

Mathematics Curriculum

Strand: I – Patterns, Relationships and Functions

Grade: 3 – 5

Standard	1. Students recognize similarities and generalize patterns, use patterns to create models and make predictions, describe the nature of patterns and relationships, and construct representations of mathematical relationships.
Benchmarks	<ul style="list-style-type: none"> • Recognize, describe and extend numerical and geometric patterns. (3,4,5) • Communicate and represent patterns and relationships in diverse ways. (3,4,5) • Describe the real world using patterns. (3,4,) • Recognize and classify numeric and geometric patterns. (3, 4, 5) • Solve problems and explore new content using pattern recognition and analysis. (3,4,5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Record and describe in words patterns in various settings (quilts). • Identify and analyze patterns and relationships. • Supply missing elements and generalize the rule for the pattern. • Create and describe patterns. • Recognize patterns in different ways (calendars, multiplication tables). • Explore and observe patterns. • Explore different types and uses of patterns that are progressively more difficult and describe pattern. • Develop and use observation and strategies for analyzing. • Use numerical pattern relationships as a basis for developing number concepts. • Use constant function on a calculator to develop concept of multiplication. • Chart duration of activities. Observe patterns and make conjectures and predictions. • Represent patterns using tables and graphs. • Use visual patterns as open-ended questions for developing basic facts and part/part/whole relationships. • Make bar graphs, pictographs and charts based on data collected from surveys and experiments. • Write a rule for a pattern as a function.
Resources	<ul style="list-style-type: none"> • Graph paper • Pattern blocks • Calculators • Trailblazers • <u>Patterns, What Are They?</u>, Shimek, William

Mathematics Curriculum

Strand: I – Patterns, Relationships and Functions

Grade: 3 – 5

Standard	2. Students describe the relationships among variables, predict what will happen to one variable as another variable is changed, analyze natural variation and sources of variability, and compare patterns of change.
Benchmarks	<ul style="list-style-type: none"> • Recognize change in variability when it occurs in a variety of settings. (3,4,5) • Recognize patterns of change and natural variation to better understand variability. (3,4,5) • Explore changes and realize that changes are frequently interdependent. (4, 5) • Represent variability in a variety of symbolic forms. (3,4) • Model patterns of variability arising from physical and mathematical contexts using functions and relationships. (3,4) • Understand that variability and change are a basis for making sense of the world and of mathematical ideas. (3,4,5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Explore and recognize change at a constant or variable rate (ex. growth, cause and effect). • Student led discussion: why are there variations in results, which variables are related, which variables are dependent/independent. • Define rule using input/output data. • Identify and describe predictable changes. • Identify relationship on variable has to another. • Use patterns to answer questions, solve problems. • Name pairs of variables not related. • Classroom discussion should focus on the numeric data and its relationship to the pattern (ex. 12 is the 10th #). • Explore and compare multiple ways of representing change (ex. input/output charts, diagrams, etc.). • Compare and contrast different representations (ex. tables. vs. ordered pairs). • Explore how “chance” can affect a set of data. • Represent growing, repeating and shrinking patterns as picture and numeric patterns. • Describe changes in designs and predict next several designs. • Explain your prediction of next element of a pattern. • Explain rules for missing numbers. • Create an illustration of plant growth with time as a variable. • Discuss predictable and unpredictable events. • Discuss reasons for variation in plant growth notes.

	<ul style="list-style-type: none">• Analyze quilt patterns, predict numbers of colors/shapes.
Resources	<ul style="list-style-type: none">• Graph paper• Calculators• Trailblazers

Mathematics Curriculum

Strand: II – Geometry and Measurement

Grade: 3 – 5

Standard	1. Students develop spatial sense, use shape as an analytic and descriptive tool, identify characteristics and define shapes, identify properties and describe relationships among shapes.
Benchmarks	<ul style="list-style-type: none"> • Recognize and name familiar shapes in one, two and three dimensions such as lines, rectangles and spheres and informally discuss the shapes of a graph. (3,4,5) • Describe the attributes of familiar shapes. (4,5) • Compare, sort and classify familiar shapes. (3) • Draw and build familiar shapes. (3,4,5) • Explore ways to combine, dissect and transform shapes. (4,5) • Recognize parallel and perpendicular line segments and figures that have similarity and/or congruence. (4,5) • Use shapes, shape properties and shape relationships to describe the physical world and to solve problems. (3,4,5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Correctly use geometric vocabulary in written and oral context (ex. vertices). • Create models of two-dimensional shapes and identify by name. • Use geometric terms to describe shapes found in the real world. • Find and describe characteristics (attributes) of familiar and common objects. • Small and large group discussion to compare and analyze 2 and 3 dimensional shapes. • Create and solve riddles and logic problems describing 2 and 3 dimensional shapes. • Sort geometric solids by those that will stack, roll or slide. • Explore 2 dimensional shapes by using precut manipulatives and by folding and cutting shapes out of paper. • Draw on a 2 dimensional plain a shape that could be cut and folded to make a 3 dimensional shape. • Combine basic shapes to make original creations. • Students will manipulate 7 tangram pieces and discuss each new shape they form. • Trace shapes and their images after sliding, flipping and turning. • Dissect irregular shapes into familiar geometric shapes. • Discover symmetrical properties by paper folding or using reflective devices, and make comparisons. • Explore with tangram pieces the possible arrangements of pieces that form other geometric shapes. • Identify, discuss and create examples of parallel and perpendicular line segments observed in the classroom and in the context of geometric shapes. • Visually explore the concept of similarity and congruence between figures.

	<ul style="list-style-type: none">• Discuss, compare and contrast pairs of shapes.• Make a list of examples of similar or congruent shapes in the home or other environments.• Describe both 2 and 3 dimensional shapes found in the world.• Describe the characteristics and properties of shapes.• Use correct geometric mathematical terminology in written and oral context.• Describe and solve problems using boxes, cylinders or cubes to construct customary and non-customary objects.
Resources	<ul style="list-style-type: none">• Tangrams• Graph paper• Geoboards• Pattern blocks• Three-dimensional shapes• <u>String, Straightedge and Shadow. The Story of Geometry, Diggins, Julia</u>

Mathematics Curriculum

Strand: II – Geometry and Measurement

Grade: 3 – 5

Standard	2. Students identify locations of objects, identify location relative to other objects, and describe the effects of transformations on an object.
Benchmarks	<ul style="list-style-type: none"> • Locate and describe objects in terms of their position. (3,4,5) • Locate and describe objects in terms of their orientation, direction and relative position. Recognize symmetrical objects and identify lines of symmetry. (3,4,5) • Explore what happens to the size, shape and position of an object after sliding, flipping, turning, enlarging or reducing. (4,5) • Describe the physical world and solve problems using concepts of position, direction and orientation. (3,4,5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Use and understand position words to locate and describe objects. Write directions to locate a place or object. • Discuss locating points on a number line or on a coordinate graph. • Explore concepts of symmetry. • Locate and describe objects in terms of direction. • Explore what happens to objects that are flipped, turned or slid. • Explore transformations using grid paper or a geoboard. • Make and follow directions using north, south, east, west. • Write complete directions from one given location to another given location.
Resources	<ul style="list-style-type: none"> • Tangrams • Graph paper • Geoboards • Pattern blocks • Three-dimensional shapes • Miras (transparent, translucent, reflective manipulatives)

Mathematics Curriculum

Strand: II – Geometry and Measurement

Grade: 3 – 5

Standard	3. Students compare attributes of two objects, or of one object with a standard, and analyze situations to determine what measurements should be made and to what level of precision.
Benchmarks	<ul style="list-style-type: none"> • Compare attributes of objects, develop standard units of measurement and select and use standard tools of measurement. (3,4,5) • Identify the attribute to be measured and select the appropriate unit of measurement. (3) • Develop strategies for eliminating measurement error and compare the estimates to the results of measurement. Decide if an estimate is logical. (3,4,5) • Interpret the meaning and significance of various measurements. (3) • Explore scale drawings, models and maps and relate them to measurements of real objects. (4,5) • Apply measurement to describe the real world and to solve problems. (3,4,5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Compare and order objects by length, width, height, mass, area and volume. • Use non-standard units to measure objects. • Discuss need for standard units. • Use standard tools in metric and customary units (grams, rulers, thermometers) and determine which tool is most appropriate. • Determine the best way to find number of units of volume (cups, liters, ounces) in a large unmarked container. • Use water displacement to determine volume. • Use centimeter cubes to determine volume. • Use 2 dimensional picture to create 3 dimensional model. • Estimation activities progressing in complexity from length/height to surface area and volume. Progression of complexity increases with grades. • Use non-standard units to measure length. • Use square tiles to explain area. • Create scale drawings using scale/grid paper. • Discuss scale factors of blueprints. • Create enlargements on grid/dot paper. • Explore relationship between fixed perimeter and various areas that could be constructed with given perimeter. Use grid or dot paper. • Determine which/how many items can be purchased with fixed budget.
Resources	<ul style="list-style-type: none"> • Standard measurement tools (rulers, tape measures, scales, graduated cylinders,

centimeter grids, thermometers, etc.)

- Tangrams
- Graph paper
- Geoboards
- Pattern blocks
- Three-dimensional shapes

Mathematics Curriculum

Strand: III – Data Analysis and Statistics

Grade: 3 – 5

Standard	1. Students collect and explore data, organize data into a useful form, and develop skill in representing and reading data displayed in different formats.
Benchmarks	<ul style="list-style-type: none">• Collect and explore data through counting, measuring and conducting surveys and experiments.(3, 4, 5)• Organize data using concrete objects, pictures, tallies, tables, charts, diagrams and graphs. (4,5)• Present data using a variety of appropriate representations and explain the meaning of the data. (3,4,5)• Identify what data are needed to answer a particular question or solve a given problem and design and implement strategies to obtain, organize and present those data. (3,4,5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Collect and explore data by conducting surveys and experiments.• Create a real graph, picture graph and bar graph using the same data.• Compare and contrast different representations of the same data.• Collect and discuss a variety of data displays from printed material such as newspapers, magazines and student graphs.• Create and analyze pictographs where one element represents multiple units.• Engage in activities in which they combine multiple sets of data into one graph or chart.
Resources	<ul style="list-style-type: none">• Newspapers, charts• Student generated data (Ex. favorite colors, shoes, etc.)

Mathematics Curriculum

Strand: III – Data Analysis and Statistics

Grade: 3 – 5

Standard	2. Students examine data and describe characteristics of a distribution, relate data to the situation from which they arose, and use data to answer questions convincingly and persuasively.
Benchmarks	<ul style="list-style-type: none"> • Read and explain data collected. Read data from other sources. Focus (3) Review (4) • Describe the shape of the data using informal language; Introduce (3) Focus (4) • Draw conclusions; justify conclusions to explain trends based on data. Introduce (3) Focus (4, 5) • Raise and answer questions about the source, collection, organization and presentation of data. Draw conclusions. Explore biases in data. Introduce (4) Focus (5) • Formulate questions and problems and gather and interpret data to answer those questions; Introduce (4) Focus (5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Describe and explain data representations. Use descriptive, comparative and interpretive statements about data displays. • Compare whole data sets. • Identify the median or mode for specific small sets of data. • Conduct surveys that engage students to create constructed response. • Raise new questions, explore, and discuss problems. Compare differences of data displays. • Communicate statistics project results from various portfolio projects.
Resources	<ul style="list-style-type: none"> • Computer graphing software, age appropriate spreadsheets • Calculators • Trailblazers • Math Central

Mathematics Curriculum

Strand: III – Data Analysis and Statistics

Grade: 3 – 5

Standard	3. Students draw defensible inferences about unknown outcomes, make predictions, and identify the degree of confidence they have in their predictions.
Benchmarks	<ul style="list-style-type: none">• Make and test hypotheses. (3,4)• Conduct surveys, samplings, and experiments to solve problems and answer questions of interest. (3,4)• Formulate and communicate arguments and conclusions based on data and evaluate conclusions. (3,4)• Make and explain predictions based on data. (3,4)• Make predictions to answer questions and solve problems. (3,4)
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Make predictions about an outcome. Design a way to test the prediction and make comparisons with the result.• Design and conduct surveys, samples and experimental investigations.• Develop skills in experimenting (change only one variable).• Collect, organize data. Share conclusion and seek feedback.• Identify trends shown in the data and justify predictions based on the data. Patterns may be increasing, decreasing or variable.• Use data analysis approach to plan, use problem solving steps to gather, organize, describe and interpret the data.
Resources	

Mathematics Curriculum

Strand: IV – Number Sense and Numeration

Grade: 3 – 5

Standard	1. Students experience counting and measuring activities to develop intuitive sense about numbers, develop understanding about properties of numbers, understand the need for and existence of different sets of numbers, and investigate properties of special numbers.
Benchmarks	<ul style="list-style-type: none">• Develop an understanding of whole numbers and read, write and count using whole numbers. Investigate basic concepts of fractions and decimals. (3,4)• Investigate and develop an understanding of the basic 10, place value system. (3,4)• Develop an understanding of the properties of numbers (Ex. order) and of the properties of the special numbers 0 and 1. (3,4)• Apply understanding of number systems to model and solve problems. (4,5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Relate cents to decimals, fractions of a dollar. Draw to show equivalent models on graph paper or on paper strips folded to represent given fractions.• Show an understanding of place value arranging digits to make the largest or smallest.• Show an understanding of odd and even numbers. Develop strategies to learn properties (identify, commutativity, associativity)• Use the properties of numbers to understand and solve problems. Use understanding of multiples and whole numbers.
Resources	

Mathematics Curriculum

Strand: IV – Number Sense and Numeration

Grade: 3 – 5

Standard	2. Students recognize that numbers are used in different ways such as counting, measuring, ordering and estimating, understand and produce multiple representations of a number, and translate among equivalent representations.
Benchmarks	<ul style="list-style-type: none"> • Represent whole numbers, fractions and decimals using concrete, pictorial and symbolic representations. (3,4,5) • Explore and recognize different representations for the same number and explain why they are the same. (3) • Investigate ways numbers are used for varied purposes. (3,4) • Develop strategies for estimating quantity and evaluate the reasonableness of the estimates. (3,4) • Select appropriate numbers and representations in order to solve problems. (4,5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Students should engage in activities in which they recognize various representations of the same decimal number. • Represent whole numbers, fractions and decimals in concrete, pictorial and symbolic forms. • Explore representations of a number. Sort a set of objects into different subsets (fact families) and record answers. • Use labeling numbers such as street address. • Investigate ways numbers are used by counting, ordering and naming. • Use estimation to solve problems. • Identify various whole number representations of methods for solving a problem. Work with real life situations that involve numbers.
Resources	<ul style="list-style-type: none"> • Counting rods • Cuisenaire rods • Unifix cubes • Fraction tiles

Mathematics Curriculum

Strand: IV – Number Sense and Numeration

Grade: 3 – 5

Standard	3. Students investigate relationships such as equality, inequality, inverses, factors and multiples, and represent and compare very large and very small numbers.
Benchmarks	<ul style="list-style-type: none"> • Compare and order numbers using “equal”, “less” or “greater than”. (3,4) • Use part-whole relationships to explore numbers, develop number concepts and understand computation. (3,4) • Classify numbers as even or odd and explore concepts of factors and multiples. (3,4) • Apply understanding of number relationships in solving problems. Use properties and relationships of numbers. (3,4)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Compare whole numbers, decimals and fractions. • Describe the comparative relationships of numbers both symbolically and verbally. • Use part-whole relationships to understand addition and subtraction of whole numbers, develop an understanding of the relationship between multiplication and division, and develop fractional number concepts. • Use a hundreds grid to determine factors and multiples, coloring all multiples of any number and looking for patterns. • Show understanding of fraction concepts to solve problems. (mileage, weights) • Use large numbers to understand relationships between millions, billions, trillions.
Resources	<ul style="list-style-type: none"> • <u>Making Fractions with Easy – to – Make – Projects for Fun Math Games</u>, King, Andrew

Mathematics Curriculum

Strand: V – Numerical and Algebraic Operations and Analytical Thinking Grade: 3 – 5

Standard	1. Students understand and use various types of operations to solve problems.
Benchmarks	<ul style="list-style-type: none"> • Use manipulatives to model operations with numbers. Develop methods of recording operations and relate models and recordings to standard symbolic expressions and algorithms. (3,4) • Develop and apply appropriate method of computation from mental computation, estimation, paper and pencil or calculators. Explain reason for chosen method and reason for using certain operations in certain situations. (3,4) • Explore properties of operations (Ex. commutative and distributive properties) and give examples of how they use those properties. (3) • Apply operations efficiently and accurately in solving problems. (3,4)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Make translations between models, word problems, and symbolic equations of the four operations. • Solve multi step problems and explain their solution. • Acquire skill with pencil and paper algorithms by connecting symbolic equations with conceptual models. • Explore properties of operations using commutative property and distributive property. • Recognize that some arrangements of numbers are easier to add (or multiply) than others and be able to commute or re-associate to make the problem easier to solve. • Analyze problems to determine the operation and the best combination of numbers to solve the problem. • Know multiplication tables. • Perform division operations.
Resources	

Mathematics Curriculum

Strand: V – Numerical and Algebraic Operations and Analytical Thinking

Grade: 3 – 5

Standard	2. Students analyze problems to determine an appropriate process for solution, and use algebraic notations to model or represent problems.
Benchmarks	<ul style="list-style-type: none">• Write and solve open sentences (Ex. $___ + ___ = 5$) and write stories to fit the open sentences. (3,4)• Explore algebraic concepts with manipulatives such as balance scales, tables of input and output and pictorial representations of problems. (3,4)• Find replacement for the variables in open sentences. (3,4)• Use analytic thinking to describe situations and solve problems. (3,4)
Sample Activity/Assessment tasks	<ul style="list-style-type: none">• Write open sentences with shapes as variables from problems in a story format.• Use input/output tables and guess my rule.• Write an open sentence and solve the equation when given a word problem.• Utilize higher level thinking skills in problem solving. Explain in words/pictures/numbers how the answer was solved.• Work with a calculator to discover the rule.
Resources	

Mathematics Curriculum

Strand: VI – Probability and Discrete Mathematics

Grade: 3 – 5

Standard	1. Students develop an understanding of the notion of certainty and of probability as a measure of the degree of likelihood that can be assigned to a given event based on the knowledge available, and make critical judgments about claims that are made in probabilistic situations.
Benchmarks	<ul style="list-style-type: none"> • Develop understanding of the concepts of chance and uncertainty. (3,4,5) • Compare events and describe them as “more likely” and “less likely” and use the language of fractions to describe simple probabilities. (3,4,5) • Understand that some outcomes are affected by prior events while others are independent. (4,5) • Examine outcomes and search for explanations and realize the difference between probabilities determined from observations and probabilities derived mathematically. (4,5) • Create experiments that model the behavior of variables on a smaller scale to solve a larger problem. (4,5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Use terms: certain, not possible, least likely, most likely in written and oral context. • Explore and discuss everyday experiences of chance and certainty. • Conduct and explore simple experiments with spinners, coins, dice, etc. • Continue terminology: compare/contrast, possible vs. probable, certain vs. uncertain. • Explore ways of modeling the probability an event will occur. • Use fractions to describe simple probabilities. • Predict ratios, discuss reasons for predictions, and explore part/whole ratios. • Design and conduct simple probability experiments with colored manipulatives (etc.). Discuss possible outcomes prior to experiments. Modify predictions during discourse. • Record results in multiple representations. Analyze representations for readability. Compare results with predictions. • Record and study possible outcomes. • Examine results to see if they make sense.

	<ul style="list-style-type: none">• Explain results in written and oral context.• Represent results as ratio or fraction.• Explore if outside conditions affect outcome.• Discuss experimental probability with theoretical probability.• Continue use of correct terminology.• Discuss “randomness”.• Construct 2 spinner activities to introduce combined outcomes.• Create simulations (experiments that model the behaviors of variables) on a smaller scale to solve larger problems.• Define “trial” and identify a trial as part of experiment.• Predict events on large scale by sampling small population.
Resources	<ul style="list-style-type: none">• Spinners, die, colored cubes• Weather data• Coins• <u>Counter Logic</u>, James, Nancy Segel

Mathematics Curriculum

Strand: VI – Probability and Discrete Mathematics

Grade: 3 - 5

Standard	2. Students investigate practical situations such as scheduling, routing, sequencing, networking, organizing and classifying, and analyze ideas like recurrence relations, induction, iteration, and algorithm design.
Benchmarks	<ul style="list-style-type: none"> • Use manipulatives and diagrams to explore problems involving counting and arranging objects to practice simple arrangements. Cultivate accuracy and develop an understanding of permutations and combinations. (3,4) • Explore sets and set relationships by sorting and classifying objects. (3,4) • Model and/or trace paths using figures consisting of vertices connected by edges. (3,4,5) • Understand patterns that repeat, “now-next” patterns. (3,4,5) • Explore, develop and invent algorithms to develop procedures for solving problems. (4,5) • Analyze context of a problem to determine the best means of solving the problem. (4,5)
Sample Activity/Assessment tasks	<ul style="list-style-type: none"> • Explore a variety of problems that involve counting and arranging objects. • Develop different counting techniques and the fundamental theorem of counting. • Explore simple permutations, where order is important and not important. • Use a variety of graphic organizers to help students sort and classify (Venn diagrams, tables, concept maps). • Connect vertex-edge graphs to familiar experiences such as planning trips or shortest paths, planning bus routes. • Work with repeating patterns using objects, numbers, colors, etc. • Develop a sequence (iteration). • Repeat (iterate) a unit to measure length. • Look at previous steps to predict next in sequence. • Arrange and explain a series of pictures or events. • Explore systematic approaches for completing a task. • Solve problems with multiple solutions (making change using a variety of coins). • Discuss best solutions to problems such as planning efficient routes. • Organize a complex task and sequence events for timeliness. • Color maps with fewest colors to minimize conflict.
Resources	