CURRICULUM GUIDE

Math - Grade 8

Providence Schools

Printed by students at the Providence Career and Technical Academy

Background

Providence Schools teachers and administrators worked collaboratively with consultants from the Charles A. Dana Center at the University of Texas at Austin to develop the mathematics and science curriculum frameworks. The curriculum frameworks encompass two critical questions:

- Content Standards that establish clearly defined expectations for all students, helping to answer the question, ***What do students have to learn?***
- Performance Standards that determine performance expectations for content standards, helping to answer the question, ***How well do the students have to learn it?***

The curriculum framework provides a work plan that directs the instruction delivered in every classroom in every school in the district. Instruction—the way the curriculum is presented to students—will focus on the needs of students.

Purpose and Use of Curriculum Guides

Curriculum Guides for the curriculum for each grade and subject outline the approximate number of days that each unit in the curriculum will be taught; describe the content to be learned; and list the essential questions that students should be able to answer by the end of the unit.

Parents should become familiar with the Curriculum Guides. You should know when your child is being taught different topics. You should also know the essential questions that your child should be able to answer by the end of each unit.

It is important that you understand that you do not have to be familiar with the content that your child is learning in order to help them with their studies. There are basic questions that you can ask to determine if your child understands the content.

Ask your child what she is learning in each subject

Does she understand the topic? Is the unit exciting or boring? What specifically does she like or dislike about the topic? Does she understand how the topic relates to the real world?

You know your child better than anyone. You will be able to tell if she or he is benefiting from the instruction and understanding the content of the material by the way they answer you. Speak to your child's teacher if you suspect there is a problem.

Ask your child about his assignments

What is the required work? Has he finished the work on time? Is he having difficulty? If he is having difficulty, why?

Encourage your child to talk to her teachers if she is having difficulty understanding a concept or completing an assignment. If your child continues to experience difficulty, speak to the teacher yourself so that the two of you can work together to support your child.

Even if you do not understand the content that your child is learning, the fact that you are showing interest in his or her school work and believe that it is important that he or she does well sends a powerful message.

Sharon Contreras
Chief Academic Officer
Providence Public School Department

QUARTER 1

Content students will be learning	Essential questions students should be able to answer by end of unit
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.	» What are some examples of probability situations that involve two or more actions (compound probability)? » How can you construct an organized list of all possible outcomes for a probability event? » How can you use area model to help you analyze a probability situation? » What are the strategies used to find theoretical probabilities?
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.	» If you know that a 3-digit combination lock has a certain number of marks on it, how would you determine the number of possible combinations? » How can you use counting trees to determine the number of possible combinations? » How can you use the fundamental counting principle to determine the number of possible combinations? » How are your strategies different for situations in which repeats are allowed versus situations in which repeats are not allowed?
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.	» How do you construct a histogram and a box plot for a set of data? » How are histograms and box plots alike and how are they different? » How can you compare two data sets displayed in histograms? » How can you compare two data sets displayed in box plots?

QUARTERS 1 & 2

Content students will be learning	Essential questions students should be able to answer by end of unit
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.	» Why is data often collected from a sample rather than from an entire population? » Describe methods of random sampling and nonrandom sampling. What are the advantages and disadvantages of each method? » What similarities and differences would you expect to find in the medians, means, and ranges of samples taken from the same population group? » Which type of sampling is preferred, random or nonrandom? Explain.
Unit 1.5 - Relating Two Variables (5 days) • Explore relationships between paired values and numerical attributes represented in scatterplots of data. • Understand how a trend line can be used to model a set of data in problem-solving situations. • Understand how to write an equation for a trend line in problem-solving situations.	» What does it mean to say one variable is related to another variable? » How can you tell if a relationship is proportional or non-proportional? » What are some examples of situations where the values of two variables are not related in a predictable way? » What are some examples of situations where the values of two variables are related in a predictable way?
QUARTER 2	QUARTER 2
Unit 2.1 - Exploring Data Patterns (5 days) • Understand similarities and differences among linear and nonlinear relationships. • Explore the representations of algebraic relationships—tables, graphs, and equations. • Explore strategies for solving equations symbolically.	» What are the advantages and disadvantages of each representation (table, graph, or word description) for finding patterns and making predictions? » What causes a graph to be linear? » How can you decide from a table whether a relationship is linear? » When will a relationship between two variables be linear?
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.	» What are the advantages of using a linear model for a set of data? » What do you need to know to write an equation for a linear relationship?
UNIT CONTINUES ON NEXT PAGE	UNIT CONTINUES ON NEXT PAGE

QUARTER 2 (CONTINUED)

Content students will be learning	Essential questions students should be able to answer by end of unit
UNIT 2.2 - LINEAR MODELS AND EQUATIONS (CONTINUED)	**UNIT 2.2 - LINEAR MODELS AND EQUATIONS (CONTINUED)**
• 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.	» How can you find slope from a table? Graph? Equation? » How do you write an equation from a linear relationship when given a verbal description, table of values, a graph, two data points, or one point and the slope of a line? » What are at least three different methods for solving an equation such as $-500 + 3x = 245 + 5x$?
Unit 2.3 - Squares and Square Roots (10 days) • Draw squares on 5 × 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.	» How would you find the length of a line segment connecting two dots on dot paper? Be sure to consider all cases (horizontal, vertical, and tilted line segments). » What does it mean to find the square root of a number? » How can you approximate the value square root of a number? » How can you find the length of something without using a ruler? » What is a method for finding the length of a line segment that is precise or exact? » What is a method for finding the length of a line segment that is an estimate? » On a coordinate grid, how does horizontal and/or vertical distance compare to the diagonal distance between any two coordinates? » Suppose you know two points on a coordinate grid. How can you find the distance between them?
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.	» When given two sides of a right triangle, how can you find the length of the third side? » Suppose two points on a grid are not on the same horizontal or vertical line. Give at least three strategies for finding the distance between these points. Which of these strategies gives the precise distance? Which of these strategies gives an estimated distance? » If you are given only the side lengths, how can you determine whether a triangle is a right triangle? » When is the Pythagorean theorem used? » How can you estimate the value of a square root?

QUARTERS 2 & 3

Content students will be learning	Essential questions students should be able to answer by end of unit
Unit 2.5 - Using the Pythagorean Theorem (6 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.	» When is the Pythagorean theorem useful? » How can I estimate the square root of a number? » What is the difference between an irrational number and a rational number? » How can I find the length of something without directly measuring it? » Is your solution exact or approximate? Explain.
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.	» How is the volume of a cylinder related to the volume of a cone? » How is the volume of a pyramid related to the volume of a prism? » What is your strategy for finding the volume of any prism? » What does it mean to find surface area of a figure? » What does it mean to find volume of a figure?
QUARTER 3	**QUARTER 3**
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 students' understanding of scale factor, and its relationship to changes in 1-, 2-, and 3-dimensional measures, to solve problems.	» How is length affected by applying a scale factor to create a similar figure or shape? » How is area or surface area affected by applying a scale factor to create a similar figure or shape? » How is volume affected by applying a scale factor to create a similar figure or shape? » How can scaling strategies be used to solve problems?
Unit 3.2 - Exponential Growth (6 days) • Develop an understanding of basic exponential growth patterns as represented in tables, graphs, and equations.	» Describe an exponential growth pattern using as many key properties as you can.
UNIT CONTINUES ON NEXT PAGE	**UNIT CONTINUES ON NEXT PAGE**

QUARTER 3 (CONTINUED)

Content students will be learning	Essential questions students should be able to answer by end of unit
UNIT 3.2 - EXPONENTIAL GROWTH (CONTINUED)	**UNIT 3.2 - EXPONENTIAL GROWTH (CONTINUED)**
• 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.	» Compare and contrast a table of an exponential relationship to a table of a linear relationship. » Compare and contrast an equation of an exponential relationship to an equation of a linear relationship. » Give an example of a situation that is linear and a situation that is exponential.
Unit 3.3 - Growth Patterns, Growth Factors, and Growth Rates (6 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.	 » How can you use a table, graph, and equation to find the *y*-intercept and growth factor for an exponential relationship? » How can you use the *y*-intercept and growth factor to write an equation for an exponential relationship? » In the equation $y = a(b^x)$, what do the values of *a* and *b* represent? » How is *a* represented in the graph? Table? » How is *b* represented in the graph? Table? » If *b* were to increase, how would that affect the values in the table? The graph?
Unit 3.4 - Exponential Decay and Exponent Rules (9 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.	 » How can you recognize exponential decay from a table of data? Graph? Equation? » Compare and contrast exponential growth and exponential decay relationships. » How can you determine which model, exponential or linear, best fits the data? » What is your rule for raising a power to a power? » How is a decay factor different from a growth factor? » How is the pattern in the features of the graph related to the equation, situation, and table? » When will the dependent variable equal 0? In other words, for what value of *x* will $y = 0$ [i.e.,$(x, 0)$]? » What is your rule for multiplying exponents?

QUARTERS 3 & 4

Content students will be learning	Essential questions students should be able to answer by end of unit
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.	» How can you determine if a relationship is quadratic? » How can you answer questions about the situation by studying a table, graph, or equation of the quadratic relationship?
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.	» How can you tell that a relationship is quadratic? » What information can you get from the factored form of a quadratic equation? The expanded form? » How is the distributive property used with quadratic equations? » How do quadratic relationships compare and contrast to linear and exponential relationships?
QUARTER 4	**QUARTER 4**
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.	» How can you determine if two expressions are equivalent? » Can you write an equivalent expression for a given expression to provide new information about a relationship?
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.	» How can you use the properties of equality to solve an equation using the symbolic method? » How do you deal with the parentheses when solving an equation using the symbolic method?
UNIT CONTINUES ON NEXT PAGE	**UNIT CONTINUES ON NEXT PAGE**

QUARTER 4 (CONTINUED)

Content students will be learning	Essential questions students should be able to answer by end of unit
UNIT 4.2 - SOLVING EQUATIONS (CONTINUED)	UNIT 4.2 - SOLVING EQUATIONS (CONTINUED)
• Develop understanding and fluency with solving equations and factoring quadratic expressions.	» How can you verify that the factored form and the expanded form are equivalent expressions? » How can you verify solutions using an equation? Table? Graph? » How are the solutions of linear and quadratic equations related to graphs and tables of equations? » If the product of two factors is 0, what do you know about the factors?
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.	» How can you use symbolic statements to describe relationships? » How can symbolic reasoning help you to confirm a conjecture? » Which form (factored or expanded) is easier to use to determine whether a function is linear, exponential, quadratic, or none of these? » Which form (factored or expanded) is easier to use to determine the *x*- and *y*-intercepts? Rates of change? Maximum or minimum points of the graph of the function?
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.	» What strategies could you use to determine if a design has reflection symmetry? » How can you find the angle of rotation without actually measuring it? » What is the relationship between the number of lines of symmetry and the angle of rotation? » What are the three types of symmetry transformations? » What does it mean for a figure to have reflection symmetry? Rotation symmetry? Translation symmetry? » How can you use various tools to test or draw figures with reflection symmetry? Rotation symmetry? Translation symmetry?
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.	» How do you draw an image of a figure under reflection symmetry, using only a ruler and an angle ruler (or protractor)?
UNIT CONTINUES ON NEXT PAGE	UNIT CONTINUES ON NEXT PAGE

QUARTER 4 (CONTINUED)

Content students will be learning	Essential questions students should be able to answer by end of unit
UNIT 4.5 - SYMMETRY TRANSFORMATIONS (CONTINUED)	**UNIT 4.5 - SYMMETRY TRANSFORMATIONS (CONTINUED)**
• 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.	» How can you locate the line of symmetry when you have a figure and its reflected image? » Under a symmetry transformation (reflection, rotation, or translation), how does the original figure compare to its image? » In a translation, how are the points and the images related? » In a rotation, how are points, their images, and the center of rotation related? » In a line reflection, how are points and their images related to the line of reflection?

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