Unit 1: Geometry-Based Ratio & Proportional Reasoning

Content Area: **Mathematics**
Course(s): **Accelerated Math 7**
Time Period: **1st Marking Period**
Length: **9 Weeks**
Status: **Published**

Unit Overview

In this unit, students study scaled copies of pictures and plane figures, then apply what they have learned to scale drawings, e.g., maps and floor plans. This provides geometric preparation for grade 7 work on proportional relationships as well as grade 8 work on dilations and similarity.

In this unit, students develop the idea of a proportional relationship out of the grade 6 idea of equivalent ratios. Proportional relationships prepare the way for the study of linear functions in grade 8.

In this unit, students extend their knowledge of circles and geometric measurement, applying their knowledge of proportional relationships to the study of circles. They extend their grade 6 work with perimeters of polygons to circumferences of circles, and recognize that the circumference of a circle is proportional to its diameter, with constant of proportionality . They encounter informal derivations of the relationship between area, circumference, and radius.

In this unit, students deepen their understanding of ratios, scale factors, unit rates (also called constants of proportionality), and proportional relationships, using them to solve multi-step problems that are set in a wide variety of contexts that involve fractions and percentages.

Transfer

Students will be able to independently use their learning to solve real-world problems involving...

- representing and using rational numbers in solve real-life situation problems.
- representing rational numbers with visuals (including distance models), language, and real-life contexts.
- apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers
- Solve problems involving proportional rate of change.

For more information on transfer, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand that...

- Fractions, decimals, and percents can be used interchangeably.
- Ratios use division to represent relationships between two quantities.
- Proportion represent relationships between parts of a whole.
- The constant of proportionality is also considered to be the unit rate.
- Understand slope as being the proportional rate of change.

Essential Questions

Students will consider...

- How can you identify and represent proportional relationships?
- How can you use proportional relationships to solve real world percent problems?
- How are unit rates useful?
- How are parts of circles related to each other?
- How can you use percents to solve real world problems involving sales commissions & tax, percent error and simple interest?
- How do percents relate to scaling figures in geometry?

Application of Knowledge and Skill

Students will know...

Students will know...

- how to scale drawings and recognize scaled vs. not scaled
- how to recognize and represent proportional relationships between quantities
- how to compute unit rates associated with fractions, including ratios of lengths, areas, and other quantities measured in like or different units.

- how to use parts of circles to calculate other parts

Students will be skilled at...

Students will be skilled at...

Representing

- a scaled copy for a given scale factor
- distances using different scales
- relevant features of a classroom with a scale drawing
- situations involving percent increase and decrease
- situations with percent error
- situations from the news involving percent change

Generalizing

- about corresponding distances and angles in scaled copies
- about scale factors greater than, less than, and equal to 1
- about scale factors and area
- about scale factors with and without units
- about proportional relationships
- about equations that represent proportional relationships
- about how a constant of proportionality is represented by graphs and tables
- about categories for sorting circles
- about the relationship between circumference and diameter
- about circumference and rotation
- about the relationship between radius and area of a circle

Explaining

- how to use scale drawings to find actual distances
- how to use scale drawings to find actual distances, speed, and elapsed time
- how to use scale drawings to find actual areas
- how to solve concrete and abstract problems involving an amount plus (or minus) a fraction of that amount
- how to solve percent change problems
- strategies for solving percent problems with fractional percentages
- how to measure lengths and interpret measurement error
- strategies for solving percent error problems

Comparing

- drink mixtures and figures
- approaches to solving problems involving proportional relationships
- proportional relationships with nonproportional relationships
- tables, descriptions, and graphs representing the same situations

- graphs of proportional relationships

Interpreting

- representations showing equivalent ratios
- tables showing equivalent ratios
- situations involving proportional relationships
- how a graph represents features of a situation
- situations involving circles
- floor plans and maps
- situations involving circumference and area
- situations involving constant speed
- concrete problems involving percent increase and decrease
- problems involving sales tax and tip
- concrete situations involving percent error

Justifying

- reasoning about circumference and perimeter
- estimates for the areas of circles
- reasoning about areas of curved figures
- reasoning about the cost of stained glass windows

Academic Vocabulary

(a fraction) less than
(a fraction) more than
actual
appropriate
approximation
area
area of a circle
axes
center (of a circle)
circle
circumference
column
commission
constant
constant of proportionality
constant speed
coordinate
coordinate plane
coordinates
correspond
decimal representation

degrees Fahrenheit
design
diameter
dimension
discount
distance
distributive property
equation
equivalent ratios
equivalent scales
estimate
figure
final / new amount
floorplan
formula
half-circle
initial / original amount
interest
long division
markdown
markup
measurement
measurement error
one-dimensional
origin
original
per
percent error
percentage
percentage decrease
percentage increase
perimeter
pi
plot
polygon
proportional relationship
quadrilateral
quantity
quotient
radius
reasonable
reciprocal
relate
relationship
repeating decimal
represent
rotation
row
sales tax
scale
scale drawing
scale factor

scale without units
scaled copy
segment
situation
squared
steady
surface area
tape diagram
tax rate
temperature
three-dimensional
tip
travel
two-dimensional
unit rate
value
volume

Learning Goal 1

Analyze proportional relationships through scale drawings and use them to solve real-world and mathematical problems.

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.

Target #1.1 -- DOK: 1 Recall and 2 Skill/Concept

SWBAT

- describe some characteristics of a scaled copy.
- tell whether or not a figure is a scaled copy of another figure.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #1.2 -- DOK: 2 Skill/Concept

SWBAT

- describe what the scale factor has to do with a figure and its scaled copy.
- In a pair of figures, identify corresponding points, corresponding segments, and corresponding angles.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.7.RP.A.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.4	Model with mathematics.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #1.3 -- DOK: 2 Skill/Concept

SWBAT:

- draw a scaled copy of a figure using a given scale factor.
- identify what operation to use on the side lengths of a figure to produce a scaled copy.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #1.4 -- DOK: 2 Skill/Concept

SWBAT:

- use corresponding distances and corresponding angles to tell whether one figure is a scaled copy of another.
- see a figure and its scaled copy and explain what is true about corresponding angles.
- see a figure and its scaled copy and explain what is true about corresponding distances.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #1.5 -- DOK 2 Skill/Concept

SWBAT:

- describe the effect on a scaled copy when I use a scale factor that is greater than 1, less than 1, or equal to 1.
- explain how the scale factor that takes Figure A to its copy Figure B is related to the scale factor that takes Figure B to Figure A.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #1.6 -- DOK 3 Strategic Thinking

SWBAT:

- describe how the area of a scaled copy is related to the area of the original figure and the scale factor that was used.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.

MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
MA.7.G.B.6	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Target #1.7 -- DOK: 2 Skill/Concept

SWBAT:

- explain what a scale drawing is, and I can explain what its scale means.
- use a scale drawing and its scale to find actual distances.
- use actual distances and a scale to find scaled distances.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #1.8 -- DOK 2 Skill/Concept

SWBAT:

- use a map and its scale to solve problems about traveling.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #1.9 -- DOK: 3 Strategic Thinking

SWBAT:

- determine the scale of a scale drawing when I know lengths on the drawing and corresponding actual lengths.
- know how different scales affect the lengths in the scale drawing.

- given actual measurements, create a scale drawing at a given scale.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #1.10 -- DOK: 2 Skill/Concept

SWBAT

- given a scale drawing, create another scale drawing that shows the same thing at a different scale.
- use a scale drawing to find actual areas.

	Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #1.11 -- DOK 3: Strategic Thinking

SWBAT

- explain the meaning of scales expressed without units.
- use scales without units to find scaled distances or actual distances.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #1.12 DOK 3: Strategic Thinking

SWBAT

- tell whether two scales are equivalent.
- write scales with units as scales without units.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Learning Goal 2

Identify characteristics of proportional relationships. Use multiple representations for proportional relationships (equations, tables, graphs)

CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.

Target #2. 1 -- DOK: 2 Skill/Concept

SWBAT:

- use a table to reason about two quantities that are in a proportional relationship.
- understand the terms proportional relationship and constant of proportionality.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.7.RP.A.2a	Decide 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.
MA.7.RP.A.2b	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Target #2.2 -- DOK: 2 Skill/Concept

SWBAT:

- find missing information in a proportional relationship using a table.
- find the constant of proportionality from information given in a table.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.7.RP.A.2a	Decide 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.
MA.K-12.4	Model with mathematics.
MA.7.RP.A.2b	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
MA.K-12.5	Use appropriate tools strategically.

Target #2.3 -- DOK: 3 Strategic Thinking

SWBAT:

- write an equation of the form $y = kx$ to represent a proportional relationship described by a table or a story.
- write the constant of proportionality as an entry in a table.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.4	Model with mathematics.
MA.7.RP.A.2c	Represent proportional relationships by equations.
MA.K-12.7	Look for and make use of structure.

Target #2.4 -- DOK: 2 Skill/Concept

SWBAT:

- find two constants of proportionality for a proportional relationship.
- write two equations representing a proportional relationship described by a table or story.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical problems.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.7.RP.A.2b	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
MA.K-12.4	Model with mathematics.
MA.7.RP.A.2c	Represent proportional relationships by equations.
MA.K-12.6	Attend to precision.

Target #2.5 -- DOK: 2 Skill/Concept

SWBAT:

- find missing information in a proportional relationship using the constant of proportionality.
- relate all parts of an equation like $y = kx$ to the situation it represents.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.4	Model with mathematics.
MA.7.RP.A.2c	Represent proportional relationships by equations.

Target #2.6 -- DOK: 3 Strategic Thinking

SWBAT:

- decide if a relationship represented by a table could be proportional and when it is definitely not proportional.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.4	Model with mathematics.

Target #2.7 -- DOK: 3 Strategic Thinking

SWBAT:

- decide if a relationship represented by an equation is proportional or not.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.7.RP.A.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.6	Attend to precision.
MA.7.G.B.6	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Target #2.8 -- DOK: 4 Extended Thinking

SWBAT:

- ask questions about a situation to determine whether two quantities are in a proportional relationship.
- solve all kinds of problems involving proportional relationships.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical problems.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.

Target #2.9 -- DOK: 3 Strategic Thinking

SWBAT:

- Understand the graph of a proportional relationship lies on a line through (0,0).

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.

MA.7.RP.A.2a	Decide 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.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.

Target #2.10 -- DOK: 4 Extended Thinking

SWBAT:

- draw the graph of a proportional relationship given a single point on the graph (other than the origin).
- find the constant of proportionality from a graph.
- understand the information given by graphs of proportional relationships that are made of up of points or a line.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical problems.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.4	Model with mathematics.
MA.7.RP.A.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.
MA.K-12.7	Look for and make use of structure.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Target #2.11 DOK: 3 Strategic Thinking

SWBAT

- compare two related proportional relationships based on their graphs.
- Understand that the steeper graph of two proportional relationships has a larger constant of proportionality.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2a	Decide 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.

MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.

Target #2.12 DOK: 3 Strategic Thinking

SWBAT

- interpret a graph of a proportional relationship using the situation.
- write an equation representing a proportional relationship from a graph.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2a	Decide 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.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Learning Goal 3

Explore circles in terms of relationships among radius, diameter and circumference. Calculate area of circles

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.

Target #3.1 DOK: 2 Skill/Concept

SWBAT

- examine quotients and use a graph to decide whether two associated quantities are in a proportional relationship.

- understand that it can be difficult to measure the quantities in a proportional relationship accurately.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2a	Decide 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.
MA.K-12.4	Model with mathematics.

Target #3.2 DOK: 1 Recall

SWBAT

- describe the characteristics that make a shape a circle.
- identify the diameter, center, radius, and circumference of a circle.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.7.G.A	Draw, construct, and describe geometrical figures and describe the relationships between them.
MA.7.G.A.2	Draw (with technology, with ruler and protractor, as well as freehand) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

Target #3.3 DOK 2: Skill/Concept

SWBAT

- describe the relationship between circumference and diameter of any circle.
- explain what Π (pi) means.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.7.RP.A.2a	Decide 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.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.7.G.B.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Target #3.4 DOK: 2 Skill/Concept

SWBAT

- choose an approximation for Π based on the situation or problem.
- If the radius, diameter, or circumference of a circle is known, find the other two.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.G.B.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Target #3.5 DOK 3: Strategic Thinking

SWBAT

- If the radius or diameter of a wheel is known, find the distance the wheel travels in some number of revolutions.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.7.RP.A.2a	Decide 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.
MA.K-12.4	Model with mathematics.
MA.7.RP.A.2c	Represent proportional relationships by equations.
MA.K-12.6	Attend to precision.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
MA.7.G.B.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Target #3.6 DOK: 3 Strategic Thinking

SWBAT

- know whether or not the relationship between the diameter and area of a circle is proportional and can explain how I know.
- If a circle's radius or diameter is known, find an approximation for its area.

MA.7.RP.A.2a	Decide 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.
MA.7.G.A	Draw, construct, and describe geometrical figures and describe the relationships between them.
MA.7.G.B	Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.
MA.7.G.B.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Target #3.7 DOK: 2 Skill/Concept

SWBAT

- explain how the area of a circle and its circumference are related to each other.
- know and apply the formula for area of a circle.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.G.B.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Target #3.8 DOK: 2 Skill.Concept

SWBAT

- calculate the area of more complicated shapes that include fractions of circles.
- write exact answers in terms of Π.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.G.B.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Target #3.9 DOK: 3 Strategic Thinking

SWBAT

- decide whether a situation about a circle has to do with area or circumference.

- use formulas for circumference and area of a circle to solve problems.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.7	Look for and make use of structure.
MA.7.G.B.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Learning Goal 4

Use proportional relationships to solve multistep ratio and percent problems (for example, simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error)

CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.

Target #4.1 DOK: 1 Recall

SWBAT

- solve problems about ratios of fractions and decimals.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.7.RP.A.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
MA.K-12.6	Attend to precision.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Target #4.2 DOK: 2 Skill/Concept

SWBAT

- use a table with 2 rows and 2 columns to find an unknown value in a proportional relationship.
- When there is a constant rate, identify the two quantities that are in a proportional relationship.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.7.RP.A.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.

MA.K-12.6	Attend to precision.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Target #4.3 DOK 2: Skill/Concept

SWBAT

- use the distributive property to rewrite an expression like $x + {}^1/_2\, x$ as $(1+ {}^1/_2)x$.
- I understand that "half as much again" and "multiply by ${}^3/_2$" mean the same thing.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.6	Attend to precision.

Target #4.4 DOK: 2 Skill/Comcept

SWBAT

- use the distributive property to rewrite an equation like $x + 0.5x = 1.5x$.
- write fractions as decimals.
- understand that "half as much again" and "multiply by 1.5" mean the same thing.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

Target #4.5 DOK: 2 Skill/Concept

SWBAT

- draw a tape diagram that represents a percent increase or decrease.
- When a starting amount and the percent increase or decrease is known, find the new amount.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.

MA.K-12.6	Attend to precision.

Target #4.6 DOK: 2 Skill/Concept

SWBAT

- use a double number line diagram to help me solve percent increase and decrease problems.
- understand that if I know how much a quantity has grown, then the original amount represents 100%.
- When the new amount and the percentage of increase or decrease is known, find the original amount.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
MA.K-12.7	Look for and make use of structure.

Target #4.7 DOK: 3 Strategic Thinking

SWBAT

- solve percent increase and decrease problems by writing an equation to represent the situation and solving it.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
MA.K-12.6	Attend to precision.

Target #4.8 DOK: 2 Skill/Concept

SWBAT

- understand and solve problems about sales tax and tips.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Target #4.9 DOK: 2 Skill/Concept

SWBAT

- understand and solve problems about commission, interest, markups, and discounts.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Target #4.10 DOK: 2 Skill/Concept

SWBAT

- find the percentage increase or decrease when the original amount and the new amount are known.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Target #4.11 DOK: 3 Strategic Thinking

SWBAT

- represent measurement error as a percentage of the correct measurement.
- understand that all measurements include some error.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.5	Use appropriate tools strategically.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
MA.K-12.6	Attend to precision.

Target #4.12 DOK: 2 Skill/Concept

SWBAT

- solve problems that involve percent error.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.6	Attend to precision.
MA.7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems.
MA.K-12.7	Look for and make use of structure.

Formative Assessment and Performance Opportunities

- cK-12 Adaptive Practice
- Clicker
- Exit/Admit Ticket
- Journal
- Kahoot
- My Favorite No
- Student Persentation
- Student-Teacher Conference
- Think-Pair-Share

Summative Assessment

- End of Unit Test
- LinkIt!
- Portfolio
- Pre-Unit Diagnostic Test
- Project
- Quiz

21st Century Life and Careers and Technology

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

TECH.8.1.8.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.8.C.CS4	Contribute to project teams to produce original works or solve problems.
TECH.8.1.8.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.8.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.

Accommodations & Modifications

- 2-color chips
- Adaptive Practice (cK-12 modality)
- Calculator
- Clickers
- Conceptual processing: provide physical example
- Document Cameras
- Graphing Calculators
- Kahoot
- Lesson Extentions
- Manipulatives
- Modification as per IEP/504
- PLIX (cK-12 modality)
- Provide digital version of activities (assistive technology)
- Provide sticky notes or whiteboards
- Show students how to simplify ratios prior to multiplying, reducing the chance of making an error
- Small group instruction

Interdisciplinary Connections

Have students create scale drawings and scale models using proportional relationships (MA.7.G.A.1)

VPA.1.3.8.D.CS1	The creation of art is driven by the principles of balance, harmony, unity, emphasis, proportion, and rhythm/movement.