, geometric measures, times, and temperatures within and between measurement systems (for example, miles per hour and feet per second, cubic inches to cubic centimeters).
 - iii. Use measures expressed as rates (for example, speed, density) and measures expressed as products (for example, person-days) to solve problems; check the units of the solutions; and use dimensional analysis to check the reasonableness of the answer.
 - iv. Compute the perimeter, area, and volume of common geometric objects and use the results to find measures of less common objects.
 - v. Know how perimeter, area, and volume are affected by changes of scale.
 - vi. Estimate and compute the area of more complex or irregular two- and three-dimensional figures by breaking the figures down into more basic geometric objects.
 - vii. Relate the changes in measurement with a change of scale to the units used (for example, square inches, cubic feet) and to conversions between units (1 square foot = 144 square inches of [1 ft² = 144 in²], 1 cubic inch is approximately 16.38 cubic centimeters [1 in³ = [16.36 cm³]).

III. Probability and Statistics

- i. Show the relationship between two variables using a scatterplot and describe the apparent relationship informally.
- ii. Find the upper and lower quartiles for a data set.
- iii. Understand that if p is the probability of an event occurring, $1 - p$ is the probability of the event not occurring.
- iv. Understand the difference between independent and dependent events.

GRADE 8 MATHEMATICS

I. Algebra

a. Properties of The Real Numbers

- i. Raise a positive number to a fractional power and simplify appropriately, including rationalizing the denominator of a simple radical expression.
- ii. Know and use of the rules of exponents extended to fractional exponents.
- iii. Use the definition of absolute value to solve equations such as $|2x - 3| + 3x = 4x - 2$
- iv. and understand why “extraneous solutions” are not solutions at all.

b. Relations, Functions, and Graphs (Two Variables)

- i. Plot a set of ordered pairs and surmise a reasonable graph of which the points are a part.
- ii. Make a reasonable table of ordered pairs from a given function rule, plot the points, and surmise its graph.
- iii. Know that the points of intersections of two graphs are simultaneous solutions of the relations that define them and indicate approximate numerical solutions.

c. Linear Equations and Functions (Two Variables)

- i. Graph linear equations by finding the x- and y-intercepts; for example, know that $2x + 3y = 4$ is linear and graph it using its intercepts.
- ii. Convert between slope-intercept form ($y = mx + b$) and standard form ($ax + by = c$).
- iii. Write an equation for a line given two points or one point and its slope.
- iv. Know lines are parallel or perpendicular from their slopes.
- v. Find the equation of a line perpendicular to a given line that passes through a given point.
- vi. Understand and graph the solution set of a linear inequality.
- vii. Solve a system of two linear equations in two variables algebraically and interpret the answer graphically.
- viii. Solve a system of two linear inequalities in two variables and sketch the solution set.
- ix. Solve word problems (including mixture, digit, and age problems) that involve linear equations.

d. Arithmetic of Rational Expression

- i. Factor second- and higher-degree polynomials when standard techniques apply, such as factoring the GCF out of all terms of a polynomial, the difference of two squares, and perfect squares trinomials.
- ii. Add, subtract, multiply, and divide rational expressions and express in simplest form.

e. Quadratic Equations and Functions

- i. Solve quadratic equations in one variable by factoring or by completing the square.
- ii. Complete the square to write a quadratic expression as the difference of two squares.
- iii. Graph quadratic functions by completing the square to find the vertex and know that their zeros (roots) are the x-intercepts.
- iv. Know the quadratic formula and be familiar with its proof by completing the square.
- v. Know how to clear fractions to solve equations that lead to linear or quadratic equations.

- vi. Know how to use squaring to solve problems that lead to linear or quadratic equations.
- vii. Solve word problems, including physical problems such as the motion of an object under the force of gravity, and combined rate (work) problems.

II. **Geometry**

a. Analytic Geometry

- i. reinforce the knowledge of algebra with geometry and vice versa.
- ii. know that the midpoint of a line segment of any slope, projected perpendicularly onto the horizontal x-axis or vertical y-axis, will be the midpoint of its projection.
- iii. know the similar triangles connection (aa similarity) with slope and that this is the tangent of the angle the line makes with the x-axis.

b. Introduction to Trigonometry

- i. Know that in a right triangle the cosine of an angle is the ratio of the adjacent side to the hypotenuse and the sine is the ratio of the opposite side to the hypotenuse.
- ii. Know the values of the sine, cosine, and tangent of 0, 30, 45, 60, and 90 degrees and use a scientific calculator to determine the approximate value of any acute angle.
- iii. use a scientific calculator to determine the approximate value of an acute angle of a Given sine, cosine, or tangent.

III. **Triangles and Proofs**

- a. Prove that the bisector of an angle is the set of all points equidistant from both sides.
- b. Prove that any triangle inscribed in a circle with one side as the diameter is a right triangle.
- c. Prove the Pythagorean Theorem.
- d. Know that a line tangent to a circle is perpendicular to the radius at the point of tangency.
- e. Taking geometry as a model, understand the concept of a mathematical proof, as distinct from an opinion, an approximation, or a conjecture based on specific cases.
- f. In geometry and elsewhere, understand that a single-counter example suffices to disprove a general assertion.