Grade 7 Unit 1 at a Glance: Working With Rational Numbers

Overview and Pacing Guide

Unit Overview

The unit begins with students using a balloon model to informally explore adding and subtracting integers. With the model, adding or removing heat represents adding or subtracting positive integers, and adding or removing weight represents adding or subtracting negative integers.

Students then move from the balloon model to a number line model for adding and subtracting integers, eventually extending the addition and subtraction rules from integers to all rational numbers. Number lines and multiplication patterns are used to find products of rational numbers. The relationship between multiplication and division is used to understand how to divide rational numbers. Properties of addition are briefly reviewed, then used to prove rules for addition, subtraction, multiplication, and division.

This unit includes problems with real-world contexts, formative assessment lessons, quizzes, and Gallery problems.

Standards

The Number System

- 7.NS.A.1, 7.NS.A.1.a, 7.NS.A.1.b, 7.NS.A.1.c, 7.NS.A.1.d, 7.NS.A.2, 7.NS.A.2.a, 7.NS.A.2.b, 7.NS.A.2.c, 7.NS.A.2.d, 7.NS.A.3

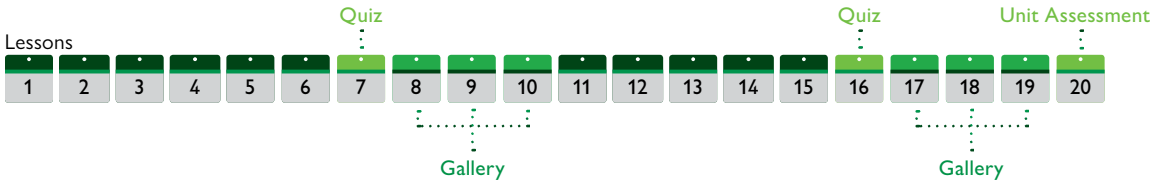
Goals and Learning Objectives

- Learn general methods for adding and subtracting integers, and model integer addition and subtraction on a number line.
- Understand the relationship between the distance between two points on the number line and the difference in the coordinates of those points. Extend this to find distances in real-life situations.
- Extend models and rules for adding and subtracting integers to positive and negative fractions and decimals, and solve real-world problems involving them.
- Understand and apply addition and multiplication properties to simplify numerical expressions.
- Use knowledge of multiplication and division of positive and negative numbers to solve problems.
- Represent multiplication of a negative integer and a positive integer on a number line. Use patterns to understand products of two negative integers.
- Explain why the product of two negative numbers is positive and the product of a negative number and a positive number is negative. Understand how to determine whether a quotient will be positive or negative.
- Understand the definition of rational numbers and be able to write them as ratios of integers or as terminating or repeating decimals.

Assessments

- Exercises after each instructional lesson
- Self Check the day before each quiz (6, 15)
- Quiz (7, 16)
- Unit Assessment (20)

Instruction and Assessment Pacing Plan



Grade 7 Unit 2 at a Glance: Proportional Relationships

Overview and Pacing Guide

Unit Overview

Students start the unit by predicting what will happen in certain situations. They intuitively discover that they can predict outcomes in situations that are proportional and might have a hard time with situations that are not proportional.

Students use situations to explore proportional relationships, looking at these situations in tables, equations, and graphs. They realize that a proportional relationship is represented on a graph as a straight line that passes through the origin and that there are straight-line graphs that do not represent a proportional relationship. They next look at rates expressed as fractions, finding the unit rate (the constant of proportionality) and then using the constant of proportionality to solve a problem.

In the second part of the unit, students work with percentages. First, percentages are tied to proportional relationships, and then students examine percentage situations as formulas, graphs, and tables. Students explore salary increase, see the similarities with sales taxes, and then go on to explore percent decrease. Students end this sequence of lessons with a formative assessment that focuses on percent increase and percent decrease and ties this to decimals.

The Gallery problems provide students with ample opportunities to check, deepen, and apply their understanding of proportional relationships, including percentages.

Standards

Ratios and Proportional Relationships

- **7.RP.A.1, 7.RP.A.2, 7.RP.A.2.a, 7.RP.A.2.b, 7.RP.A.2.c, 7.RP.A.2.d, 7.RP.A.3**

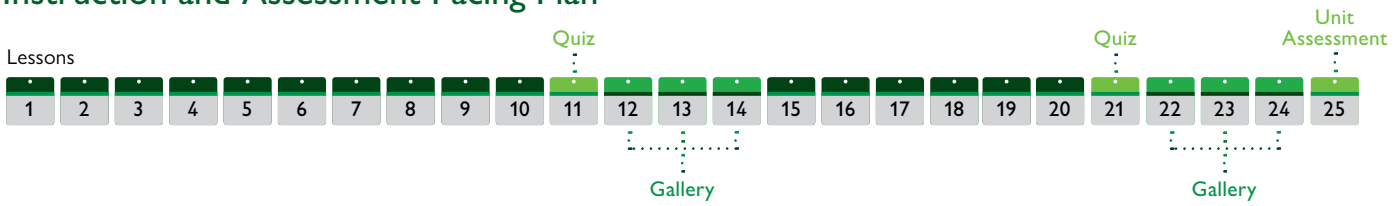
Goals and Learning Objectives

- Identify proportional relationships and define the constant of proportionality.
- Recognize that a proportional relationship is shown on a graph as a straight line that passes through the origin (0, 0).
- Understand that when a constant rate is involved, the unit rate is the constant of proportionality. Use the unit rate to write and solve a formula of the form $y = kx$.
- Use formulas, graphs, and tables to identify, analyze, and represent proportional relationships.
- Deepen understanding of proportional relationships and apply this deepened understanding to new problem situations.
- Find the total cost in a sales tax situation and understand that the relationship between the price of an item and the total cost is proportional only if the sales tax is constant.
- Extend proportionality understanding to apply it to percent increase and percent decrease problems.
- Use tables, graphs, and equations to solve for an unknown amount in sales tax and percent increase or percent decrease situations.

Assessments

- Exercises after each instructional lesson
- Self Check 1 or 2 days before each quiz (10, 19)
- Quiz (11, 21)
- Unit Assessment (25)

Instruction and Assessment Pacing Plan



Grade 7 Unit 3 at a Glance: Constructions and Angles

Overview and Pacing Guide

Unit Overview

The unit is divided into two sections. The first focuses on types of angles—adjacent, supplementary, complementary, and vertical—and how they are manifested in quadrilaterals. The second section looks at triangles and their properties, including the angle sum and how this affects other figures.

Initial concepts are developed through folding paper to create figures and observing the angles formed. Protractors and rulers are used to draw figures with given properties.

Students explore different types of angles and where the types of angles appear in quadrilaterals. They explore parallelograms with specific properties, such as perpendicular diagonals.

Students then explore triangles with certain known and unknown elements. Through exploration, students discover that the sum of the measure of the interior angles of a triangle is 180° and that the sum of the measures of the interior angles of a quadrilateral is 360°. They explore other polygons to find their angle sum and determine if there is a relationship to the angle sum of triangles. This extends to finding the measure of the interior angles of regular polygons and speculating about how this relates to a circle.

The unit concludes with a four-day Gallery and the Unit Assessment.

Standards

Geometry

- 7.G.A.2, 7.G.B.5

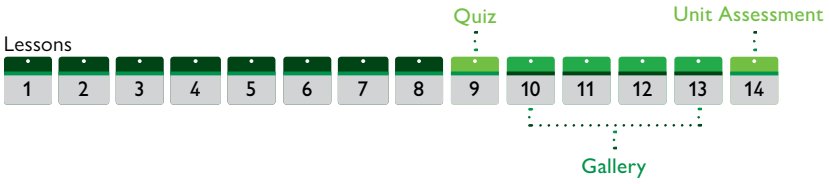
Goals and Learning Objectives

- Review characteristics that describe quadrilaterals and triangles. Discuss what students know about these shapes.
- Measure angles with a protractor and estimate angle measures as greater than or less than 90°. Understand the definition of vertical, adjacent, supplementary, and complementary angles.
- Understand that the sum of angle measures in any quadrilateral is 360°. Understand the relationship of the angles and diagonals in a parallelogram.
- Measure the angles formed by the intersection of the diagonals of a rhombus. Explore the relationships of the angles and the diagonals of different squares, rectangles, rhombuses, parallelograms, and other quadrilaterals.
- Draw triangles with given conditions. Find the sum of the measures of the angles of a triangle.
- Explore conditions that result in triangles. Identify types of triangles based on the measure of the angles or the measures of the sides.
- Find angle sums in polygons. Generalize to find the angle sum for any polygon. Find interior angle measures for regular polygons. Solve for missing angle measures in polygons.
- Apply skills learned in the unit. Understand the relationship of angles created by intersecting lines. Understand the relationship of angles found in quadrilaterals, triangles, and polygons.

Assessments

- Exercises after each instructional lesson
- Self Check the day before the quiz (8)
- Quiz (9)
- Unit Assessment (14)

Instruction and Assessment Pacing Plan



Grade 7 Unit 4 at a Glance: Zooming In On Figures

Overview and Pacing Guide

Unit Overview

The first set of lessons looks at 2-D figures and area and length calculations. Students explore finding the area of polygons by deconstructing them into known figures. This exploration leads to looking at regular polygons and deriving a general formula. The general formula for polygons leads to the formula for the area of a circle. Students also investigate the ratio of circumference to diameter (pi). All of this is applied toward looking at scale and the way that length and area are affected. All of the lessons feature examples of real-world contexts.

The second set of lessons focuses on 3-D figures and surface area and volume calculations. Students revisit nets to arrive at a general formula for finding the surface area of any right prism. Students extend their knowledge of area of polygons to surface area calculations as well as a general formula for the volume of any right prism. Students explore the 3-D surface that results from a plane slicing through a rectangular prism or pyramid. Students also explore 3-D figures composed of cubes, finding the surface area and volume by looking at 3-D views.

The unit ends with project presentations and a unit assessment.

Standards

Geometry

- 7.G.A.1, 7.G.A.3, 7.G.B.4, 7.G.B.6

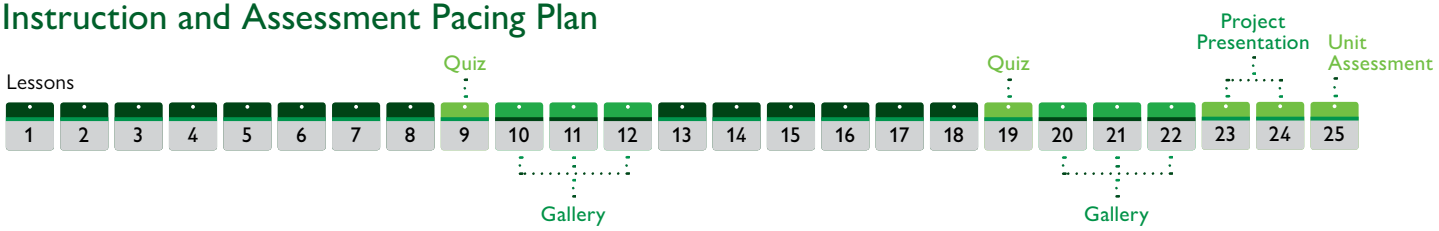
Goals and Learning Objectives

- Review area of triangles, rectangles, and parallelograms. Find the area of regular polygons. Generalize an area formula for any regular polygon.
- Measure round objects and find the ratio of the circumference to the diameter of those objects. Derive and apply formulas for the circumference of a circle and the area of a circle.
- Understand that scale drawings are proportional. Use scale to find actual measurements. Interpret scale drawings and redraw them at a different scale.
- Understand 2-D measurements: area of composite figures, including regular polygons; area and circumference of circles.
- Find the volume of right prisms. Understand the formula for the volume of a pyramid and apply it to solve problems. Identify the plane figures that result from a plane cutting through a rectangular prism or pyramid.
- Find a general formula for surface area of prisms. Explore the relationship between 2-D views of figures and their surface area. Find the surface area of different solids.
- Understand 3-D measurements: surface area and volume of right prisms; surface area and volume of figures composed of cubes.
- Present projects and demonstrate understanding of the unit concepts. Give feedback on other students' project presentations. Exhibit good listening skills.

Assessments

- Exercises after each instructional lesson
- Self Check the day before each quiz (8, 18)
- Quiz (9, 19)
- Unit Assessment (25)

Instruction and Assessment Pacing Plan



Grade 8 Unit 3 at a Glance: Transformations

Overview and Pacing Guide

Unit Overview

The unit starts with an informal exploration of images of tessellations and everyday objects to introduce the idea of translations, rotations, and reflections. Students first determine that figures are congruent under translation, reflection, and rotation, without reference to the coordinate system. They then carry out each type of transformation in the coordinate plane. Students examine sequences of translations, reflections, and rotations and confirm that figures remain congruent under sequences of these three transformations.

Next, the focus becomes the transformation of dilation and the importance of scale factors. Students learn that dilated figures are similar, not congruent (unless the scale factor is 1). Then students focus on the effects of each transformation on the coordinates of points and make generalizations about a point (x, y) under given transformations. Students analyze and perform combinations of transformations with an emphasis on scale factor.

The last section builds on the similarity of dilated triangles, first with a focus on the conditions of similarity for triangles and then on using knowledge of similar triangles to find missing measurements of real-world objects. The unit ends with a final lesson and a Gallery, which provides a range of problems about transformations, and the Unit Assessment.

Standards

Geometry

- 8.G.A.1, 8.G.A.1.a, 8.G.A.1.b, 8.G.A.1.c, 8.G.A.2, 8.G.A.3, 8.G.A.4, 8.G.A.5

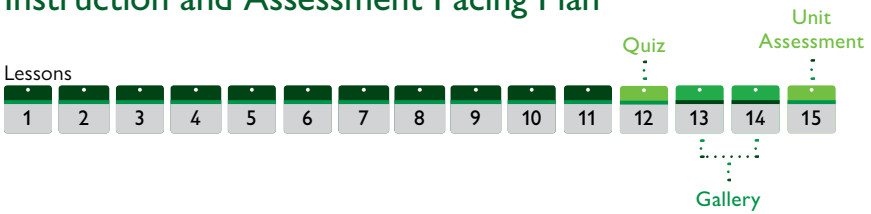
Goals and Learning Objectives

- Identify transformations in real-world images and movements.
- Carry out translations, reflections, and rotations and examine features of the resulting figures: side lengths, angles, parallel lines.
- Understand the concept of dilation. Identify centers of dilation and scale factors in pairs and sets of similar figures.
- Explore the effects of transformations on the coordinates of points. Interpret and use algebraic notation to express the effects of transformations on the coordinates of points.
- Recognize transformations in a growth pattern. Apply sequences of translations, reflections, rotations, and dilations to produce a given figure with a repeating pattern.
- Identify and explain the similarity criteria for triangles. Recognize the connection between dilation and similarity among triangles.
- Identify similar triangles in diagrams and images of real-world objects. Use similar triangles to find missing measurements.
- Synthesize and connect strategies for investigating transformations. Apply deepened understanding of transformations to new problem situations.

Assessments

- Exercises after each instructional lesson
- Self Check the day before the quiz (11)
- Quiz (12)
- Unit Assessment (15)

Instruction and Assessment Pacing Plan



Grade 8 Unit 6 at a Glance: Triangles and Beyond

Overview and Pacing Guide

Unit Overview

In this unit, an initial exploratory lesson on the art of M.C. Escher gets students thinking about geometry in general. The remaining lessons in the unit are divided into three parts: transversals and their related angles; the Pythagorean Theorem and its applications; and volume of cylinders, cones, and spheres.

The first set of lessons explores transversals intersecting parallel lines and the relationship of the resulting angles. Students look at congruent angles and angle sums and explore the sum of the angle measures in triangles. Students also examine the relationship of an exterior angle to the sum of the remaining two interior angles.

The second set of lessons focuses on understanding and applying the Pythagorean Theorem. Students apply the theorem to find lengths in two-dimensional and three-dimensional figures, and then they find lengths of line segments in the coordinate plane.

The third set of lessons focuses on three-dimensional figures involving circles and volume calculations. Students derive the formula for the volume of cylinders and then find the formula for the volume of a cone and the volume of spheres. Finally, students explore the relationships between the volumes of cylinders, cones, and spheres that have the same radius and height.

The unit finishes with a unit assessment.

Standards

Geometry

- 8.G.A.5, 8.G.B.6, 8.G.B.7, 8.G.B.8, 8.G.C.9

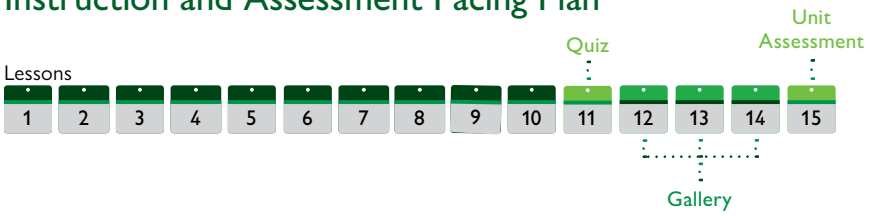
Goals and Learning Objectives

- Explore the relationship between geometry and art. Investigate the art of M.C. Escher and tessellations of triangles.
- Understand the relationships among angles created by transversals crossing parallel lines—which angles are congruent and which angles are supplementary.
- Understand why the sum of the angle measures of a triangle is 180°. Show that the sum of two interior angles of a triangle is equal to the third angle's exterior angle measure.
- Understand and apply the Pythagorean Theorem. Apply the converse of the Pythagorean Theorem to determine if a triangle is a right triangle.
- Find lengths of line segments in the coordinate plane. Understand a general method to find the length of a line segment.
- Derive the formulas for the volume of a cylinder, a cone, and a sphere. Apply the volume formulas to solve problems.
- Explore how the volumes of cylinders, cones, and spheres are related.
- Apply knowledge about angle relationships, the Pythagorean Theorem, and volume to solve problems.

Assessments

- Exercises after each instructional lesson
- Self Check the day before the quiz (10)
- Quiz (11)
- Unit Assessment (15)

Instruction and Assessment Pacing Plan



Grade 7 Unit 5 at a Glance: Algebraic Reasoning

Overview and Pacing Guide

Unit Overview

This unit covers the Grade 7 Common Core State Standards for Expressions and Equations. Students extend what they learned in Grade 6 about evaluating expressions and using properties to write equivalent expressions. They write, evaluate, and simplify expressions that now contain both positive and negative rational numbers.

Students write algebraic expressions for problem situations and discuss how different equivalent expressions can be used to represent different ways of solving the same problem. They also make connections between various forms of rational numbers. Using formal algebraic methods, students apply what they learned previously about solving equations such as $x + 2 = 6$ or $3x = 12$ to solving equations such as $3x + 6 = 12$ and $3(x - 2) = 12$.

Further on in this unit, students use estimation and mental math to estimate solutions. They learn how solving linear inequalities differs from solving linear equations, and then they solve and graph linear inequalities such as $-3x + 4 < 12$. Students use inequalities to solve real-world problems, solving the problem first with arithmetic and then by writing and solving an inequality. They see that the solution of the algebraic inequality may differ from the solution to the problem.

Standards

Expressions and Equations

- **7.EE.A.1, 7.EE.A.2, 7.EE.B.3, 7.EE.B.4, 7.EE.B.4.a, 7.EE.B.4.b**

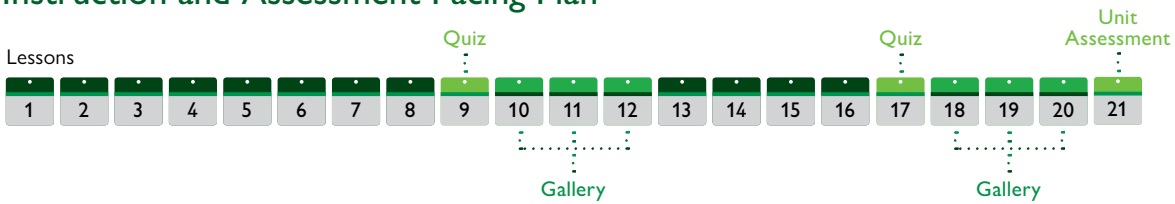
Goals and Learning Objectives

- Review the relationship between distance, time, and speed. Write an algebraic expression for distance in terms of time, *t*.
- Write expressions and equations to represent real-world situations. Evaluate expressions for given values of a variable.
- Write algebraic expressions for finding the perimeter or area of figures. Identify equivalent expressions.
- Simplify more complicated expressions that involve multiplication by negative numbers. Solve percent-of-increase and percent-of-decrease problems using equivalent algebraic expressions.
- Solve equations containing both positive and negative rational numbers. Solve equations using addition, subtraction, multiplication, and division of rational numbers. Match equations to problems.
- Write equations to solve multi-step real-life problems involving rational numbers. Estimate the solution and determine if the estimate is reasonable. Write the solution as a complete sentence.
- Observe that when multiplying or dividing both sides of an inequality by the same negative number, the inequality sign must change direction.
- Use an algebraic inequality to solve problems, including real-world problems. Interpret the solution to an algebraic inequality within the context of a word problem. Graph the solutions of inequalities using number lines.

Assessments

- Exercises after each instructional lesson
- Self Check the day before each quiz (8, 16)
- Quiz (9, 17)
- Unit Assessment (21)

Instruction and Assessment Pacing Plan



Grade 7 Unit 6 at a Glance: Samples and Probability

Overview and Pacing Guide

Unit Overview

Students are introduced to the concept of probability as a measure of likelihood and how to calculate the probability of equally likely events using a ratio. Next, students compare expected results with actual results by calculating the probability of an event and conducting an experiment. They collect data to estimate the experimental probabilities. They use ratio and proportion to predict results for a large number of trials. Students learn about compound events and determine the theoretical probability of independent events and then dependent events.

Students are introduced to the concept of sampling as a method to determine characteristics of a population. They consider how a sample can be random or biased, and they think about methods to randomly sample a population to ensure that it is representative. Students collect and analyze data for their project. They begin to develop intuition about appropriate sample size by conducting an experiment, comparing different sample sizes, and deciding whether increasing the sample size improves the results. Students compare two data sets using any tools they wish.

The unit ends with 3 days for students to work on Gallery problems, 2 days for them to present their projects, and 1 day for the Unit Assessment.

Standards

Statistics and Probability

- **7.SP.A.1, 7.SP.A.2, 7.SP.B.3, 7.SP.B.4, 7.SP.C.5, 7.SP.C.6, 7.SP.C.7, 7.SP.C.7.a, 7.SP.C.7.b, 7.SP.C.8, 7.SP.C.8.a, 7.SP.C.8.b, 7.SP.C.8.c**

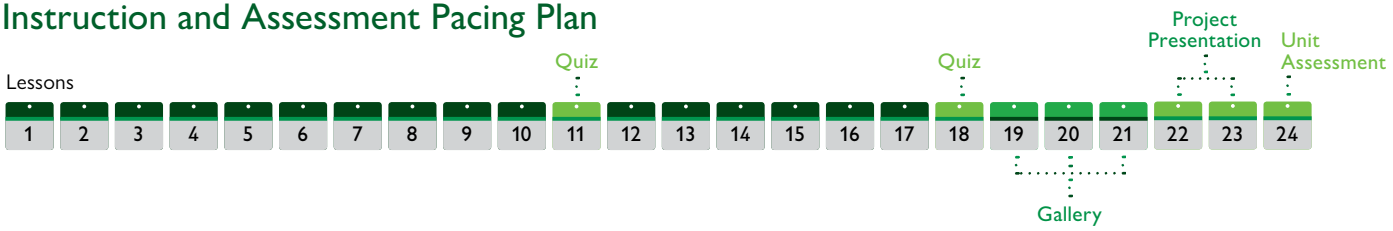
Goals and Learning Objectives

- Define probability as a measure of likelihood and the ratio of favorable outcomes to the total number of outcomes for an event. Predict results on the basis of theoretical probability using ratio and proportion. Compare expected results with actual results.
- Learn about experimental probability. Compare theoretical probability with experimental probability and show that experimental probability approaches theoretical probability with more trials.
- Learn about compound events and sample spaces. Understand the difference between independent and dependent compound events. Solve compound event problems.
- Introduce sampling as a method to generalize about a population. Discuss the concept of a random sample versus a biased sample. Determine methods to generate random samples.
- Explore sample size. Look at the effects of using a nonrandom sample. Review tools used to analyze data. Explore sample size compared with population size.
- Apply knowledge of statistics to compare sets of data. Use measures of center and spread to analyze data. Decide which graph is appropriate for a given situation.
- Apply knowledge of sampling and data analysis to solve problems. Determine a random, representative sample that is nonbiased and of adequate sample size. Generalize about a population on the basis of sampling.
- Present projects and demonstrate an understanding of the unit concepts. Provide feedback on others' presentations. Review presentation feedback and reflect.

Assessments

- Exercises after each instructional lesson
- Self Check the day before each quiz (10, 17)
- Quiz (11, 18)
- Unit Assessment (24)

Instruction and Assessment Pacing Plan



Grade 8 Unit 2 at a Glance: Roots and Exponents

Overview and Pacing Guide

Unit Overview

Students start with a paper-cutting activity to explore the pattern obtained by repeatedly multiplying by 2. Students review the meaning of positive integer exponents and learn the vocabulary associated with exponential notation including the terms *squared* and *cubed*. They learn about square roots and cube roots and use them to solve equations and to simplify expressions.

Next, students discover and apply properties of exponents: the product of powers; the quotient of powers; the power of a power; and the power of a product. Students are introduced to scientific notation and to the meaning of zero and negative integer exponents.

Students then extend what they know about scientific notation to include calculations with numbers in scientific notation. They solve problems involving very large and very small numbers and, after studying absolute values, they extend the definition of scientific notation to include negative numbers. Rational and irrational numbers are also covered with students converting between fraction and decimal forms of rational numbers. Students locate both rational and irrational numbers on the number line.

The unit includes two opportunities to complete self-assessment activities and two sets of Gallery problems to further explore concepts. It concludes with a unit assessment.

Standards

The Number System

- **8.NS.A.1, 8.NS.A.2**

Expressions and Equations

- **8.EE.A.1, 8.EE.A.2, 8.EE.A.3, 8.EE.A.4**

Goals and Learning Objectives

- Identify equivalent numerical expressions including those involving exponents of 2 and 3.
- Understand the meaning of raising a fraction to an exponent. Reinforce the distinction between repeated multiplication and repeated addition.
- Simplify numerical expressions involving powers of 2 and 3, square roots, and cube roots.
- Recognize patterns in simplifying variable expressions in which two factors with the same base are multiplied or divided.
- Learn the definition of scientific notation, identify and write numbers written in scientific notation.
- Add, subtract, multiply, and divide numbers expressed in scientific notation using the properties of exponents and a calculator.
- Distinguish between rational and irrational numbers and understand that square roots of non-square numbers are irrational numbers.
- Approximate the values of irrational numbers, including square roots of non-square numbers and factors of π. Use the number line to order both rational and irrational numbers.

Assessments

- Exercises after each instructional lesson
- Self Check the day before each quiz (8, 16)
- Quiz (9, 17)
- Unit Assessment (21)

Instruction and Assessment Pacing Plan