Unit 1: Rational Numbers and Exponents

Content Area: **Math**
Course(s): **Math 7H Pre-Algebra**
Time Period:
Length: **45 Days**
Status: **Published**

Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Pre-Algebra H, Grade 7

Rational Numers and Exponents

Belleville Board of Education

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Unit Overview

In this unit students will use previous knowledge to build a foundation of the language of algebra while exploring operations with integers, rational numbers and exponents

From this unit students will be able to apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. They will use properties of operations to generate equivalent expressions and solve real-life and mathematical problems using numerical and algebraic expressions and equations.

Enduring Understanding

Students will understand....

The importance of mathematical rules, for example order of operations, and why they are necessary to evaluate expressions.

Numerical representations can be used to describe and compare the value of real-world quantities

There are many ways to represent a number.

Absolute value is the distance from 0, and distance is always a positive number.

That every fraction has a decimal equivalent.

The decimal expansion of a rational number either terminates or repeats.

The decimal expansion of an irrational numbers does not terminate or repeat.

Exponents(powers) can be used to shorten representation of numbers of varying size.

Numbers with very small or very large values can be expressed concisely using scientific notation.

Essential Questions

Why do I need mathematical operations?

How do I know which mathematical operation to use?

How can I use numbers and symbols to represent mathematical ideas?

Why is it beneficial to be able to write numbers in different ways ?

How are rational and irrational numbers different?

How are exponents and roots helpful when representing real-world data?

Exit Skills

Translate verbal phrases into numerical expressions.

Use order of operations to evaluate expressions.

Evaluate expressions.

Simplify algebraic expressions.

Select appropriate strategy to solve problems.

Use numbers and symbols to represent mathematical ideas.

Use ordered pairs to locate points.

Graph points on a coordinate plane.

Graph algebraic relationships.

Compare integers.

Add, subtract, multiply and divide integers.

Find absolute value of an expression.

Convert fractions to decimals.

Compare fractions and decimals.

Write rational numbers as fractions.

Identify and classify rational numbers.

Add, subtract, multiply and divide fractions.

Evaluate algebraic expressions with fractions.

Write and evaluate expressions using exponents.

Write expressions using negative exponents.

Multiplying and division monomials.

Find square roots and cube roots,

Identify and classify numbers in the set of real numbers.

Express numbers in scientific notation.

New Jersey Student Learning Standards (NJSLS)

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.8.NS.A.1	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.8.EE.A.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
MA.K-12.5	Use appropriate tools strategically.
MA.8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.
MA.K-12.6	Attend to precision.
MA.8.EE.A.3	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.
MA.K-12.7	Look for and make use of structure.
MA.8.EE.A.4	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use

	millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.
MA.7.NS.A.1a	Describe situations in which opposite quantities combine to make 0.
MA.7.NS.A.1b	Understand $p + q$ as the number located a distance $\|q\|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
MA.7.NS.A.1c	Understand subtraction of rational numbers as adding the additive inverse, $p – q = p + (–q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
MA.7.NS.A.1d	Apply properties of operations as strategies to add and subtract rational numbers.
MA.7.NS.A.2a	Understand that multiplication is extended from fractions to 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. Interpret products of rational numbers by describing real-world contexts.
MA.7.NS.A.2b	Understand 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.If p and q are integers, then $–(p/q) = (–p)/q = p/(–q)$. Interpret quotients of rational numbers by describing real-world contexts.
MA.7.NS.A.2c	Apply properties of operations as strategies to multiply and divide rational numbers.
MA.7.NS.A.2d	Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
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.

Interdisciplinary Connections

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.

Learning Objectives

Students will be able to .....

Translate verbal expressions to numerical expressions.

Apply order of operations to simplify numerical expressions.

Choose an appropriate problem solving strategy.

Identify and apply properties of addition and multiplication.

Graph points on a coordinate plane.

Identify and compare integers.

Determine absolute value.

Explore and apply rules for adding and subtracting integers.

Explore and apply rules for multiplying and dividing integers.

Write fractions as decimals and decimals as fractions.

Multiply and divide rational numbers.

Compute the sum and difference of like and unlike fractions.

Identify properties of rational numbers and use them to simplify numerical expressions.

Transform a number using exponents.

Write and evaluate numbers using negative exponents.

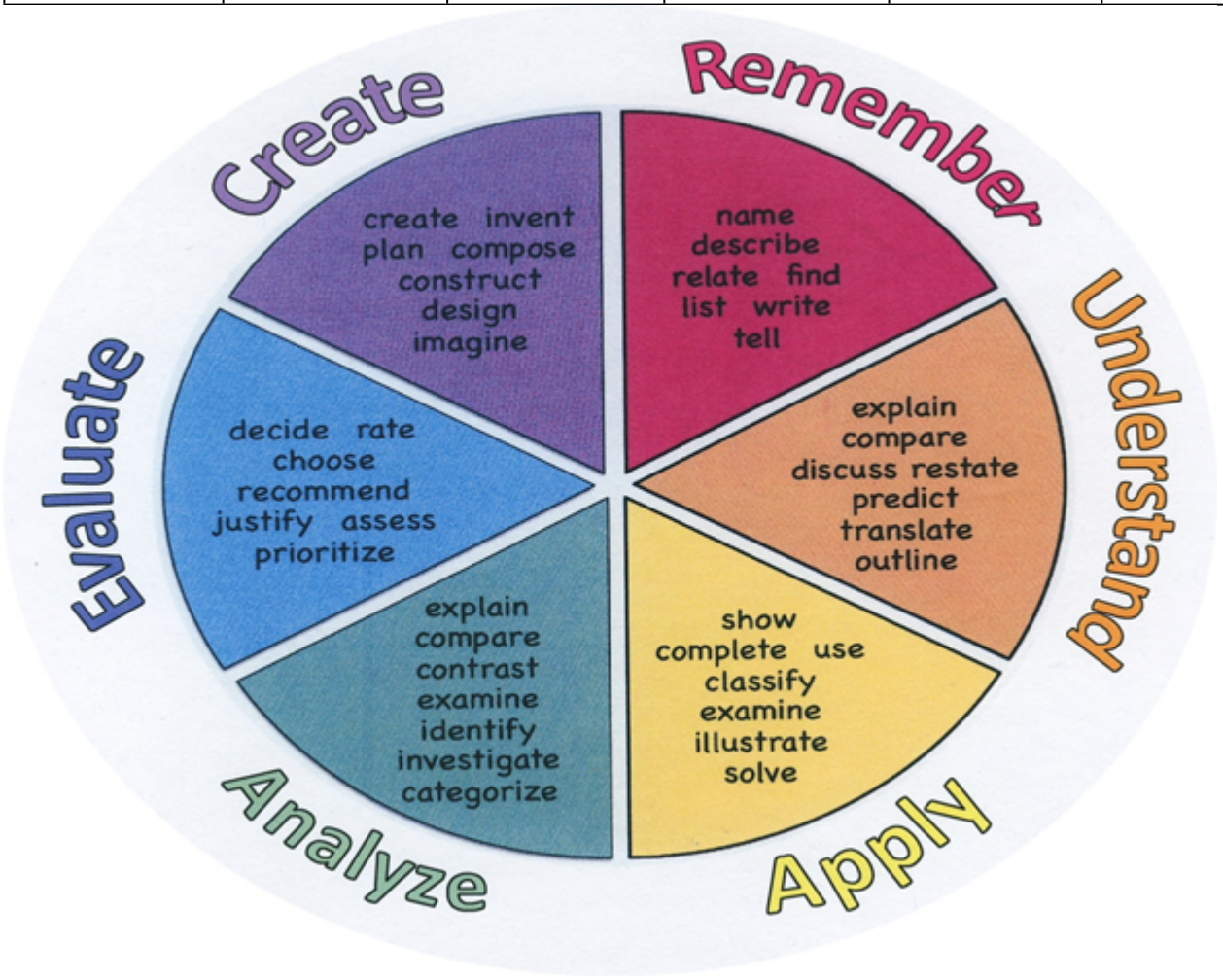
Explore how to multiply and divide two powers with the same base

Use scientific notation with positive and negative exponents.

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 Memorize Name Omit Recite Select State Count Draw Outline Point Quote Recall Recognize Repeat Reproduce	Extend Give Examples Illustrate Indicate Interrelate Interpret Infer Match Paraphrase Represent Restate Rewrite Select Show Summarize Tell Translate Associate Compute Convert Discuss Estimate Extrapolate Generalize Predict	Paint Prepare Produce Select Show Sketch Solve Use Add Calculate Change Classify Complete Compute Discover Divide Examine Graph Interpolate Manipulate Modify Operate Subtract	Infer Point out Select Subdivide Survey Arrange Breakdown Combine Detect Diagram Discriminate Illustrate Outline Point out Separate	Conclude Contrast Critique Determine Grade Justify Measure Rank Rate Support Test	Hypothesize Invent Make Originate Organize Plan Produce Role Play Drive Devise Generate Integrate Prescribe Propose Reconstruct Revise Rewrite Transform



Suggested Activities & Best Practices

Inquiry Labs - Textbook pages 11,52,61,69,92,166

Textbook, eAssessment, supplemental materials:

https://my.mheducation.com/login

AI Assessment and Learning System:

https://www.aleks.com/

Videos on mathematical concepts (grade 6 - alg 2)

https://www.virtualnerd.com/

Lessonplans and instructional resources:

https://betterlesson.com/home?from=bl_landing_plans_cta

Golf Video - positive and negative numbers:

http://www.nbclearn.com/science-of-golf/cuecard/64722

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

Quia (Quintessential Instructional Archive)- use to create or use already created online activities:

https://www.quia.com/web

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

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 assessment

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

Admit/Exit tickets-formative assessment

Web-based assessment-alternative 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

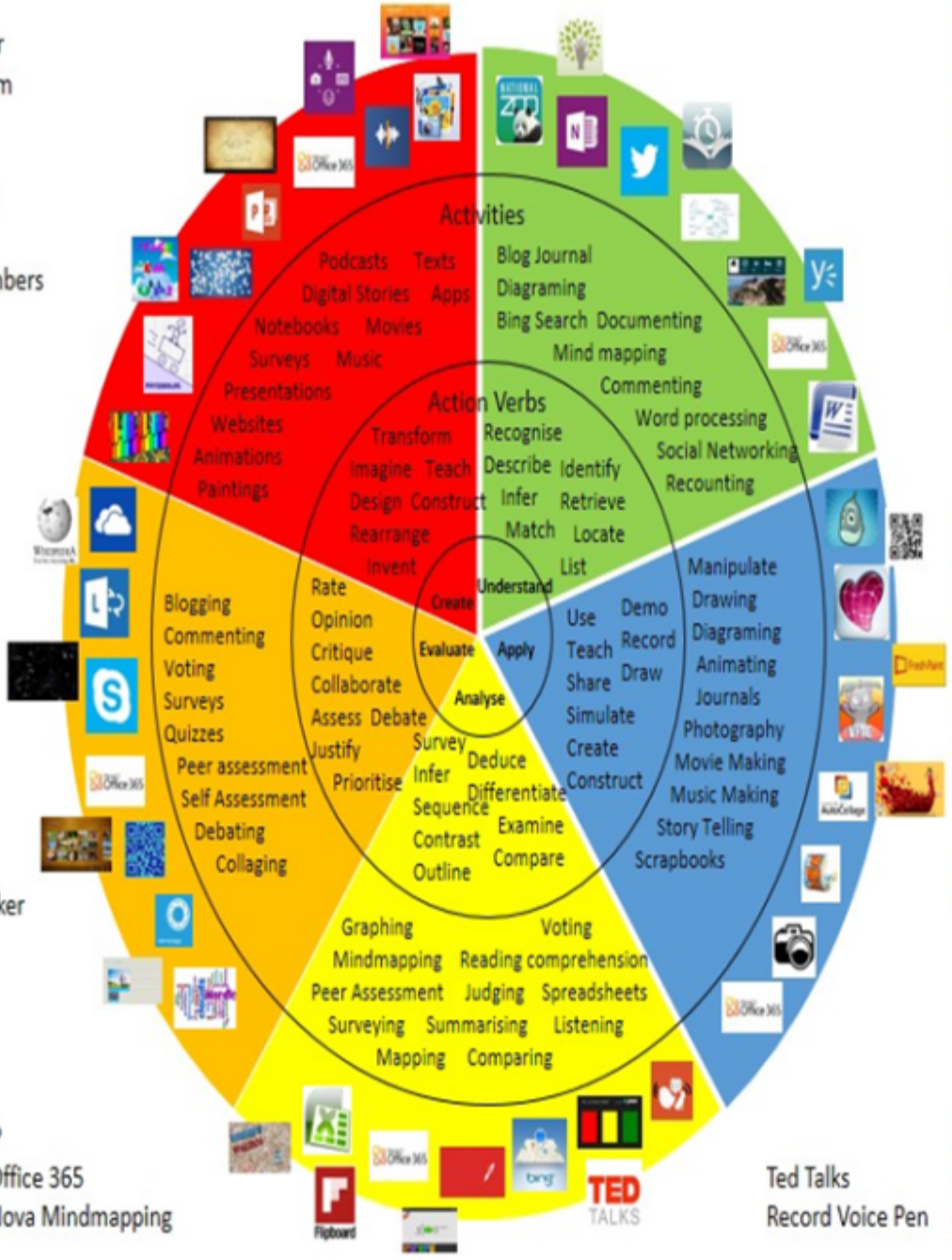
Use interactive tools such as nearpod, peardeck, edpuzzle to enhance a presentation and allow students to watch and engage during the lesson while the teacher gathers data throughout the lesson

- ALEKS
- Calculator/Graphing calculator
- Google Classroom
- Google Suites
- McGraw-Hill Education
- Edulastic
- EdPuzzle
- Desmos.com
- geogebra.org
- Youtube
- Khan academy
- MS Excel
- Office 365
- MS Word
- Peardeck
- Nearpod
- PodCasts
- MS Powerpoint
- 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 involving integers or have students follow their track

Create a digital word wall 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 Integers and Absolute Values 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, desmos or peardeck to keep students anonymous

Reteach Integers and Absolute Values using Glencoe reteach masters

Aleks - Assign student content involving integers 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

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

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

Reteach Integers and Absolute Values using Glencoe reteach masters

Aleks - Assign student content involving integers 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

Variables & Expressions: https://catalog.mcgraw-hill.com/repository/private_data/DOC/50000405/68/99.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

Unit Name: Rational Numbers and Exponents: Graphing in Four Quadrants

NJSLS:

Interdisciplinary Connection: Computer Programming, Finance

Statement of Objective: Identify a coordinate plane and graph points and algebraic relationships on a coordinate plane.

Anticipatory Set/Do
Now: https://nj.pbslearningmedia.org/resource/vtl07.math.geometry.pla.coordingrd/using-a-coordinate-grid/#.W3bLHOhKjIV

Learning Activity: Discuss why 2 values are needed to describe a point, Horizontal and vertical : x and y axis, Quadrants I, II, III, and IV, (x,y)

Students will work in small groups to plot points on a coordinate plane using desmos or edpuzzle to gather student data

Graph real-world scenarios: Money vs time; growth vs time

Student Assessment/CFU's:Questions and Answers, Oral Response, Board work ,Observation, Self-Assessment

Materials: Graph paper , worksheets, video

21st Century Themes and Skills: Global Awareness,Financial,Economic,Business and Entrepreneurial Literacy.

Differentiation/Modifications: small group instruction, repeat directions, glencoe enrichment and reteaching activities

Integration of Technology: video, desmos,

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.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.