Unit 2: Proportionality and Linear Relationships

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Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Grade 7H Pre-Algebra, Unit 2

Proportionality and Linear Relationships

Belleville Board of Education

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Unit Overview

In this unit students will analyze proportional relationships and use them to solve real-world mathematical problems.

From this unit students will be able to use proportional relationships to solve problems, and understand the connections between relationships of data , lines, and linear equation

Enduring Understanding

Students will understand:
that fractions, decimals, and percents can be used to represent equivalent forms of the same value.

that unit rates allow comparisons between ratios of like and different units.

that proportional relationships represent how quantities relate to each other.

scale drawings are used to represent objects that are too big or too small to be drawn actual size.

proportional relationships can be used to solve percent problems.

the difference between percent increase and decrease.

simple and compound interest.

expressions can be used to reason about and represent situations.

variables can have different meanings depending on the context of the problems.

variables can be used to write expressions for values that are unknown.

why you would rewrite an expression in terms of the context of the situation.

how to write algebraic equations and inequalities.

the connection between equalities and inequalities.

some real -word problems can have a range of solutions(inequalities).

tables and graphs can be used to represent, analyze, and solve real-world problems related to linear equations.

if a set of ordered pairs is or is not a function.

functional relationships can be expressed numerically, graphically, and verbally.

the graph of a direct variation passes through the
origin, the point (1,r) on a linear graph represents the unit rate & the constant of proportionality is the slope.

identify slope and y-intercept of a lines and describe what they represent in real world problems.

Essential Questions

How can ratios and proportions be used to solve real-world problem?

How can we draw or model real world objects?

How can you use proportional relationships to solve real-world percent problems?

What is the difference between percent increase and percent decrease?

What does it mean to evaluate algebraic expressions ?

How can you rewrite expressions to help you solve problems?

How does the solution to an equation differ from the solution to an inequality?

What type of real life situations can be represented by a linear equation?

How are equations and inequalities used to model and solve real-world problems?

How are linear functions used to model proportional relationships?

What are some ways in which functions and relations can be represented

How are linear functions used to model proportional relationships?

How do you graph a linear function using a table?

How can equations, graphs, word descriptions, and tables describe a function?

How can you use a graph to show the relationship between two variables that vary directly?

What is the constant of proportionality?

What information does the slope of a line and y- intercept tell you?

Exit Skills

Upon completion of this unit, students will be able to;

Express ratios as fractions in simplest form.

Find and compare unit rates.

Convert rates between units of measurements.

Use an equation to describe proportional relationships.

Identify and analyze proportional relationships.

Solve proportions.

Solve problems involving scale drawings and similar figures.

Write and solve percent problems.

Find percent increase and decrease.

Find markup price and discounted price.

Find simple and compound interest.

Use the distributive property.

Simplify algebraic expressions.

Add and subtract linear expressions.

Model real world problems with linear expressions.

Solve equation using Multiplication & Addition Properties.

Solve two step equations.

Solve problems in form $p(x+q)=r$.

Solve equations with variables on both sides.

Model real world problems with equations and solve them.

Write inequalities and graph on number line.

Use Addition and Subtraction Properties of Inequality to solve inequalities.

Solve Inequalities by multiplying or dividing

Solve multi-step equations and inequalities.

Model real world problems with inequalities and solve them.

Determine whether a relation is a function.

Write a function in function notation.

Solve linear functions in two variables.

Graph linear functions using ordered pairs.

Identify direct variation.

Find a constant of proportionality for a linear relationship.

Determine slope and y- intercept of a line.

Graph a line using the slope and y-intercept.

Describe what slope and y-intercept represent in a real - world problem.

New Jersey Student Learning Standards (NJSLS)

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.7.RP.A.2	Recognize and represent proportional relationships between quantities.
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.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-12.5	Use appropriate tools strategically.
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-12.6	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.
MA.8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
MA.8.EE.B.6	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.
MA.8.EE.C.7	Solve linear equations in one variable.
MA.8.EE.C.7a	Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
MA.8.EE.C.7b	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
MA.7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
MA.7.NS.A.2c	Apply properties of operations as strategies to multiply and divide rational numbers.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
MA.7.EE.A.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

MA.7.EE.A.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.
MA.7.EE.B.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. 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.
MA.7.EE.B.4	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
MA.7.EE.B.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. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.
MA.7.EE.B.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. Graph the solution set of the inequality and interpret it in the context of the problem.

Interdisciplinary Connections

LA.RI.7	Reading Informational Text
LA.RI.7.1	Cite several pieces of textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.
LA.W.7.1.A	Introduce claim(s), acknowledge alternate or opposing claims, and organize the reasons and evidence logically.
6-8.MS-PS1-2.4.1	Analyze and interpret data to determine similarities and differences in findings.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.

Learning Objectives

The student will be able to .....

Compute unit rates associated with ratios of fractions, lengths, and other quantities measured in like or different units

Recognize proportional and non proportional relationships and represent proportional relationships between quantities.

Compare two different proportional relationships.

Graph proportional relationships, interpreting the constant of proportionality.

Solve problems involving scale drawings of geometric figures.

Estimate percents.

Use proportional relationships and percent equation to solve percent problems.

Solve problems involving percent of change

Compute a discount or markup and the resulting sale price after a discount or markup.

Compute simple and compound interest.

Simplify algebraic expressions using Distributive Property and concept of like terms

Add and subtract linear expressions.

Solve linear equations and inequalities in one variable and be able to justify each step in the process and the solution.

Write linear equations and inequalities in one variable and use them to solve problems.

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

Determine whether a relation is a function.

Represent a linear relationship using a table of values.

Graph a linear equation by using 2 or more points.

Determine the constant of proportionality when solving problems with direct variation.

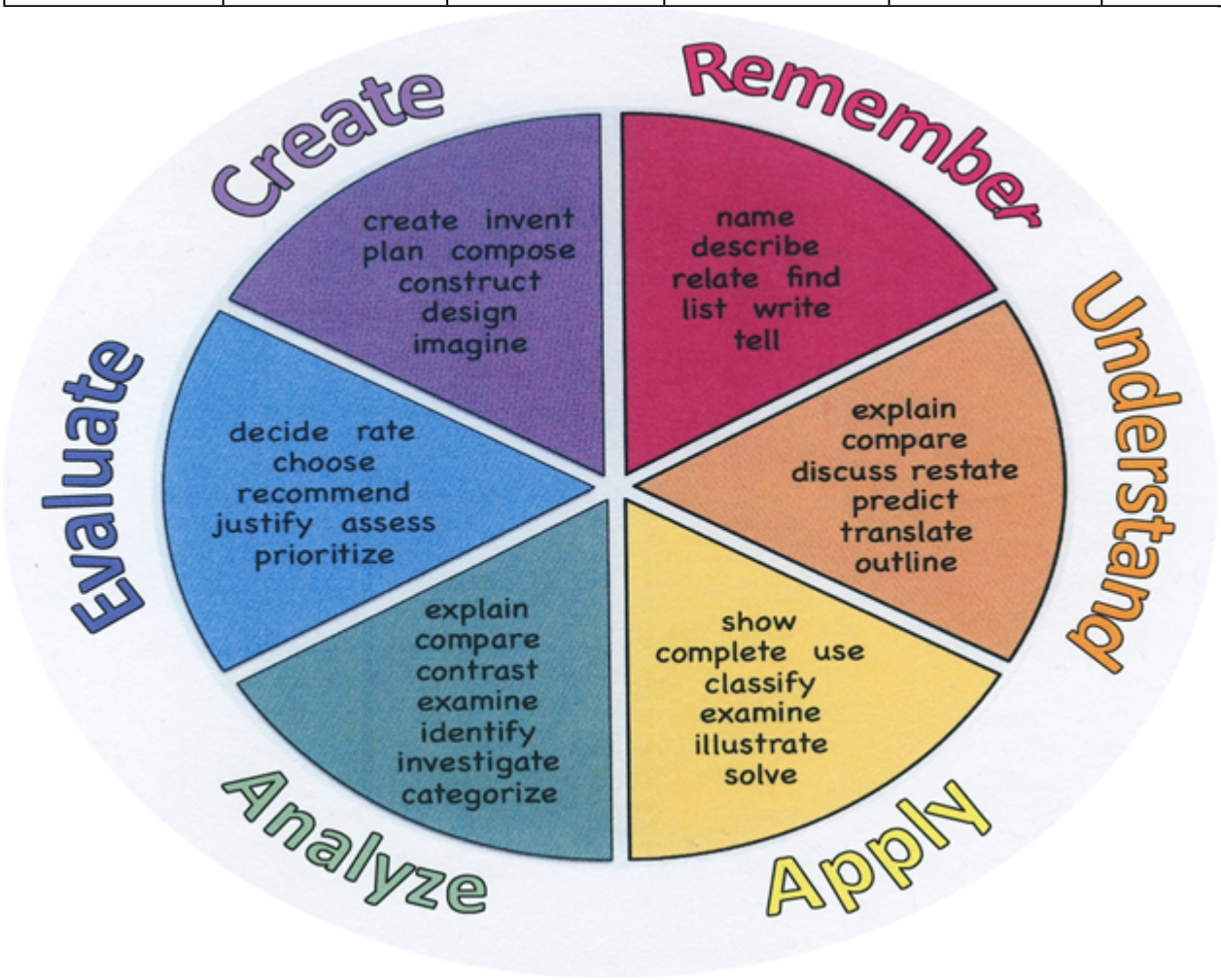
Interpret slope as the unit rate of the graph.

Find and interpret the slope and y-intercept when graphing a linear equation for a real world problem.

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play

Draw Outline Point Quote Recall Recognize Repeat Reproduce	Paraphrase Represent Restate Rewrite Select Show Summarize Tell Translate Associate Compute Convert Discuss Estimate Extrapolate Generalize Predict	Add Calculate Change Classify Complete Compute Discover Divide Examine Graph Interpolate Manipulate Modify Operate Subtract	Detect Diagram Discriminate Illustrate Outline Point out Separate	Rate Support Test	Drive Devise Generate Integrate Prescribe Propose Reconstruct Revise Rewrite Transform



Suggested Activities & Best Practices

Textbook, eAssessment, supplemental materials:

https://my.mheducation.com/login

Inquiry Labs textbook - p. 230, 248, 268, 286, 297, 314, 330,344,353,403,418

AI Assessment and Learning System:

https://www.aleks.com/

Learner-Centererd Classroom lessons:

https://betterlesson.com/common_core

Video Math Lessons:

https://www.virtualnerd.com/

Mindset:

https://www.youtube.com/watch?v=3icoSeGqQtY

http://www.youcubed.org/wp-content/uploads/Positive-Classroom-Norms2.pdf

Math Discourse:

https://mrorr-isageek.com/start-a-math-fight/

Teaching Strategies for Improving Algebra Knowledge in Middle and High School Students:

https://ies.ed.gov/ncee/wwc/PracticeGuide/20

Coaching Corner:

https://sites.google.com/belleville.k12.nj.us/thecoachingcorner/home

Algebra Tools - Functions:(Refer to problems included in the pre-requisite skills in this document)

https://www.state.nj.us/education/aps/cccs/math/NJISTFunctions.pdf

Algebra Tools - Algebra:(Refer to problems included in the pre-requisite skills in this document)

https://www.state.nj.us/education/aps/cccs/math/NJISTAlgebra.pdf

Misc Mathematics materials:

http://www.mathnstuff.com/

Order of Operations Kahoot:

https://create.kahoot.it/details/order-of-operations/e38e26d8-ee8a-484b-83b9-c22f78f32a61

Scientific Notation Kahoot:

https://create.kahoot.it/details/scientific-notation/4a841be2-d3e0-46ec-b724-09b8921c434a

Constant of proportionality:

https://www.maneuveringthemiddle.com/how-to-teach-proportional-relationships/

Educational animations, games and interactive math tools for middle school students

http://mathsnacks.com/

Assessment Evidence - Checking for Understanding (CFU)

Use interactive classroom tools such as Nearpod, peardeck, edpuzzle to infuse CFUs throughout lesson.

Glencoe McGraw Hill : Chapter Assessments, Midchapter Assessments-summative assessmernt

EAssessment test generator: https://assess.k12.mhedu.com/Instructor/TestGenerator.aspx-summative assessment

Evaluation rubric-formative assessment

Web-based assessment-alternate assessment

Multimedia reports-benchmark assessment

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite

- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Math Accelerated-A Pre-Algebra Program 2017 - McGraw-Hill

Math Accelerated-A Pre-Algebra Program 2017 - Digital Resources - McGraw-Hill

Ancillary Resources

Glencoe McGraw-Hill Algebra 1 2014

Aleks

Technology Infusion

Use interactive tools such as nearpod, peardeck, edpuzzle to enhance a presentation and allow students to engage during the lesson while the teacher gathers data throughout the lesson.

- ALEKS
- Calculator/Graphing calculator
- Google Classroom
- Google Suite
- McGraw-Hill Education

- Edulastic
- EdPuzzle
- Desmos.com
- geogebra.org
- Youtube
- Khan academy
- MS Excel
- Office 365
- MS Word
- PodCasts
- MS Powerpoint
- Peardeck
- Nearpod
- Wikipedia
- Skype
- Twitter
- Ted Talks
- Flipgrid

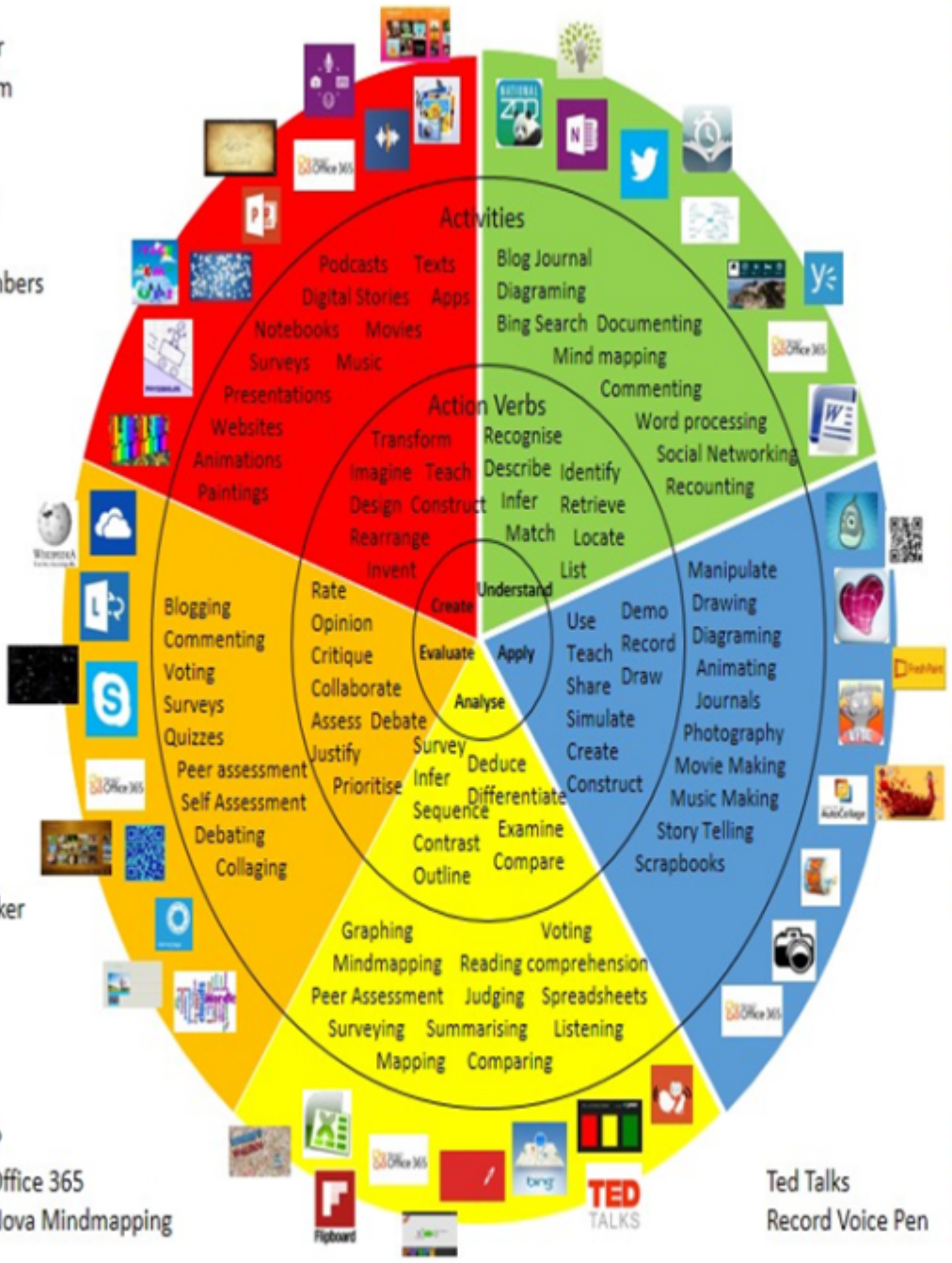
Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker

Where's Waldo?
MS Excel
Flipboard
Office 365
Nova Mindmapping

Ted Talks
Record Voice Pen



Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
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.CRP11	Use technology to enhance productivity.
CAEP.9.2.8.B.2	Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
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.8.1.12.A.3	Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
TECH.8.1.12.F.CS1	Identify and define authentic problems and significant questions for investigation.

21st Century Skills/Interdisciplinary Themes

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

Use The Glencoe Personal Tutor (English and Spanish) to reteach or revisit concepts such as Ordering Integers, Expressions with Absolute Value, Comparing Integers

Aleks - Assign student content from this unit or have students follow their tracks to assist in filling in gaps

Create physical or digital anchor charts students can refer to

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe

- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Use The Glencoe-McGrawHill Personal Tutor to review or revisit content

Create Number Talks in Google Classroom

Reteach Ratios using Glencoe reteach masters

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Use The Glencoe-McGrawHill Personal Tutor to review or revisit content

Create Number Talks in Google Classroom or desmos to keep students anonymous

Reteach Ratios using Glencoe reteach masters

Aleks - Assign student content involving ratios proportions, percents or have students follow their track (students can use Spanish toggle)

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Reteach Percents using Glencoe reteach masters

Use The Glencoe-McGrawHill Personal Tutor to review or revisit content(English or Spanish)

Create Number Talks in Google Classroom

Aleks - Assign student content involving ratios, proportions, percents or have students follow their track (students can use Spanish toggle)

Use Virtual Manipualtives or Physical Manipulatives

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required

- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Use Glencoe Enrichment Activities and Worksheets to extend the lesson such as

Ratios: https://catalog.mcgraw-hill.com/repository/private_data/DOC/50000405/69/39.pdf

Math Forum: Problems of the Week, Sample Lesson(Min,Max), Reasoning and Making Sense Task Library

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Using the template below, please develop a **Sample Lesson** for the first unit only.

Unit Name:

NJSLS:

Interdisciplinary Connection:

Statement of Objective:

Anticipatory Set/Do Now:

Learning Activity:

Student Assessment/CFU's:

Materials:

21st Century Themes and Skills:

Differentiation/Modifications:

Integration of Technology: