Archdiocese of Washington Catholic Schools
Academic Standards
Mathematics

6th Grade

Standard 1 – Number Sense

Students compare and order positive and negative integers, decimals, fractions, and mixed numbers. They find multiples* and factors*.*

6.1.1 Understand and apply the basic concept of negative numbers (e.g., on a number line, in counting, in temperature, in "owing").

Example: The temperature this morning was -6˚ and now it is 3˚. How much has the temperature risen? Explain your answer.

6.1.2 Interpret the absolute value of a number are the distance from zero on a number line, and find the absolute value of real numbers.

Example: Use a number line to explain the absolute values of -3 and of 7.

6.1.3 Compare and represent on a number line positive and negative integers, fractions, decimals (to hundredths), and mixed numbers.

Example: Find the positions on a number line of 3.56, -2.5, $1\frac{5}{6}$, and -4.

6.1.4 Convert between any two representations of numbers (fractions, decimals, and percents) without the use of a calculator.

Example: Write $\frac{5}{8}$ as a decimal and as a percent.

6.1.5 Recognize decimal equivalents for commonly used fractions without the use of a calculator.

Example: Know that $\frac{1}{3}$ = 0.333 …, ½ = 0.5, $\frac{2}{5}$ = 0.4, etc.

6.1.6 Use models to represent ratios.

Example: Divide 27 pencils to represent the ratio 4:5.

6.1.7 Find the least common multiple* and the greatest common factor* of whole numbers. Use them to solve problems with fractions (e.g., to find a common denominator to add two fractions or to find the reduced form for a fraction).

Example: Find the smallest number that both 12 and 18 divide into. How does this help you add the fractions $\frac{5}{12}$ and $\frac{7}{18}$?

*positive and negative integers: …, -3, -2, -1, 0, 1, 2, 3, …
*multiples: e.g., multiples of 7 are 7, 14, 21, 28, etc.
*factors: e.g., factors of 12 are 1, 2, 3, 4, 6, 12
*least common multiple: e.g., least common multiple of 4 and 6 is 12
*greatest common factor: e.g., greatest common factor of 18 and 42 is 6

Standard 2 – Computation

Students solve problems involving addition, subtraction, multiplication, and division of integers. They solve problems involving fractions, decimals, ratios, proportions, and percentages.

6.2.1 Add and subtract positive and negative integers.

Example: 17 ÷ -4 = ?, -8 - 5 = ?

6.2.2 Multiply and divide positive and negative integers.

Example: Continue the pattern: 3 x 2 = ?, 2 x 2 = ?, 1 x 2 = ?, 0 x 2 = ?, -1 x 2 = ?, -2 x 2 = ?, etc.

6.2.3 Multiply and divide decimals.

Example: 3.265 x 0.96 = ?, 56.79 ÷ 2.4 = ?

6.2.4 Explain how to multiply and divide positive fractions and perform the calculations.

Example: Explain why $\frac{5}{8} \div \frac{15}{16} = \frac{5}{8} \times \frac{16}{15} = \frac{2}{3}$.

6.2.5 Solve problems involving addition, subtraction, multiplication, and division of positive fractions and explain why a particular operation was used for a given situation.

Example: you want to place a towel bar 9 ¾ inches long in the center of a door 27 ½ inches wide. How far from each edge should you place the bar? Explain your method.

6.2.6 Interpret and use ratios to show the relative sizes of two quantities. Use the notations: a/b, a to b, a:b.

Example: A car moving at a constant speed travels 130 miles in 2 hours. Write the ratio of distance to time and use it to find how far the car will travel in 5 hours.

6.2.7 Understand proportions and use them to solve problems.

Example: Sam made 8 out of 24 free throws. Use a proportion to show how many free throws Sam would probably make out of 60 attempts.

6.2.8 Calculate given percentages of quantities and solve problems involving discounts at sales, interest earned, and tips.

Example: In a sale, everything is reduced by 20%. Find the sale price of a shirt whose pre-sale price was $30.

6.2.9 Use estimation to decide whether answers are reasonable to decimal problems.

Example: your friends says that 56.79 ÷ 2.4 = 2.36625. Without solving, explain why you thing the answer is wrong.

6.2.10 Use mental arithmetic to add or subtract simple fractions and decimals.

Example: Subtract $\frac{1}{6}$ from ½ without using pencil and paper.

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Standard 3 – Algebra and Functions

Students write verbal expressions and sentences as algebraic expressions and equations. They evaluate algebraic expressions, solve simple linear equations, and graph and interpret their results. They investigate geometric relationships and describe them algebraically.

6.3.1 Write and solve one-step linear equations and inequalities in one variable and check the answers.

Example: The area of a rectangle is 143 cm² and the length is 11 cm. Write an equation to find the width of the rectangle and use it to solve the problem. Describe how you will check to be sure that your answer is correct.

6.3.2 Write and use formulas with up to three variables to solve problems.

Example: You have P dollars in a bank that gives r% simple interest per year. Write a formula for the amount of interest you will receive in one year. Use the formula to find the amount of interest on $80 at 6% per year.

6.3.3 Interpret and evaluate mathematical expressions that use grouping symbols such as parentheses.

Example: Find the values of 10 – (7 – 3) and of (10 – 7) – 3.

6.3.4 Use parentheses to indicate which operation to perform first when writing expressions containing more than two terms and different operations.

Example: Write in symbols: add 19 and 34 and double the result.

6.3.5 Use variables in expressions describing geometric quantities.

Example: Let l, w, and P be the length, width, and perimeter of a rectangle. Write a formula for the perimeter in terms of the length and width.

6.3.6 Apply the correct order of operations and the properties of real numbers (e.g., identity, inverse, commutative*, associative*, and distributive* properties) to evaluate numerical expressions. Justify each step in the process.

Example: Simplify 3(4 - 1) + 2. Explain your method.

6.3.7 Identify and graph ordered pairs in the four quadrants of the coordinate plane.

Example: Plot the points (3, -1), (-6, 2) and (9, -3). What do you notice?

6.3.8 Solve the problems involving linear functions with integer* values. Write the equation and graph the resulting ordered pairs of integers on a grid.

Example: A plant is 3 cm high the first time you measure it (on Day 0). Each day after that the plant grows by 2 cm. Write and equation connecting the height and the number of the day and draw its graph.

6.3.9 Investigate how a change in one variable relates to a change in a second variable.

Example: In the last example, what do you notice about the shape of the graph?

*commutative: the order when adding or multiplying numbers makes no difference (e.g., 5 + 3 = 3 + 5), but note that this is not true for subtraction or division
*associative: the grouping when adding or multiplying numbers make s no difference (e.g., in 5 + 3 + 2, adding 5 and 3 and then adding 2 is the same as 5 added to 3 + 2), but note that this is not true fro subtraction and division
*distributive: e.g., 3(5 + 2) = 3 X 5 + 3 x 2
*integers: …, -3, -2, -1, 0, 1, 2, 3 …

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Standard 4 – Geometry

Students identify, describe, and classify the properties of plane and solid geometric shapes and the relationships between them.

6.4.1 Identify and draw vertical*, adjacent*, complementary, and supplementary* angles and describe these angle relationships.

Example: Draw two parallel lines with another line across them. Identify all pairs of supplementary angles.

6.4.2 Use the properties of complementary, supplementary, and vertical angles to solve problems involving an unknown angle. Justify solutions.

Example: Find the size of the supplement to an angle that measures 122˚. Explain how you obtain your answer.

6.4.3 Draw quadrilaterals* and triangles from given information about them.

Example: Draw a quadrilateral with equal sides but no right angles.

6.4.4 Understand that the sum of the interior angles of any triangle is 180˚ and that the sum of the interior angles of any quadrilateral is 360˚. Use this information to solve problems.

Example: find the size of the third angle of a triangle with the angles of 73˚ and 49˚.

6.4.5 Identify and draw two-dimensional shapes that are similar*.

Example: Draw a rectangle similar to a given rectangle, but twice the size.

6.4.6 Draw the translation (slide) and reflection (flip) of shapes.

Example: Draw a square and then slide it 3 inches horizontally across your page. Draw the new square in a different color.

6.4.7 Visualize and draw two-dimensional views of three-dimensional objects made from rectangular solids.

Example: Draw a picture of an arrangement of rectangular blocks from the top, front, and right-hand side.

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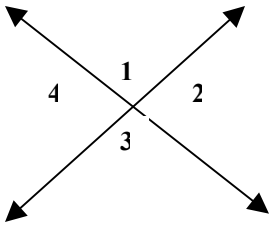
*vertical angle: angles 1 and 3, or 2 and 4

*adjacent angles: angles 1 and 2 or 2 and 3, etc.

*complementary angles: two angles whose sum is 90˚

*supplementary angles: two angles who sum is 180˚ (angels 1 and 2)



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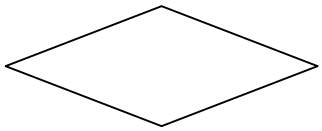
*quadrilateral: a two-dimensional figure with four sides



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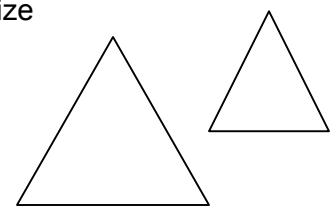
*similar: figures that have the same shape but may not have the same size



Standard 5 – Measurement

Students deepen their understanding of the measurement of plane and solid shapes and use this understanding to solve problems. They calculate with temperature and money, and choose appropriate units of measure in other areas.

6.5.1 Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles.

Example: A triangular sheet of metal is about 1 foot across. Describe the units and tools you would use to measure its weight, its angles, and the length of its sides.

6.5.2 Understand and use larger units for measuring length by comparing miles to yards and kilometers to meters.

Example: How many meters are in a kilometer?

6.5.3 Understand and use larger units for measuring area by comparing acres and square miles to square yards and square kilometers to square meters.

Example: How many square meters are in a square kilometer?

6.5.4 Understand the concept of the constant π as the ratio of the circumference to the diameter of a circle. Develop and use the formulas for the circumference and area of a circle.

Example: Measure the diameter and circumference of several circular objects. (Use string to find the circumference.) With a calculator, divide each circumference by its diameter. What do you notice about the results?

6.5.5 Know common estimates of π (3.14, $22/7$) and use these values to estimate and calculate the circumference and the area of circles. Compare with actual measurements.

Example: Find the area of a circle of radius 15 cm.

6.5.6 Understand the concept of significant figures and round answers to an appropriate number of significant figures.

Example: You measure the diameter of a circle as 2.47 m and use the approximation 3.14 for π to calculate the circumference. Is it reasonable to give 7.7558 m as your answer? Why or why not?

6.5.7 Construct a cube and rectangular box from two-dimensional patterns and use these patterns to compute the surface area of these objects.

Example: Find the total surface area of a shoe box with length 30 cm, width 15 cm, and height 10 cm.

6.5.8 Use strategies to find the surface area and volume of right prisms* and cylinders using appropriate units.

Example: Find the volume of a cylindrical can 15 cm high and with a diameter of 8 cm.

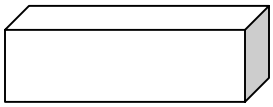
6.5.9 Use a formula to convert temperatures between Celsius and Fahrenheit.

Example: What is the Celsius equivalent of 100˚F? Explain your method.

6.5.10 Add, subtract, multiply, and divide with money in decimal notation.

Example: Share $7.25 among five people.

*right prism: a three-dimensional shape with two congruent ends that are polygons and all other faces are rectangles



Standard 6 – Data Analysis and Probability

Students compute and analyze statistical measures for data sets. They determine theoretical and experimental probabilities and use them to make predictions about events.

6.6.1 Organize and display single-variable data in appropriate graphs and stem-and-leaf plots*, and explain which types of graphs are appropriate for various data sets.

Example: This stem-and-leaf diagram show a set of test scores for your class:

Stem	Leaf
6	2 3 7
7	1 5 5 6 8 9
8	0 1 1 2 3 3 5 7 8 8
9	1 2 2 3 3 4

Find your score of 85 in this diagram. Are you close to the top or the bottom of the class on this test?

6.6.2 Make frequency tables for numerical data, grouping the data in different ways to investigate how different groupings describe the data. Understand and find relative and cumulative frequency for a data set. Use histograms of the data and of the relative frequency distribution, and a broken line graph for cumulative frequency, to interpret the data.

Example: A bag contains pens in three colors. Nine students each draw a pen from the bag without looking, then record the results in the frequency table shown. Complete the column showing relative frequency.

Color	Frequency	Relative Frequency
Red	2	2/9
Green	4	
Purple	3	

6.6.3 Compare the mean*, median*, and mode* for a set of data and explain which measure is most appropriate in a given context.

Example: Twenty students were given a science test and the mean, median and mode were as follows:

mean = 8.5, median = 9, mode = 10.

What does the difference between the mean and the mode suggest about the twenty quiz scores?

6.6.4 Show all possible outcomes for compound events in an organized way and find the theoretical probability of each outcome.

Example: A box contains four cards with the numbers 1 through 4 written on them. Show a list of all the possible outcomes if you draw two cards from the box without looking. What is the theoretical probability that you will draw the numbers one and two? Explain your answer.

6.6.5 Use data to estimate the probability of future events.

Example: Teams A and B have played each other 3 times this season and Team A has won twice. When they play again, what is the probability of Team B winning? How accurate do you think this estimate is?

6.6.6 Understand and represent probabilities as ratios, measures of relative frequency, decimals between 00 and 1, and percentages between 0 and 100 and verify that the probabilities computed are reasonable.

Example: the weather forecast says that the chance of rain today is 30%. Should you carry an umbrella? Explain your answer.

*stem-and-leaf plot: see diagram in the first example
*mean: the average obtained by adding the values and dividing by the number of values
*median: the value that divides a set of data (written in order of size) into two equal parts
*mode: the most common value in a set of data

Standard 7 – Problem Solving

Students make decisions about how to approach problems and communicate their ideas.

6.7.1 Analyze problems by identifying relationships, telling relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.

Example: Solve the problem: "Develop a method for finding all the prime numbers up to 100." Notice that any numbers that 4, 6, 8, … divide into also divide exactly by 2, and so you do not need to test 4, 6, 8, …

6.7.2 Make and justify mathematical conjectures based on a general description of a mathematical question or problem.

Example: In the first example, decide that you need to test only the prime numbers as divisors, and explain it in the same way as for 4, 6, 8, ….

6.7.3 Decide when and how to break a problem into simpler parts.

Example: In the first example, decide to find first those numbers not divisible by 2.

Students use strategies, skills, and concepts in finding and communicating solutions to problems.

6.7.4 Apply strategies and results from simpler problems to solve more complex problems.

Example: In the first example, begin by finding all the prime numbers up to 10.

6.7.5 Express solutions clearly and logically by using the appropriate mathematical terms and notation. Support solutions with evidence in both verbal and symbolic work.

Example: In the first example, use a hundreds chart to cross off all multiples of 2 (except 2), then all multiples of 3 (except 3), then all multiples of 5 (except 5), etc. Explain why you are doing this.

6.7.6 Recognize the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

Example: Calculate the perimeter of a rectangular field that needs to be fenced. How accurate should you be: to the nearest kilometer, meter, centimeter, or millimeter? Explain your answer.

6.7.7 Select and apply appropriate methods for estimating results of rational-number computations.

Example: Measure the length and height of the walls of a room to find the total area. Estimate an answer by imagining meter squares covering the walls.

6.7.8 Use graphing to estimate solutions and check the estimates with analytic approaches.

Example: use a graphing calculator to estimate the coordinates of the point where the straight line $y = 8x - 3$ crosses the x-axis. Confirm your answer by checking it in the equation.

6.7.9 Make precise calculations and check the validity of the results in the context of the problem.

Example: In the first example, check whether some of the numbers not crossed out are in fact primes.

Students determine when a solution is complete and reasonable and move beyond a particular problem by generalizing to other situations.

6.7.10 Decide whether a solution is reasonable in the context of the original situation.

Example: In the first example, decide whether your method was a good one – did it find all the prime numbers efficiently?

6.7.11 Note the method of finding the solution and show a conceptual understanding of the method by solving similar problems

Example: Use a hundreds chart to find all the numbers that are multiples of both 2 and 3.