

Math 7

UNIT 1- Proportional Relationships: Ratios, Rates, and Circles



ESSENTIAL QUESTION

How can proportional reasoning be applied to everyday life?

BIG IDEAS

Students will visually represent proportional relationships with rational numbers and use them to solve real-world and mathematical problems. Students will use proportional reasoning to reproduce scale drawings of geometric figures. Students will be able to discover the connections between the area and circumference of circles in relation to pi.

GUIDING QUESTIONS

Content and Process

- How are the sides and area affected when scaling geometric figures? **7.G.1**
- How can scale drawings be used to reproduce figures at different sizes? **7.G.1**
- What strategies can be used to compute unit rates from a ratio of fractions? **7.RP.1**
- Why are two quantities considered proportional? **7.RP.2, 7.RP.2a**
- How does the correlation between values in a table or points on a graph and their unit rate determine proportionality? **7.RP.2b**
- How can equations represent a proportional relationship? **7.RP.2, 7.RP.2c**
- What do the points on a graph of a proportional relationship represent in terms of the situation? **7.RP.2d**
- How can proportions be used to solve multi-step ratio problems? **7.RP.3**
- How are diameter and circumference related to the area of a circle? **7.G.4**
- How can formulas be used to solve real-world problems involving circles? **7.G.4**
- How can proportions be used to show the relationship between a circle's radius and its circumference or area? **7.G.4**

Reflective

- How can I find the constant of proportionality in a table, graph, or equation?
- What proportional relationships in the world can you think of?
- If a round pizza has a diameter of 16 inches and a square pizza has a side length of 15 inches, how do you know which will give you the most pizza?

FOCUS STANDARDS

Standards of Mathematical Practice

MP. 1 Make sense and persevere in solving problems

MP. 7 Look for and make use of structure

Content Standards

7.G.1. Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

7.G.4. Use the formulas for the area and circumference of a circle and solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

7.RP.1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks*

$\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the **complex fraction** $\frac{\frac{1}{2}}{\frac{1}{4}}$ miles per hour (interpreting a complex fraction as division of fractions), equivalently 2 miles per hour.

7.RP.2. Recognize and represent proportional relationships between quantities:

- **7.RP.2.a.** Determine whether two quantities are in a proportional relationship, e.g. by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
- **7.RP.2b.** Analyze a table or graph and recognize that, in a proportional relationship, every pair of numbers has the same unit rate (referred to as the “m”).
- **7.RP.2c.** Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p , the relationship between the total cost and the number of items can be expressed as $t = pn$.*
- **7.RP.2d.** Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate.

7.RP.3. Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

SUPPORTING RESOURCES

Mindset Mathematics - Grade 7

Seeing Proportional Relationships Pg. 69- 91 (Key Learning Experiences)

i-Ready- Grade 7

Unit 1, Lesson 1: Solve Problems Involving Scale **7.G.1**

Unit 1, Lesson 2: Find Unit Rates Involving Ratios of Fractions **7.RP.1**

Unit 1, Lesson 3: Understand Proportional Relationships **7.RP.2b, 7.RP.2c**

Unit 1, Lesson 4: Represent Proportional Relationships **7.RP.2a, 7.RP.2d, 7.RP.2b**

Unit 1, Lesson 5: Solve Proportional Relationship Problems **7.RP.2b, 7.RP.3**

Unit 1, Lesson 6: Solve Area and Circumference Problems Involving Circles **7.G.4**

SOCIAL-EMOTIONAL SKILLS

RELATIONSHIP SKILLS

The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. The ability to communicate clearly, listen well, cooperate with others, resist inappropriate social pressure, negotiate conflict constructively, and seek and offer help when needed.

- Communication
- Social engagement
- Relationship-building
- Teamwork

TECHNOLOGY SKILLS

Based on ISTE Standards for Students, these are discrete technology skills that unit designers will use to integrate digital tools in students' learning experiences. Intentionally broad and device and app agnostic, these skills build upon one another and provide students a strong foundation in technology use.

KEY LEARNING EXPERIENCES

Required Key Learning Experiences

Mindset Mathematics- Grade 7

Big Idea 3: Seeing Proportional Relationships

Visualize- *Growing Dough*

- Students explore how tables and graphs can show proportional change in the ingredients of multiple batches of pizza dough.

Play- *Is it Proportional?*

- Students explore four different data sets, hunting for proportional relationships.

Investigate- *Sizing Up Proportions*

- Is cost proportional to size? Students investigate pricing structures for items that come in different sizes to determine whether they are fair.

Optional Key Learning Experiences

Mindset Mathematics- Grade 7

Big Idea 2: Constructing Figures to Scale

Visualize- *What is Scale?*

- Students build on their intuition about scale to explore the measurement information embedded in scale images of animals and define the concept of scale.

Play- *A Fishy Image*

- Students play with scale by trying to use data to correct a collection of fish drawings that are not shown accurately in relationship to one another.

Investigate- *Magnifying Solids*

- When you scale up a solid, what happens to its surface area and volume? Students explore how scale is related across linear measurement, area, and volume for rectangular prisms.

Big Idea 10: Exploring Circles

Visualize- *Building Hunches about Circumference*

- Students build hunches about the relationship between the diameter and circumference of a circle by measuring several objects with adding machine tape and looking for patterns.

Play- *Dissecting Circle Area*

- Students explore the formula for the area of a circle and build visual representations of what it means

Investigate- *Unraveling Circles*

- Students investigate the length of a roll of foam, exploring the connection between the circumference and area of a circle.

Math 7

UNIT 2- Numbers and Operations: Add and Subtract Rational Numbers



ESSENTIAL QUESTION

How can visuals and models be used to represent the addition and subtraction of rational numbers in our world?

BIG IDEAS

Students will use models to represent adding and subtracting rational numbers.
Students will solve and interpret real-world and mathematical problems involving adding and subtracting rational numbers.

GUIDING QUESTIONS

Content and Process

- How can a number line be used to represent addition and subtraction? **7.NS.1**
- How are models used to prove that opposites combine to 0? **7.NS.1a**
- How does understanding absolute value help when adding and subtracting rational numbers? **7.NS.1b, 7.NS.1d**
- How can the additive inverse be used to model the subtraction of rational numbers? **7.NS.1c**
- How can the properties of operations be used as a strategy to add and subtract rational numbers? **7.NS.1e**

Reflective

- Using a model, such as a number line, how would you show a friend how to add and subtract integers?
- When may you have to add and subtract rational numbers in the real world?

FOCUS STANDARDS

Standards of Mathematical Practice

MP. 4 Model with mathematics

MP. 6 Attend to precision

Content Standards

7.NS.1. Represent addition and subtraction on a horizontal or vertical number line diagram.

- **7.NS.1a.** Describe situations in which opposite quantities combine to make 0. Show that a number and its opposite have a sum of 0 (are additive inverses). *For example, show zero-pairs with two-color counters.*
- **7.NS.1b.** Show $p + q$ as the number located a distance $|q|$ from p , in the positive or negative direction depending on whether q is positive or negative.

- **7.NS.1c.** Model subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$.
- **7.NS.1d.** Model subtraction as the distance between two rational numbers on the number line where the distance is the absolute value of their difference.
- **7.NS.1e.** Apply properties of operations as strategies to add and subtract rational numbers.

SUPPORTING RESOURCES

Mindset Mathematics- Grade 7

Operating with Opposites Pg. 197-224 (Key Learning Experiences)

i-Ready- Grade 7

Unit 2, Lesson 7: Understand Addition with Negative Integers **7.NS.1a, 7.NS.1b**

Unit 2, Lesson 8: Add with Negative Numbers **7.NS.1e**

Unit 2, Lesson 9: Understand Subtraction with Negative Integers **7.NS.1c, 7.NS.1d**

Unit 2, Lesson 10: Add and Subtract Positive and Negative Numbers **7.NS.1e**

SOCIAL-EMOTIONAL SKILLS

SOCIAL-AWARENESS

The ability to take the perspective of and empathize with others, including those from diverse backgrounds and cultures. The ability to understand social and ethical norms for behavior and to recognize family, school, and community resources and supports.

- Perspective-taking
- Empathy
- Appreciating diversity
- Respect for others

TECHNOLOGY SKILLS

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KEY LEARNING EXPERIENCES

Required Key Learning Experiences

Mindset Mathematics- Grade 7

Big Idea 8: Operating with Opposites

Visualize- *Line Dancing*

- Students create a human number line to physically represent what happens when we add and subtract with integers. Students can visualize the translations, reflections, dilations, and contractions these

operations create.

Note: Only complete the addition and subtraction portion of the activity.

Optional Key Learning Experiences

Mindset Mathematics- Grade 7

Big Idea 8: Operating with Opposites

Play- *Integer Tic-Tac-Toe*

- Students play with integer operations through addition and multiplication tic-tac-toe games.

Note: Only complete the addition portion of the activity.

Math 7

UNIT 3- Numbers and Operations: Multiply and Divide Rational Numbers



ESSENTIAL QUESTION

How can visuals and models be used to represent the multiplication and division of rational numbers in our world?

BIG IDEAS

Students will use models to represent multiplying and dividing rational numbers.
Students will solve and interpret real-world and mathematical problems involving multiplying and dividing rational numbers.

GUIDING QUESTIONS

Content and Process

- How is multiplying and dividing negative numbers related to multiplying and dividing positive numbers? **7.NS.2**
- What patterns are present when multiplying and dividing signed numbers? **7.NS.2a, 7.NS.2b**
- How can the properties of operations be used as a strategy to add and subtract rational numbers? **7.NS.2c**
- What methods can be used to convert fractions to decimals? **7.NS.2d**
- How do the characteristics of a decimal determine if it is rational? **7.NS.2d**
- How can operations with rational numbers be used to solve real-world problems? **7.NS.3**
- How can rational numbers in equivalent forms be used to solve multi-step real-life problems? **7.EE.3**
- How can estimation be used and mental computation to assess the reasonableness of answers? **7.EE.3**

Reflective

- What surprised you when multiplying and dividing rational numbers?
- Why is it important to understand integer operations in our world?

FOCUS STANDARDS

Standards of Mathematical Practice

MP. 4 Model with mathematics

MP. 6 Attend to precision

Content Standards

7.NS.2. Apply and extend previous understandings of multiplication and division of positive rational numbers to multiply and divide all rational numbers.

- **7.NS.2a.** Describe how multiplication is extended from positive rational numbers to all rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers.
- **7.NS.2b.** Explain that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. Leading to situations such that if p and q are integers, then $-\left(\frac{p}{q}\right) = \frac{-p}{q} = \frac{p}{-q}$.
- **7.NS.2c.** Apply properties of operations as strategies to multiply and divide rational numbers.
- **7.NS.2d.** Convert a rational number in the form of a fraction to its decimal equivalent using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

7.NS.3. Solve and interpret real-world and mathematical problems involving the four operations with rational numbers. (Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)

7.EE.3. Solve multi-step real-life and mathematical problems with rational numbers. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional $\frac{1}{10}$ of her salary an hour, or \$2.50, for a new salary of \$27.50.*

SUPPORTING RESOURCES

Mindset Mathematics - Grade 7

Operating with Opposites Pg. 197-206 (Key Learning Experiences)

i-Ready - Grade 7

Unit 3, Lesson 11: Understand Multiplication with Negative Integers **7.NS.2a**

Unit 3, Lesson 12: Multiply and Divide with Negative Numbers **7.NS.2b, 7.NS.2c**

Unit 3, Lesson 13: Express Rational Numbers as Terminating or Repeating Decimals **7.NS.2d**

Unit 3, Lesson 14: Use the Four Operations with Negative Numbers **7.NS.3**

Supplemental Lessons

Supplemental Lesson Needed for 7.EE.3

SOCIAL-EMOTIONAL SKILLS

SELF-AWARENESS

The ability to accurately recognize one’s own emotions, thoughts, and values and how they influence behavior. The ability to accurately assess one’s strengths and limitations, with a well-grounded sense of confidence, optimism, and a “growth mindset.”

- Identifying emotions
- Accurate self-perception
- Recognizing strengths
- Self-confidence

- Self-efficacy

TECHNOLOGY SKILLS

Based on ISTE Standards for Students, these are discrete technology skills that unit designers will use to integrate digital tools in students' learning experiences. Intentionally broad and device and app agnostic, these skills build upon one another and provide students a strong foundation in technology use.

KEY LEARNING EXPERIENCES

Required Key Learning Experiences
Mindset Mathematics - Grade 7

Big Idea 8: Operating with Opposites

Visualize- *Line Dancing*

- Students create a human number line to physically represent what happens when we add and subtract with integers. Students can visualize the translations, reflections, dilations, and contractions these operations create.

Note: Only complete the multiplication and division portion of the activity.

Investigate- Coordinating Multiplication

- Students connect area to integer multiplication and division by examining patterns on the coordinate plane.

Optional Key Learning Experiences
Mindset Mathematics - Grade 7

Big Idea 8: Operating with Opposites

Play- *Integer Tic-Tac-Toe*

- Students play with integer operations through addition and multiplication tic-tac-toe games.

Note: Only complete the multiplication portion of the activity.

Math 7

UNIT 4- Algebraic Thinking: Expressions, Equations, and Inequalities



ESSENTIAL QUESTION

How can algebraic concepts be used to represent real-world situations?

BIG IDEAS

Students will apply and make use of percentages in real-world situations. Students will use all four operations to generate equivalent expressions. Students will write and apply equations or inequalities to real-world situations, to find solutions.

GUIDING QUESTIONS

Content and Process

- How can the properties of operations be used to add, subtract, factor, and expand linear expressions? **7.EE.1**
- How can various forms of expressions show how quantities are related? **7.EE.2**
- How can two-step equations and inequalities be used to make sense of real world situations? **7.EE.4**
- How can rational numbers in word problems be used to construct equations and solve for unknowns? **7.EE.4a**
- How can rational numbers in word problems be used to construct inequalities and solve for unknowns? **7.EE.4b**
- How can the solution set of an inequality be graphed on a number line? **7.EE.4b**

Reflective

- What real-world scenario could be used to represent the equation $2x + 3 = 13$?
- What are two scenarios where you would use variables in your life?
- How could you explain to a friend how to graph $y < 2x + 1$?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.2 Reason abstractly and quantitatively.

MP.5 Use appropriate tools strategically.

Content Standards

7.EE.1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. Note: factoring is limited to integer coefficients. *For example: apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6(4x + 3y)$.*

7.EE.2. Understand that rewriting an expression in different forms in a problem context can shed light on the

problem and how the quantities in it are related. *For example, $a + 0.05a = 1.05a$ means that “increase by 5%” is the same as “multiply by 1.05.”*

7.EE.4. Use variables to represent quantities in a real-world or mathematical problem, and construct two-step equations and inequalities to solve problems by reasoning about the quantities.

- **7.EE.4a.** Solve word problems leading to equations of the form $px + q = r$, and $p(x + q) = r$ where p , q , and r are specific rational numbers. Solve equations of these forms fluently (efficiently, accurately, and flexibly). Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
- **7.EE.4b.** Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$ where p , q , and r are specific rational numbers and $p > 0$. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and describe the solutions.*

SUPPORTING RESOURCES

Mindset Mathematics - Grade 7

Using Algebra as a Problem-Solving Tool Pg. 225-250 (Key Learning Experience)

i-Ready - Grade 7

Unit 4, Lesson 15: Write Equivalent Expressions Involving Rational Numbers **7.EE.1**

Unit 4, Lesson 16: Understand Reasons for Rewriting Expression **7.EE.2**

Unit 4, Lesson 17: Understand Multi-step Equations **7.EE.4a, 7.EE.4b**

Unit 4, Lesson 18: Write and Solve Multi-Step Equations **7.EE.4a**

Unit 4, Lesson 19: Write and Solve Inequalities **7.EE.4b**

SOCIAL-EMOTIONAL SKILLS

SELF-MANAGEMENT

The ability to successfully regulate one’s emotions, thoughts, and behaviors in different situations — effectively managing stress, controlling impulses, and motivating oneself. The ability to set and work toward personal and academic goals.

- Impulse control
- Stress management
- Self-discipline
- Self-motivation
- Goal-setting
- Organizational skills

TECHNOLOGY SKILLS

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KEY LEARNING EXPERIENCES

Mindset Mathematics-Grade 7

Big Idea 9: Using Algebra as a Problem-Solving Tool

Visualize- *Case by Case*

- Students explore how to represent growing and shrinking patterns by connecting visual representations of patterns to integers.

Play- *(Non) Linear Pattern Puzzles*

- Students build a visual understanding of the differences between nonlinear and linear patterns and construct a pattern puzzle carnival to hunt for nonlinear patterns.

Investigate- *Linear Letters*

- Students investigate how letters formed on a grid grow and whether these patterns of growth are always linear. Students investigate which letters grow most rapidly, or have the steepest slope.

Math 7



UNIT 5- Proportional Reasoning: Percents and Statistical Samples

ESSENTIAL QUESTION

How can proportional reasoning be used to solve problems about percents and statistical sampling?

BIG IDEAS

Students will use proportions to solve various percent problems.
Students will use data from a relevant sample to gain information and make inferences about a larger population.
Students will apply the appropriate measures of center and variability to make comparisons between sets of data.

GUIDING QUESTIONS

Content and Process

- How can proportions be used to solve multi-step ratio and percent problems? **7.RP.3**
- How are statistics used to gain information about a population? **7.SP.1**
- What determines whether a sample is an accurate representation of a population? **7.SP.1a, 7.SP.1b**
- How can data from a sample be used to generate inferences about a population? **7.SP.2**
- How can multiple samples reveal the accuracy of a prediction or estimation? **7.SP.2**
- How are measures of center and variability used to make inferences and comparison between two sets of data? **7.SP.3, 7.SP.4**

Reflective

- What coupon would you rather have, 20% off or \$20 off?
- What is a situation where it would be more appropriate to use the median instead of the mean? Why?
- If the average height of one sports team at your school is 10 cm taller than another team, what can you infer about the two teams?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.3 Construct viable arguments and critique the reasoning of others.

MP.7 Look for and make use of structure.

Content Standards

7.RP.3. Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

7.SP.1. Use statistics to gain information about a population by examining a sample of the population;

- **7.SP.1a.** Know that generalizations about a population from a sample are valid only if the sample is

representative of that population and generate a valid representative sample of a population.

- **7.SP.1b.** Identify if a particular random sample would be representative of a population and justify your reasoning.

7.SP.2. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to informally gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.*

7.SP.3. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability (requires introduction of mean absolute deviation). *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*

7.SP.4. Use measures of center (mean, median and/or mode) and measures of variability (range, interquartile range and/or mean absolute deviation) for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book. (NOTE: Students should not have to calculate mean absolute deviation but use it to interpret data).*

SUPPORTING RESOURCES

Mindset Mathematics-Grade 7

Sampling to Understand Populations Pg. 171-195 (Key Learning Experiences)
Understanding Percents in the World Pg. 93-118 (Key Learning Experience)

i-Ready- Grade 7

Unit 5, Lesson 20: Solve Problems Involving Percents **7.RP.3**

Unit 5, Lesson 21: Solve Problems Involving Percent Change and Percent Error **7.RP.3**

Unit 5, Lesson 22: Understand Random Sampling **7.SP.1a**

Unit 5, Lesson 23: Reason About Random Samples **7.SP.2**

Unit 5, Lesson 24: Compare Populations **7.SP.3, 7.SP.4**

SOCIAL-EMOTIONAL SKILLS

RELATIONSHIP SKILLS

The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. The ability to communicate clearly, listen well, cooperate with others, resist inappropriate social pressure, negotiate conflict constructively, and seek and offer help when needed.

- Communication
- Social engagement
- Relationship-building

- Teamwork

TECHNOLOGY SKILLS

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KEY LEARNING EXPERIENCES

Required Key Learning Experiences
Mindset Mathematics - Grade 7

Big Idea 4: Understanding Percents in the World

Play- *Building Benchmarks*

- Students build understanding of benchmark percents by folding adding machine paper, and use this model to make connections between percents and money.

Investigate- *What's It Going to Cost?*

- Students investigate how to use benchmark percents and patterns to find other percents in context such as sales tax, discounts, and tips.

Big Idea 7: Sampling to Understand Populations

Play- *Catch and Release*

- Students use sampling to make inferences about the size and makeup of the populations of small objects, such as beads, beans, and buttons.

Investigate- *Wildlife Populations*

- Students investigate how to adapt sampling methods to estimate large wildlife populations from images.

Optional Key Learning Experiences
Mindset Mathematics - Grade 7

Big Idea 4: Understanding Percents in the World

Visualize- *Painting Percents*

- Students analyze and design paintings to visualize percents as a portion "out of 100," and connect

percents to decimals and fractions.

Big Idea 7: Sampling to Understand Populations

Visualize- *Sampling Dots and Beads*

- Students invent ways of sampling to understand the representation of different color dots and beads in non repeating designs.

Math 7

UNIT 6- Solids and Triangles



ESSENTIAL QUESTION

How can understanding geometric figures help find answers to real-world problems?

BIG IDEAS

Students will compose and decompose three-dimensional shapes to understand the connections between a two-dimensional and three-dimensional world.

Students will use observations of prisms and cylinders to derive formulas to calculate surface area and volume.

GUIDING QUESTIONS

Content and Process Objectives

- When a triangle or rectangle is rotated around an edge, what 3-dimensional figure is formed? **7.G.2**
- Which shapes are created from various slices of three-dimensional figures? **7.G.3**
- What are the relationships between various three-dimensional geometric shapes? **7.G.5**
- How can the formula for the volume and surface area of prisms and cylinders be derived? **7.G.5a, 7.G.5b**
- How can area, surface area, and volume be applied to solve real-world problems? **7.G.6**

Reflective

- What patterns do you notice when you slice a shape parallel or perpendicular to the base?
- How would you explain how to find the volume of a prism or cylinder to a friend?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.1 Make sense and persevere in solving problems.

MP.5 Use appropriate tools strategically.

Content Standards

7.G.2. Identify three-dimensional objects generated by rotating a two-dimensional (rectangular or triangular) object around one edge.

7.G.3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right cylinder.

7.G.5. Investigate the relationship between three-dimensional geometric shapes;

- **7.G.5a.** Generalize the volume formula for prisms and cylinders ($V = bh$ where B is the area of the base and h is the height).
- **7.G.5b.** Generalize the surface area formula for prisms and cylinders ($SA = 2B + Ph$ where B is the area of the base, P is the perimeter of the base, and h is the height (in the case of a cylinder, perimeter

is replaced by circumference).

7.G.6. Solve real-world and mathematical problems involving area of two-dimensional objects and volume and surface area of three-dimensional objects including cylinders and right prisms. (Solutions should **not** require students to take square roots or cube roots. *For example, given the volume of a cylinder and the area of the base, students would identify the height.*)

SUPPORTING RESOURCES

Mindset Mathematics - Grade 7

Connecting 2D and 3D Worlds Pg. 27-45 (Key Learning Experiences)

i-Ready- Grade 7

Unit 6, Lesson 25: Solve Problems Involving Area and Surface Area **7.G.6**

Unit 6, Lesson 26: Solve Problems Involving Volume **7.G.6**

Unit 6, Lesson 27: Describe Plane Sections of Three-Dimensional Figures **7.G.3**

Supplemental Lessons

Supplemental Lessons Needed for 7.G.2 and 7.G.5

SOCIAL-EMOTIONAL SKILLS

RESPONSIBLE DECISION MAKING

The ability to make constructive choices about personal behavior and social interactions based on ethical standards, safety concerns, and social norms. The realistic evaluation of consequences of various actions, and a consideration of the well-being of oneself and others.

- Identifying problems
- Analyzing situations
- Solving problems
- Evaluating
- Reflecting
- Ethical responsibility

TECHNOLOGY SKILLS

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KEY LEARNING EXPERIENCES

Required Key Learning Experiences

Mindset Mathematics - Grade 7

Big Idea 1: Connecting 2D and 3D Worlds

Visualize- *Seeing Slices*

- Students visualize and explore the two-dimensional shapes that can be made by slicing a rectangular solid.

Play- *Playing with Clay*

- Students play with slicing a variety of three-dimensional figures to see what shapes the sliced faces can make and how these compare with slicing rectangular solids.

Optional Key Learning Experiences

Mindset Mathematics - Grade 7

Big Idea 1: Connecting 2D and 3D Worlds

Investigate- *The Area of Slices*

- Students investigate the area of faces made by slicing different types of geometric solids.

Math 7



UNIT 7- Probability: Theoretical Probability, Experimental Probability and Compound Events

ESSENTIAL QUESTION

BIG IDEAS

How can properties of probability be used to make educated decisions in real world situations?

Students will collect, organize and display data to find the probability of events and determine which outcomes are more likely to occur.
Students understand the difference between experimental and theoretical probability and when to use each one.
Students can conduct a probability experiment and analyze the results through a probability model to make educated decisions.

GUIDING QUESTIONS

Content and Process

- How can probability be expressed as a number between 0 and 1? **7.SP.5**
- What happens to the experimental probability as more trials are conducted? **7.SP.6**
- How can creating probability models be helpful to compare results with expected outcomes? **7.SP.7**
- What factors cause differences between experimental and theoretical probabilities? **7.SP.7**
- How can probability models (uniform and non-uniform) be used to determine the likelihood of an event? **7.SP.7a, 7.SP.7b**
- How do lists, tables, tree diagrams, and simulations help determine the probability of compound events? **7.SP.8**
- How can a model (list, table, tree diagram) be used to represent the sample space of compound events and express the probability as a fraction? **7.SP.8a, 7.SP.8b**
- How can a simulation be designed and used to generate frequencies for compound events? **7.SP.8c**

Reflective

- When rolling two dice, what is the probability that the sum of the two numbers is 8?
- What are three ways to express the probability of rolling an odd number on a six-sided die?
- How can you explain to a friend why theoretical and experimental probabilities can differ?

FOCUS STANDARDS

Standards of Mathematical Practice

MP.2 Reason abstractly and quantitatively.

MP.8 Look for and express regularity in repeated reasoning.

Content Standards

7.SP.5. Express the probability of a chance event as a number between 0 and 1 that represents the likelihood of the event occurring. (Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around $\frac{1}{2}$ indicates an event that is neither unlikely nor likely, and a probability near 1

indicates a likely event.)

7.SP.6. Collect data from a chance process (probability experiment). Approximate the probability by observing its long-run relative frequency. Recognize that as the number of trials increase, the experimental probability approaches the theoretical probability. Conversely, predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*

7.SP.7. Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

- **7.SP.7a.** Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.*
- **7.SP.7b.** Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*

7.SP.8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

- **7.SP.8a.** Know that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
- **7.SP.8b.** Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g. “rolling double sixes”), identify the outcomes in the sample space which compose the event.
- **7.SP.8c.** Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*

SUPPORTING RESOURCES

Mindset Mathematics-Grade 7

Modeling Probabilities Pg. 145- 170 (Key Learning Experiences)

i-Ready- Grade 7

Unit 7, Lesson 30: Understand Probability **7.SP.5**

Unit 7 Lesson 31: Solve Problems Involving Experimental Probability **7.SP.6, 7.SP.7b**

Unit 7, Lesson 32: Solve Problems Involving Probability Models **7.SP.7a, 7.SP.7b**

Unit 7, Lesson 33: Solve Problems Involving Compound Events **7.SP.8a, 7.SP.8b, 7.SP.8c**

SOCIAL-EMOTIONAL SKILLS

SELF-MANAGEMENT

The ability to successfully regulate one’s emotions, thoughts, and behaviors in different situations — effectively managing stress, controlling impulses, and motivating oneself. The ability to set and work toward personal and academic goals.

- Impulse control

- Stress management
- Self-discipline
- Self-motivation
- Goal-setting
- Organizational skills

TECHNOLOGY SKILLS

Based on ISTE Standards for Students, these are discrete technology skills that unit designers will use to integrate digital tools in students' learning experiences. Intentionally broad and device and app agnostic, these skills build upon one another and provide students a strong foundation in technology use.

KEY LEARNING EXPERIENCES

Required Key Learning Experiences

Mindset Mathematics - Grade 7

Big Idea 6: Modeling Probabilities

Visualize- *What's the Chance of That?*

- Students find and compare the theoretical and experimental probabilities for tossing a cube onto different colored regions of a painting, connecting probability to area.

Play- *Probability Carnival*

- Students play multiple dice games to develop ways of modeling and visually proving the probabilities of winning and not winning.

Investigate- *Go, Go Galton Board!*

- Students investigate compound probability by using geoboards to make Galton Boards, random sorting machines.

Optional Key Learning Experiences

Mindset Mathematics - Grade 7

Big Idea 5: Building Intuition about Probability

Visualize- *Is It Fair?*

- Students build intuition about what makes a game of chance fair and connect chance to area by exploring spinner games.

Play- *Fair Sums?*

- When rolling a single die, all outcomes are equally likely. What happens when you roll two or more dice and find the sum? Students explore the shape of probabilities by experimenting with rolling multiple dice.

Investigate- *What's in the Bag?*

- Students explore bags of colored cubes to predict their contents. Groups try to name how likely it is to draw a blue cube from the bag, inventing ways of quantifying probability.