

**CURRICULUM**

**GUIDE**

Math – Grade 8

Providence  
Schools

## QUARTER I

### Content students have to learn

### Processes students will learn and use

#### Unit 1.1 – Probability (8 days)

- Understand probability concepts, such as fair game, experimental probability, and theoretical probability.
- Explore the use of area models for analyzing the theoretical probabilities for two-stage outcomes (compound probability).
- Understand differences between the probability of an outcome and the long-term average of many trials in a situation with a payoff.
- Determine and compare theoretical and experimental probability in problem-solving situations.
- Analyze problem-solving situations using theoretical and experimental probabilities.

- » Determine, collect, and organize the relevant information needed to solve real-world problems.
- » Formulate, test, and justify mathematical conjectures and arguments.
- » Formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.
- » Understand that many real-world applications require an understanding of mathematical concepts (e.g., personal finance, running a business, building a house, following a recipe, or sending a rocket to the moon).

#### Unit 1.2 – Counting Techniques (6 days)

- Investigate counting techniques in problemsolving contexts.
- Understand the use of counting techniques to determine numbers of combinations or permutations in problem-solving contexts.
- Uncover patterns that help in counting the outcomes of complex processes.
- Apply counting techniques, including the fundamental counting principle, in problemsolving contexts.

- » Connect new mathematical ideas to those already studied and build upon them.
- » Present, share, explain, and justify thinking with others and build upon the ideas of others to solve problems.
- » Use mathematical symbols and notation.
- » Formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.

#### Unit 1.3 – Comparing Data Sets (8 days)

- Develop strategies for interpreting and analyzing data sets represented in histograms and box-and-whisker plots.
- Understand how to use measures of central tendency and dispersions to analyze data and solve problems.
- Understand how different representations or elements of representations can be used to more accurately report data sets in problemsolving situations.
- Analyze data sets and representations of data sets.

- » Determine, collect, and organize the relevant information needed to solve real-world problems.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.
- » Use and create representations to solve problems and organize thoughts and ideas.
- » Convert among representations (e.g., a table of values, an equation, and a graph may all be representations of the same function).

#### Unit 1.4 – Analyzing a Sample (7 days)

- Develop strategies for interpreting and analyzing data sets represented in line graphs and box-and-whisker plots.
- Understand how to use measures of central tendency and dispersions to analyze data and solve problems.
- Understand how different representations or elements of representations can be used to more accurately report data sets in problemsolving situations.
- Understand strategies for making predictions and develop sampling plans to test predictions.
- Understand how and why sampling is used in problem-solving contexts.

- » Determine, collect, and organize the relevant information needed to solve real-world problems.
- » Use technology when appropriate to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Present, share, explain, and justify thinking with others and build upon the ideas of others to solve problems.
- » Formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.

## QUARTER I

### Content students have to learn

### Processes students will learn and use

#### Unit 1.5 – Relating Two Variables (5 days)

- Explore relationships between paired values and numerical attributes represented in scatter plots of data.
  - Understand how a trend line (estimated line of best fit) can be used to model a set of data in problem-solving situations.
  - Understand how to write an equation for an estimated line of best fit in problem-solving situations.
  - Solve problems by analyzing data using a variety of representations (box plots, histograms, scatter plots).
- » Use technology when appropriate to solve problems.
  - » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
  - » Formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.
  - » Convert between representations (e.g., a table of values, an equation, and a graph may all be representations of the same function).
  - » Apply integrated problem-solving strategies to solve problems in the physical, natural, and social sciences and in pure mathematics.
  - » Use mathematical symbols and notation.
  - » Use models and technology to develop equivalent representations of the same mathematical concept.
  - » Understand that many real-world applications require an understanding of mathematical concepts (e.g., personal finance, running a business, building a house, following a recipe, or sending a rocket to the moon).

**Content students have to learn**

**Processes students will learn and use**

**Unit 2.1 – Exploring Data Patterns  
(7 days)**

- Understand similarities and differences among linear and nonlinear relationships.
- Explore the representations of algebraic relationships—tables, graphs, and equations.
- Revisit and explore strategies for writing equations and solving equations symbolically.

- » Use technology when appropriate to solve problems.
- » Present, share, explain, and justify thinking with others and build upon the ideas of others to solve problems.
- » Use mathematical symbols and notation.
- » Formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.
- » Use models and technology to develop equivalent representations of the same mathematical concept.
- » Use and create representations to solve problems and organize thoughts and ideas.
- » Convert between representations (e.g., a table of values, an equation, and a graph may all be representations of the same function).

**Unit 2.2 – Linear Models and Equations  
(9 days)**

- Understand how the representations of algebraic relationships—tables, graphs, and equations—can be used to solve problems (find specific cases).
- Explore strategies for solving equations symbolically.
- Develop strategies for using mathematical models to answer questions, including the use of slope and y-intercept.
- Use mathematical models to answer questions about linear relationships.
- Practice effective strategies for writing linear equations from verbal, numerical, or graphical information.
- Develop skill in solving linear equations with approximations and exact reasoning methods.

- » Use technology when appropriate to solve problems.
- » Articulate ideas clearly and logically in both written and oral form.
- » Present, share, explain, and justify thinking with others and build upon the ideas of others to solve problems.
- » Use mathematical symbols and notation.
- » Use models and technology to develop equivalent representations of the same mathematical concept.
- » Convert between representations (e.g., a table of values, an equation, and a graph may all be representations of the same function).
- » Connect understandings of mathematical concepts to real-world applications (e.g., personal finance, running a business, building a house, following a recipe, or sending a rocket to the moon).
- » Explain in oral and written form the relationships between a real-world problem and an appropriate mathematical model.

**Unit 2.3 – Squares and Square Roots  
(9 days)**

- Draw squares on  $5 \times 5$  dot grids and find their areas.
- Introduce the concept of square root.
- Understand square root geometrically, as the side length of a square with known area.
- Use geometric understanding of square roots to find lengths of line segments on a dot grid.

- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Formulate, test, and justify mathematical conjectures and arguments.
- » Present, share, explain, and justify thinking with others and build upon the ideas of others to solve problems.
- » Use mathematical symbols and notation.
- » Use models and technology to develop equivalent representations of the same mathematical concept.
- » Use and create representations to solve problems and organize thoughts and ideas.
- » Connect new mathematical ideas to those already studied and build upon them.

## QUARTER 2

### Content students have to learn

### Processes students will learn and use

#### Unit 2.4 – Discovery of the Pythagorean Theorem (7 days)

- Discover the Pythagorean theorem through exploration and geometric proof.
- Understand how the Pythagorean theorem is used to find unknown side lengths of right triangles in problem-solving situations.
- Investigate using the Pythagorean theorem to find distance between two points on a grid.
- Investigate strategies for determining whether a triangle is a right triangle based on its side lengths.
- Understand the relationship between the areas of squares and the length of their sides (squares and square roots).
- Develop strategies for using the Pythagorean theorem to solve problems in and outside of mathematics.

- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Formulate, test, and justify mathematical conjectures and arguments.
- » Construct and determine the validity of a mathematical argument or a solution.
- » Use mathematical symbols and notation.
- » Formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.
- » Connect new mathematical ideas to those already studied and build upon them.
- » Connect understandings of mathematical concepts to real-world applications (e.g., personal finance, running a business, building a house, following a recipe, or sending a rocket to the moon).

#### Unit 2.5 – Using the Pythagorean Theorem (4 days)

- Understand the meanings of rational numbers and irrational numbers.
- Develop strategies for comparing rational and irrational numbers using number lines.
- Explore the use of the Pythagorean theorem in problem-solving situations involving right triangles.
- Investigate the special properties of equilateral and 30-60-90 triangles.
- Understand how the properties of special triangles are used to solve problems.

- » Use problem-solving strategies appropriately and effectively for a given situation.
- » Apply integrated problem-solving strategies to solve problems in the physical, natural, and social sciences and in pure mathematics.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Use mathematical symbols and notation.
- » Connect understandings of mathematical concepts to real-world applications (e.g., personal finance, running a business, building a house, following a recipe, or sending a rocket to the moon).
- » Explain in oral and written form the relationships between a real-world problem and an appropriate mathematical model.

#### Unit 2.6 – Geometry and Measurement (8 days)

- Deepen understanding of volume and surface area of prisms, cones, cylinders, and pyramids.
- Develop a strategy for finding the volume of a cylinder using its dimensions.
- Connect the strategy for finding volume of a cylinder to the idea of layers in rectangular and other prisms.
- Investigate the use of volume and surface area in problem-solving situations.
- Understand how relationships between prisms and pyramids can be used to develop a strategy for finding the volume of a pyramid.

- » Formulate, test, and justify mathematical conjectures and arguments.
- » Articulate ideas clearly and logically in both written and oral form.
- » Present, share, explain, and justify thinking with others and build upon the ideas of others to solve problems.
- » Use mathematical symbols and notation. • Use and create representations to solve problems and organize thoughts and ideas.
- » Connect new mathematical ideas to those already studied and build upon them.

## QUARTER 3

### Content students have to learn

### Processes students will learn and use

#### Unit 3.1 – Mathematical Similarity (8 days)

- Develop strategies and procedures for finding missing measures in similar figures using scale factor.
- Understand how perimeter, area, and angle measures are affected when a scale factor is applied.
- Understand how changes in one or more dimensions of a rectangular prism affect the prism's volume.
- Understand the effect on surface area of applying a scale factor to a rectangular prism.
- Understand the effect on volume of applying a scale factor to a rectangular prism.
- Apply understanding of scale factor, and its relationship to changes in 1-, 2-, and 3- dimensional measures, to solve problems.

- » Use problem-solving strategies appropriately and effectively for a given situation.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Formulate, test, and justify mathematical conjectures and arguments.
- » Present, share, explain, and justify thinking with others and build upon the ideas of others to solve problems.
- » Use and create representations to solve problems and organize thoughts and ideas.
- » Connect new mathematical ideas to those already studied and build upon them.

#### Unit 3.2 – Exponential Growth (6 days)

- Develop an understanding of basic exponential growth patterns as represented in tables, graphs, and equations.
- Solve problems involving exponential growth.
- Understand the role of the growth factor in exponential relationships.
- Understand how to express a product of identical factors in both exponential form and standard form.
- Compare different exponential growth patterns and compare exponential and linear growth.

- » Use technology when appropriate to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Use mathematical symbols and notation.
- » Formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.
- » Use models and technology to develop equivalent representations of the same mathematical concept.
- » Use and create representations to solve problems and organize thoughts and ideas.
- » Convert between representations (e.g., a table of values, an equation, and a graph may all be representations of the same function).
- » Connect new mathematical ideas to those already studied and build upon them.

#### Unit 3.3 – Growth Patterns, Growth Factors, and Growth Rates (7 days)

- Understand and interpret the  $y$ -intercept for an exponential relationship.
- Develop strategies for finding the growth factor of an exponential relationship based on a verbal description, table, graph, or equation for an exponential relationship.
- Translate among the representations of an exponential relationship to solve problems.
- Investigate growth factors involving percents to solve problems.

- » Determine, collect, and organize the relevant information needed to solve real-world problems.
- » Apply integrated problem-solving strategies to solve problems in the physical, natural, and social sciences and in pure mathematics.
- » Use technology when appropriate to solve problems.
- » Use models and technology to develop equivalent representations of the same mathematical concept.
- » Convert between representations (e.g., a table of values, an equation, and a graph may all be representations of the same function).
- » Understand that many real-world applications require an understanding of mathematical concepts.
- » Explain in oral and written form the relationships among various mathematical concepts.

## QUARTER 3

### Content students have to learn

### Processes students will learn and use

#### Unit 3.4 – Exponential Decay and Exponent Rules (8 days)

- Extend understandings of exponential relationships to include exponential decay.
- Develop an understanding of exponent rules and their application.
- Use tables, graphs, and equations to solve problems involving exponential decay.

- » Determine, collect, and organize the relevant information needed to solve real-world problems.
- » Apply integrated problem-solving strategies to solve problems in the physical, natural, and social sciences and in pure mathematics.
- » Use technology when appropriate to solve problems.
- » Use mathematical symbols and notation.
- » Formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.
- » Use models and technology to develop equivalent representations of the same mathematical concept.
- » Convert between representations (e.g., a table of values, an equation, and a graph may all be representations of the same function).

#### Unit 3.5 – Introduction to Quadratic Relationships (5 days)

- Investigate connections among the patterns in a table and graph of a quadratic relationship.
- Understand how tables and graphs can be used to make predictions about quadratic relationships.
- Develop strategies for using equations, graphs, and tables to solve problems about quadratic relationships in problem-solving situations.

- » Use problem-solving strategies appropriately and effectively for a given situation; determine, collect, and organize the relevant information needed to solve real-world problems.
- » Apply integrated problem-solving strategies to solve problems in the physical, natural, and social sciences and in pure mathematics.
- » Formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.
- » Use and create representations to solve problems and organize thoughts and ideas.
- » Convert between representations.

#### Unit 3.6 – Quadratic Expressions (9 days)

- Develop an understanding of equivalent quadratic expressions.
- Represent a quadratic relationship in expanded and factored forms.
- Explore the distributive property using area models.
- Use the area model and distributive property to multiply two binomials.
- Understand how the properties of numbers are used to simplify and transform algebraic expressions and equations.

- » Construct and determine the validity of a mathematical argument or a solution.
- » Present, share, explain, and justify thinking with others and build upon the ideas of others to solve problems.
- » Use models and technology to develop equivalent representations of the same mathematical concept.
- » Convert between representations (e.g., a table of values, an equation, and a graph may all be representations of the same function).
- » Connect new mathematical ideas to those already studied and build upon them.
- » Understand that many real-world applications require an understanding of mathematical concepts.
- » Explain in oral and written form the relationships among various mathematical concepts (e.g., the relationship between exponentiation and multiplication).

**Content students have to learn**

**Processes students will learn and use**

**Unit 4.1 – Algebraic Expressions  
(11 days)**

- Develop an understanding of equivalent expressions (that is, of two expressions that model exactly the same relationship).
- Represent a quadratic relationship in expanded and factored forms as two equivalent ways to write an expression for the area of a rectangle that has been subdivided into two rectangles.
- Understand how the properties of numbers are used to simplify and transform algebraic expressions and equations.
- Develop strategies for determining if two expressions model the same relationship.

- » Use problem-solving strategies appropriately and effectively for a given situation.
- » Apply integrated problem-solving strategies to solve problems in the physical, natural, and social sciences and in pure mathematics.
- » Apply mathematical reasoning skills in other disciplines.
- » Present, share, explain, and justify thinking with others and build upon the ideas of others to solve problems.
- » Use mathematical symbols and notation.
- » Use models and technology to develop equivalent representations of the same mathematical concept.
- » Use and create representations to solve problems and organize thoughts and ideas.
- » Understand that many real-world applications require an understanding of mathematical concepts (e.g., personal finance, running a business, building a house, following a recipe, or sending a rocket to the moon).
- » Explain in oral and written form the relationships between a real-world problem and an appropriate mathematical model.

**Unit 4.2 – Solving Equations  
(7 days)**

- Develop a strategy for distributing a negative sign over a sum or difference in a linear expression.
- Develop a strategy for solving linear equations with parentheses.
- Develop understanding and fluency with solving equations and factoring quadratic expressions.

- » Apply integrated problem-solving strategies to solve problems in the physical, natural, and social sciences and in pure mathematics.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Construct and determine the validity of a mathematical argument or a solution.
- » Apply mathematical reasoning skills in other disciplines.
- » Use mathematical symbols and notation.
- » Use models and technology to develop equivalent representations of the same mathematical concept.
- » Connect new mathematical ideas to those already studied and build upon them.

**Unit 4.3 – Functions  
(9 days)**

- Understand how to interpret rate of change for a linear equation from an equation that is not in  $y = mx + b$  form.
- Develop strategies for writing and interpreting equivalent expressions in context.
- Understand how to use patterns of change to write linear, exponential, and quadratic relationships.
- Understand how to determine characteristics of the graph (patterns of change, intercepts, maxima and minima, shape, etc.) of an equation by looking at its symbolic representation.

- » Apply integrated problem-solving strategies to solve problems in the physical, natural, and social sciences and in pure mathematics.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed. Use mathematical symbols and notation.
- » Use models and technology to develop equivalent representations of the same mathematical concept.
- » Convert between representations (e.g., a table of values, an equation, and a graph may all be representations of the same function).
- » Formulate, test, and justify mathematical conjectures and arguments.

**Content students have to learn**

**Processes students will learn and use**

**Unit 4.4 – Types of Symmetry  
(5 days)**

- Understand important properties of symmetry—reflections, rotations, and translations.
- Understand how to design shapes that have specific symmetries.

- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Articulate ideas clearly and logically in both written and oral form.
- » Connect new mathematical ideas to those already studied and build upon them.
- » Understand that many real-world applications require an understanding of mathematical concepts (e.g., personal finance, running a business, building a house, following a recipe, or sending a rocket to the moon).

**Unit 4.5 – Symmetry Transformations  
(4 days)**

- Understand key properties and features of transformations—lines of reflection, magnitudes and directions of translations, and centers and angles of rotation.
- Understand the symmetries of a design made from a figure and its image(s) under a symmetry transformation.
- Understand how precise mathematical directions for performing symmetries affect the points on the original and its image.
- Based on what symmetry or symmetries a given figure has, understand the important geometric properties, such as measures of sides and angles, lengths of diagonals, or intersection points of diagonals.
- Understand the power of transformational geometry to describe motions, patterns, designs, and properties of shapes in the real world.

- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Articulate ideas clearly and logically in both written and oral form.
- » Connect new mathematical ideas to those already studied and build upon them.

Providence  
Schools

797 Westminster Street  
Providence, RI 02903

[www.providenceschools.org/guides](http://www.providenceschools.org/guides)