Wall Township Public Schools	Board Approval Date: 8/19/2025

Course Title: Math 8

Course Description: In Grade 8, instruction focuses broadly on three critical areas:
(1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations;
(2) grasping the concept of a function and using functions to describe quantitative relationships;
(3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.*
**See the end of document for additional information related to the critical areas of focus.*

New Jersey Student Learning Standards - Mathematics

Vision for Mathematics Education in New Jersey
A New Jersey education in Mathematics builds quantitatively and analytically literate citizens prepared to meet the demands of college and career, and to engage productively in an information-driven society. All students will have access to a high-quality mathematics education that fosters a population that:

- leverages data in decision-making and as a lens for discussing, analyzing, and responding to practical questions.
- persists to make sense of and model problems arising in everyday life, society, and the workplace.

- thinks critically and strategically to assess quantitative relationships and to solutions to complex problems.
- employs precise reasoning and constructs viable arguments to deduce conclusions, recognize false statements and assess peers' reasoning.
- interprets, evaluates and critiques the mathematics embedded in social, scientific and commercial systems, as well as the claims made in the private and public sectors.
- communicates precisely when conveying, representing, and justifying both qualitative and quantitative perspectives.

Standards for Mathematical Practice*

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

**See end of document for additional information related to the mathematical practices.*
Inclusion of Climate Change Opportunities ( ) notes opportunities to integrate specific examples of climate change education provided by additional age-appropriate resources The goal of inclusion of climate change education implementation is to foster generations of New Jersey students that can analyze, question, interpret, to think independently, and bring critical deduction to fulfill, and to lead in jobs created by burgeoning industries of the future green economy.

Grade 8 Overview	
Domain	**Cluster Headings**
The Number System	Know that there are numbers that are not rational and approximate them by rational numbers, and understand properties of rational and irrational numbers.
Expressions and Equations	Work with radicals and integer exponents. Understand the connections between proportional relationships, lines, and linear equations. Analyze and solve linear equations and pairs of simultaneous linear equations.

Functions	Define, evaluate, and compare functions. Use functions to model relationships between quantities.
Geometry	Understand congruence and similarity using physical models, transparencies, or geometry software. Understand and apply the Pythagorean Theorem. Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.
Statistics and Probability	Investigate patterns of association in bivariate data.

Course Sequence & Pacing	
Unit Title	**Estimated Number of Instructional Periods** Days, w/Optional, w/Additional Learning Activities included**
Unit 1: Rigid Transformations and Congruence	16/18/20
Unit 2: Dilations, Similarity, and Slope	14/15/17
Unit 3: Proportional and Linear Relationships	16/18/20
Unit 4: Linear Equations and Linear Systems	17/19/21
Unit 5: Functions and Volume	17/20/22
Unit 6: Associations in Data	15/16/18
Unit 7: Exponents and Scientific Notation	17/19/21
Unit 8: The Pythagorean Theorem and Irrational Numbers	21/23/25
Total Days	133/148/164

**Instructional periods are scheduled for 54 minutes.

Unit 1

Desired Results

Unit 1 Title: Rigid Transformations and Congruence

Unit Summary: Students investigate translations, reflections, and rotations, and use these transformations to make informal arguments about congruence. They also explore angle relationships on parallel lines and the triangle sum theorem.

Sub-Unit 1: Rigid Transformations (Lessons 1–6 + Practice Day + Quiz)

- Describe and perform translations, reflections, and rotations on and off a grid.

Sub-Unit 2: Congruence (Lessons 7–9)

- Use rigid transformations to determine and justify whether two figures are congruent.

Sub-Unit 3: Angle Relationships (Lessons 10–13 + Practice Day)

- Use rigid transformations to determine missing angle measurements on parallel lines and in triangles.

Learning Standards

NJSLS Math:

8.G Geometry

A. Understand congruence and similarity using physical models, transparencies, or geometry software

1. Verify experimentally the properties of rotations, reflections, and translations: **8.G.A.1**

a. Lines are transformed to lines, and line segments to line segments of the same length. **8.G.A.1.a**

b. Angles are transformed to angles of the same measure. **8.G.A.1.b**

c. Parallel lines are transformed to parallel lines. **8.G.A.1.c**

2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. **8.G.A.2**

3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. **8.G.A.3**

5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.* **8.G.A.5**

Math Practices: MP1, MP2, MP3, MP4, MP5, MP6, MP7, MP8

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- Act as a responsible and contributing community members and employee
- Attend to financial well-being
- Consider the environmental, social and economic impacts of decisions
- Demonstrate creativity and innovation
- Utilize critical thinking to make sense of problems and persevere in solving them
- Model integrity, ethical leadership and effective management
- Plan education and career paths aligned to personal goals
- Use technology to enhance productivity increase collaboration and communicate effectively
- Work productively in teams while using cultural/global competence

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MSETS1-4, 6.1.8.CivicsDP.1).
9.4.8.DC.2: Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8).
9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information.
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Computer Science & Design Thinking *(CS & DT)*:

The practices describe the behaviors and ways of thinking that computationally literate students use to fully engage in today's data-rich and interconnected world. Computational thinking is at the heart of the practices and refers to the thought processes involved in expressing solutions as computational steps that can be carried out by a computer. It requires understanding the capabilities of computers, formulating problems addressed by a computer, and designing algorithms that a computer can execute. Curriculum writers and educators will want to consider how they can design learning experiences that will enable their students to develop these skills in conjunction with the content knowledge reflected in the core ideas and performance expectations. components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form.

8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.

8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.

Learning Targets

Unit Essential Questions:

- What are different ways to transform a figure?
- How can we use rigid transformations to decide whether two figures are congruent?
- How can transformations help make sense of angle relationships?

Unit Enduring Understandings:

- Different transformations can change the position or orientation of a figure without changing its size or shape, allowing us to explore geometric relationships and properties.
- Rigid transformations—such as translations, rotations, and reflections—preserve size and shape, making them useful tools for determining whether two figures are congruent.
- Understanding transformations can deepen our insight into angle relationships by showing how angles behave under movement and how they relate in geometric figures.

Vocabulary: clockwise, congruent, correspond, counterclockwise, image, preimage, reflection, rigid transformation, rotation, sequence of transformations, tessellation, transformation, translation, transversal

Students will be able to:

- ***Lesson 1 "Transformers" Describing Movement**
  Describe transformations using a variety of languages.

Building Toward: 8.G.A.1, MP7
**Optional Lesson*

- **Lesson 2 "Spinning, Flipping, Sliding" Naming Transformations**
  Determine whether a transformation is a translation, rotation, or reflection and describe how each affects a figure.
  8.G.A.1, MP3. MP6
- **Lesson 3 "Transformation Golf" Sequences of Transformations**
  Use sequences of transformations to move one figure onto another in the context of golf.
  8.G.A.1, MP1, MP7
- **Lesson 4 "Moving Day" Describing Transformations Precisely**
  Translate, reflect, and rotate figures by hand on a square grid.
  8.G.A.1, MP5, MP6, MP7
- **Lesson 5 "Getting Coordinated, Part 1" Coordinates of Translations and Rotations**
  Investigate the effects of a translation or reflection on the coordinates of a transformed image.
  8.G.A.1, 8.G.A.3, MP3, MP8
- **Lesson 6 "Getting Coordinated, Part 2" Coordinates of Transformations**
  Continue to investigate the effects of transformations on coordinates on a plane.
  8.G.A.1, 8.G.A.3, MP3, MP8
- **Lesson 7 "No Bending, No Stretching" Rigid Transformations**
  Introduce the term rigid transformations and see that they preserve lengths and angle measures.
  8.G.A.1, 8.G.A.1.A, 8.G.A.1.B, MP3, MP5, MP7
- **Lesson 8 "Are They the Same?" Defining Congruence**
  Explore what it means for figures to be the “same” and learn the term congruent.
  8.G.A.1, 8.G.A.2, MP6
- **Lesson 9 "Are They Congruent?" Rigid Transformations and Congruent Figures:**
  Use rigid transformations to show two figures are congruent.
  8.G.A.2, MP3, MP6

- **Lesson 10 "Transforming Angles" Angle Measures in Parallel Lines**
  Apply rigid transformations to justify that vertical angles are always congruent and corresponding angles are congruent when parallel lines are cut by a transversal.
  8.G.A.1, 8.G.A.1.A, 8.G.A.1.B, 8.G.A.1.C, 8.G.A.5, MP3, MP7
- **Lesson 11 "Tearing It Up" Angle Sums in Triangles**
  Observe that the sum of the interior angles of a triangle is always 180°.
  8.G.A.2, 8.G.A.5, MP8
- **Lesson 12 "Puzzling It Out" Determining Unknown Angle Measures**
  Solve a variety of angle puzzles and continue exploring the interior angles of a triangle.
  8.G.A.5, MP1, MP3
- **Lesson 13 "Tessellate" Using Transformations to Create Art**
  Use the language of transformations to describe and investigate complex designs, with a particular focus on patterns from Islamic art and architecture.
  8.G.A, 8.G.A.1.A, MP7

Learning Activities: *Suggested or Potential Learning Activities*

Math IXL Skill Practice and Group Jams based on each lesson. IXL Learning engages students in an authentic way, encouraging them to own their learning, embrace new challenges, and build skills and confidence that last. The program offers personalized skills recommendations based on what each student has been practicing and what they are ready to learn next.

DeltaMath practice based on each lesson. DeltaMath includes a variety of interactive features and student response types which enable teachers to effectively scaffold and differentiate concepts to meet the needs of all students.

Students will work in Math IXL and DeltaMath completing recommended skills from their teacher and based on their diagnostic results.

Amplify Desmos 8.1 Sub-Unit 1: Rigid Transformations (Lessons 1-6):

- Education.com Aligned Practice Worksheets:
  - Describing Translations, Describing Reflections

- Translations on a Coordinate Plane, Reflections on a Coordinate Plane
- Describing Rotations
- Rotation on a Coordinate Plane
- Transformations on a Coordinate Plane Rotations Handout
- Transformations on the Coordinate Plane Translations Handout
- Transformations on the Coordinate Plane Reflections Handout
- Sequences of Congruences Transformations

- <u>IXL Aligned Practice Skills:</u>
  - R.1 Identify reflections, rotations, and translations (UYL)
  - R.4 Translations: find the coordinates (RUP)
  - R.3 Translations: graph the image (XUS)
  - R.7 Reflections over the x- and y-axes: find the coordinates (5UM)
  - R.6 Reflections over the x- and y-axes: graph the image (74Z)
  - R.8 Reflections: graph the image (NBM)
  - R.11 Rotations: find the coordinates (HHS)
  - R.10 Rotations: graph the image (AC9)
  - R.14 Sequences of congruence transformations: graph the image (C53)
- <u>DeltaMath Aligned Practice:</u>
  - Identify Translations (Guided)
  - Points Reflected Over an Axis (Graphically)
  - Rotate Figure about Origin (Guided)
  - Identify Transformations (Rigid Motions)
  - Translation of a Point
  - Points Reflected over an Axis
  - Composition of Transformations: Rigid Motions (Discovery)
  - Composition of Transformations: Rigid Motions

<u>Amplify Desmos 8.1 Sub-Unit 2: Congruence (Lessons 7-9):</u>

- Education.com Aligned Practice Worksheets:
    - Side Lengths and Angle Measures of Congruent Figures 1
    - Side Lengths and Angle Measures of Congruent Figures 2
    - Identify Congruent Figures Using Transformations
- IXL Aligned Practice Skills:
    - R.20 Checkpoint: Congruence transformations (CCR)
- DeltaMath Aligned Practice:
    - Identify Corresponding Parts of Congruent Figures
    - Congruence via Rigid Motions (Basic)
    - Congruence and Corresponding Parts

Amplify Desmos 8.1 Sub-Unit 3: Angle Relationships (Lessons 10-13):

- Education.com Aligned Practice Worksheets:
    - Parallel Lines Cut by a Transversal
    - Transversal Lines
    - Transversals of Parallel Lines Angle Relationships
    - Finding Missing Angles in Triangles
    - Interior Angles in Triangles Solve for the Variable
    - Finding Exterior Angles of Triangles
    - Exterior Angles of Triangles Solve for the Variable
    - Finding Missing Interior and Exterior Angles of Triangles 1 & 2
- IXL Aligned Practice Skills:
    - P.2 Find measures of complementary, supplementary, vertical, and adjacent angles (R2B)
    - P.6 Transversals of parallel lines: find angle measures (V99)
    - P.7 Transversals of parallel lines: solve for x (MWL)
    - Q.7 Find missing angles in triangles (JFJ)
    - Q.9 Triangle Angle-Sum Theorem (6Q6)
    - Q.12 Exterior Angle Theorem (FMP)

- Q.15 Checkpoint: Triangles and transversals (EPV)

- DeltaMath Aligned Practice:
  - Vertical/Adjacent/Complementary Angles (Level 1, Level 2, Algebraic)
  - Finding Angles in Transversal Problems (Level 1, Level 2)
  - Transversal Problems with Equations (Level 1, Level 2)
  - Sum of Triangle Angles Proof (Guided)
  - Solve for Interior Angles - Triangle (Level 1, Level 2)
  - Exterior Angles (Triangle)
  - Interior and Exterior Triangle Angles

Additional Activities:

- Amplify Desmos 8.1 Sub-Unit 1: Rigid Transformations (Lessons 1-6):
  - 8.1.05 Boost: Applying Translations (Amplify)
  - 8.1.06 Mini-Lesson: Determining Coordinates After a Rotation (Amplify)
  - 8.1 Sub-Unit 1 Extensions: Rigid Transformations (Amplify)
  - 8.1 Practice Day 1 (Amplify)
  - Translations Cut & Paste Matching Activity (Shared Folder)
  - Translations Digital Drag & Drop (Shared Folder)
  - Translations Spot the Difference (Shared Folder)
  - Reflections Escape Room (Shared Folder)
  - Reflections Card Sort Activity (Shared Folder)
  - Rotations Digital Activity (Shared Folder)
  - Logo Reflection Activity (Shared Folder)
- Amplify Desmos 8.1 Sub-Unit 2: Congruence (Lessons 7-9):
  - 8.1.09 Mini-Lesson: Justifying Congruent Figures (Amplify)
  - 8.1 Sub-Unit 2 Extensions: Congruence (Amplify)
- Amplify Desmos 8.1 Sub-Unit 3: Angle Relationships (Lessons 10-13):
  - 8.1.10 Boost: Identifying and Proving Congruence (Amplify)

- 8.1.12 Mini-Lesson: Determining Unknown Interior and Exterior Angles (Amplify)
- 8.1 Sub-Unit 3 Extensions: Angle Relationships (Amplify)
- 8.1 Practice Day 2 (Amplify)
- Parallel Lines and Transversals Digital Activity
- Special Angle Pairs Color by Number
- Spider Web Angle Challenge
- Design Your Own City Angle Activity
- 8.1 Unit Synthesis and Reflection (Amplify)

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Assessment Evidence

Formative Assessments: Pre-Unit Check (optional), Sub-Unit Quiz, Show What You Know

Summative Assessments: End-of-Unit Assessment

Common Benchmark Assessments: Common Cumulative Assessment

Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials

Core Instructional Program: Amplify Desmos Math Online Platform

Desmos Materials by Lesson: • colored pencils (Lessons 1, 4, 13) • notecards (as needed) (Lesson 7) • protractors (Lessons 7, 10) • rulers (Lessons 4, 7) • straightedges (Lessons 1, 3, 5, 10, 11, 13) • tracing paper (Lessons 3–4, 6–13)

Math IXL Flex Diagnostic & Practice, Education.com, DeltaMath, LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one - Additional time - Review of directions - Student restates information - Space for movement or breaks - Extra visual and verbal cues and prompts - Preferential seating - Follow a routine/schedule - Rest breaks - Verbal and visual cues regarding directions and staying on task - Checklists - Immediate feedback - Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Specific Strategies and Practices that Support English Language Learners:
English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts - Personal Glossary - Extended Time - Simplified/Verbal Instructions - Frequent Breaks - Visual learning, including graphic organizers - Use of cognates to increase comprehension - Teacher modeling - Pairing students with beginning English language skills with students who have more advanced English language skills - Scaffolding - Word walls - Think-pair-share - Cooperative learning groups - Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Students at Risk of Failure:

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice - Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments - Opportunities for make-up work or reduce number of assignments - Provide access to extra help when possible

Students with 504 Plans:

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan. 504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students:

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Homogenous Grouping - Small Group In-Depth Instruction - Differentiated Online Practice - Alternative Assessments - Pre-Assess to provide Differentiated Instruction to Accelerate Learning

-Enrichment/Extension Activities within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Unit 2

Desired Results

Unit 2 Title: Dilations, Similarity, and Slope

Unit Summary: Students study dilations and similar figures. They use similar triangles to explain, understand, and apply the concept of slope.

Sub-Unit 1: Dilations (Lessons 1–5 + Practice Day + Quiz)

- Dilate figures on and off a coordinate grid.
- Identify the scale factor and the center of dilation.

Sub-Unit 2: Similarity (Lessons 6–8)

- Use transformations to determine whether two figures are similar.
- Justify whether two figures are similar using terms such as *translation*, *reflection*, *rotation*, *dilation*, *preimage*, and *image*.

Sub-Unit 3: Slope (Lessons 9–10 + Practice Day)

- Make connections between the slope of a line and similar triangles created by that line.
- Determine the slopes of lines.

Learning Standards

NJSLS Math:

8.EE Expressions and Equations
B. Understand the connections between proportional relationships, lines, and linear equations

6. Use similar triangles to explain why the slope 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. **8.EE.B.6**

8.G Geometry
A. Understand congruence and similarity using physical models, transparencies, or geometry software

2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. **8.G.A.2**

3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. **8.G.A.3**

4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. **8.G.A.4**

5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.* **8.G.A.5**

Math Practices: MP1, MP2, MP3, MP4, MP5, MP6, MP7, MP8

Interdisciplinary Connections

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(hardware) and instructions (software) that make up a computing system communicate and process information in digital form.

8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.

8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.

Learning Targets

Unit Essential Questions:

- What does it mean to dilate a figure?
- How can transformations be used to decide whether two figures are similar?
- How can similar triangles be used to determine the slope of a line?

Unit Enduring Understandings:

- Dilating a figure changes its size while maintaining its shape and angle measures, which helps in understanding proportional relationships in geometry.
- Transformations, including dilations, can be used to determine whether two figures are similar by comparing their corresponding angles and proportional side lengths.
- Similar triangles can be used to determine the slope of a line by comparing vertical and horizontal changes, reinforcing the concept of slope as a ratio.

Vocabulary: center of a dilation, dilation, scale factor, similar, slope, slope triangle

Students will be able to:

- **Lesson 1 "Sketchy Dilations" - Introducing Dilations**
  Explore the concept of dilation as a process that produces scaled copies of an original figure.
  8.G.A.3, MP3
- **Lesson 2 "Dilation Mini Golf" - Dilations With No Grid**
  Perform dilations using measurement tools without a grid.
  8.G.A.3, MP6
- **Lesson 3 "Transformation Golf With Dilations" - Sequences of Transformations**
  Perform a sequence of transformations, including dilations, to move one figure onto another.
  8.G.A.1, 8.G.A.3, 8.G.A.4, MP1, MP6
- **Lesson 4 "'Match My Dilation" - Dilations on a Square Grid**
  Dilate figures using a square grid to support measuring distances.
  8.G.A.3, MP6, MP7
- **Lesson 5 "Dilations on a Plane" - Dilations With Coordinates**
  Dilate figures using the coordinate plane.
  8.G.A.3, MP6, MP7
- **Lesson 6 "Social Scavenger Hunt" -Similar Figures, Sides, and Angles**
  Justify whether two figures are similar, congruent, or neither using transformations.
  8.G.A.2, 8.G.A.4, MP3, MP6
- **Lesson 7 "Are Angles Enough?" - Similar Triangles**
  Justify that two triangles are similar using their angle measures.
  8.G.A.5, MP3, MP8
- **Lesson 8 "Shadows" - Side Length Relationships in Similar Triangles**
  Determine missing side lengths of similar triangles using equivalent ratio relationships.
  8.G.A, MP2, MP4
- **Lesson 9 "Water Slide" - Similarity and Slope**
  Use similar triangles and their height-to-base ratio to make sense of a given line's slope.
  8.EE.B.6, MP2, MP7

- **Lesson 10 "Slope Challenges" - Developing Fluency with Slope**
  Use slope triangles to determine slopes of lines on the coordinate plane.
  8.EE.B.6, MP3, MP8

Learning Activities: *Suggested or Potential Learning Activities*

Math IXL Skill Practice and Group Jams based on each lesson. IXL Learning engages students in an authentic way, encouraging them to own their learning, embrace new challenges, and build skills and confidence that last. The program offers personalized skills recommendations based on what each student has been practicing and what they are ready to learn next.

DeltaMath practice based on each lesson. DeltaMath includes a variety of interactive features and student response types which enable teachers to effectively scaffold and differentiate concepts to meet the needs of all students.

Students will work in Math IXL and DeltaMath completing recommended skills from their teacher and based on their diagnostic results.

Amplify Desmos 8.2 Sub-Unit 1: Dilations (Lessons 1-5):

- Education.com Aligned Practice Worksheets:
  - Describing Dilations, Find the Scale Factor 1 & 2
  - Dilations on the Coordinate Plane
  - Transformations on the Coordinate Plane Dilations Handout
- IXL Aligned Practice Skills:
  - S.2 Dilations: graph the image (9T4)
  - S.3 Dilations: find the coordinates (UV9)
- DeltaMath Aligned Practice:
  - Find the Scale Factor (Level 1, Level 2)
  - Scaled Figures (Level 1, Level 2, Level 3)
  - Create Scaled Drawings on a Grid (Level 1, Level 2)
  - Dilations of Segments and Angles
  - Dilation of a Point

- Dilations on the Coordinate Plane
- Composing Transforms: Shapes (Discovery, Shapes)

Amplify Desmos 8.2 Sub-Unit 2: Similarity (Lessons 6-8):

- Education.com Aligned Practice Worksheets:
  - Identify Similar Figures using Transformations
- IXL Aligned Practice Skills:
  - S.11 Checkpoint: Similarity transformations (DYW)
- DeltaMath Aligned Practice:
  - Similar Figures / Direct Scale (Level 1, Level 2)
  - Similar Figures / Proportion (Level 1, Level 2, Level 3)
  - Solve for Side or Perimeter, Similar Triangles
  - Scaled Figures Perimeter and Area (Level 1, Level 2)
  - Identify Corresponding Parts of Similar Figures
  - Congruence versus Similarity

Amplify Desmos 8.2 Sub-Unit 3: Slope (Lessons 9-10):

- Education.com Aligned Practice Worksheets:
  - Finding Slope from a Graph
- IXL Aligned Practice Skills:
  - Z.1 Find the slope from a graph (D7M)
- DeltaMath Aligned Practice:
  - Finding the Slope Graphically

Additional Activities:

- Amplify Desmos 8.2 Sub-Unit 1: Dilations (Lessons 1-5):
  - 8.2.04 Mini-Lesson: Dilating Figures on a Square Grid (Amplify)
  - 8.2.04 Boost: Dilating on a Grid (Amplify)
  - 8.2 Sub-Unit 1 Extensions: Dilations (Amplify)
  - 8.2 Practice Day 1 (Amplify)

- Dilate Your Name Activity
- Performance Task “Pedro’s Pool Party” (Education.com)

- Amplify Desmos 8.2 Sub-Unit 2: Similarity (Lessons 6-8):
  - 8.2.08 Mini-Lesson: Determining Missing Side Lengths in Similar Triangles (Amplify)
  - 8.2.08 Boost: Missing Side Lengths on Similar Triangles (Amplify)
  - 8.2 Sub-Unit 2 Extensions: Similarity (Amplify)
  - Scale City Activity
- Amplify Desmos 8.2 Sub-Unit 3: Slope (Lessons 9-10):
  - 8.2.10 Mini-Lesson: Calculating Slope By Drawing Triangles on a Coordinate Plane (Amplify)
  - 8.2 Sub-Unit 3 Extensions: Slope (Amplify)
  - 8.2 Practice Day 2 (Amplify)
  - 8.2 Unit Synthesis and Reflection (Amplify)

Assessment Evidence

Formative Assessments: Pre-Unit Check (optional), Sub-Unit Quiz, Show What You Know

Summative Assessments: End-of-Unit Assessment

Common Benchmark Assessments: Common Cumulative Assessment

Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials

Core Instructional Program: Amplify Desmos Math Online Platform
Desmos Materials by Lesson: • coloring tools (Lessons 5, 8) • graph paper (as needed) (Lessons 4, 9) • protractors (Lesson 6, Practice Day 2) • rulers (Lessons 2, 6, Practice Days 1–2) • straightedges (Lessons 1–6, 8–10) • tracing paper (Lessons 3, 6–7, Practice Days 1–2)
Math IXL Flex Diagnostic & Practice, Education.com, DeltaMath, LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one - Additional time - Review of directions - Student restates information - Space for movement or breaks - Extra visual and verbal cues and prompts - Preferential seating - Follow a routine/schedule - Rest breaks - Verbal and visual cues regarding directions and staying on task - Checklists - Immediate feedback - Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Specific Strategies and Practices that Support English Language Learners:
English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts - Personal Glossary - Extended Time - Simplified/Verbal Instructions - Frequent Breaks - Visual learning, including graphic organizers - Use of cognates to increase comprehension - Teacher modeling - Pairing students with beginning English language skills with students who have more advanced English language skills - Scaffolding - Word walls - Think-pair-share - Cooperative learning groups- Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Students at Risk of Failure:

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice - Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments - Opportunities for make-up work or reduce number of assignments - Provide access to extra help when possible

Students with 504 Plans:

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan. 504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan. -

Specific Strategies and Practices that Support Gifted & Talented Students:

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Homogenous Grouping - Small Group In-Depth Instruction - Differentiated Online Practice - Alternative Assessments - Pre-Assess to provide Differentiated Instruction to Accelerate Learning

-Enrichment/Extension Activities within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Unit 3

Desired Results

Unit 3 Title: Proportional and Linear Relationships

Unit Summary: Students make connections between proportional relationships and non-proportional linear relationships. They compare representations of linear relationships and interpret them in context. Students also determine solutions to two-variable linear equations of different forms.

Sub-Unit 1: Proportionality Revisited (Lessons 1–3)

- Compare and interpret proportional relationships using multiple representations such as equations, tables, and graphs.

Sub-Unit 2: Linear Relationships (Lessons 4–8 + Practice Day + Quiz)

- Represent non-proportional linear relationships with equations, tables, and graphs.
- Interpret the vertical intercept and slope of a linear relationship in context.

Sub-Unit 3: Linear Equations and Points (Lessons 9–13 + Practice Day)

- Write an equation for a linear relationship given two points.
- Make connections between graphs and solutions of two-variable linear equations.
- Analyze strategies for calculating the slope and vertical intercept of a line through two points.

Learning Standards

NJSLS Math:

8.EE Expressions and Equations
B. Understand the connections between proportional relationships, lines, and linear equations

5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.* **8.EE.B.5**

6. Use similar triangles to explain why the slope 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. **8.EE.B.6**

8.F Functions
B. Use functions to model relationships between quantities

4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. **8.F.B.4**

8.G Geometry
A. Understand congruence and similarity using physical models, transparencies, or geometry software

1. Verify experimentally the properties of rotations, reflections, and translations. **8.G.A.1**

Math Practices: MP1, MP2, MP3, MP4, MP5, MP6, MP7, MP8

Interdisciplinary Connections
Career Readiness, Life Literacies, & Key Skills *(CLKS)*: ● Act as a responsible and contributing community members and employee ● Attend to financial well-being ● Consider the environmental, social and economic impacts of decisions ● Demonstrate creativity and innovation ● Utilize critical thinking to make sense of problems and persevere in solving them ● Model integrity, ethical leadership and effective management ● Plan education and career paths aligned to personal goals ● Use technology to enhance productivity increase collaboration and communicate effectively ● Work productively in teams while using cultural/global competence **9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MSETS1-4, 6.1.8.CivicsDP.1). **9.4.8.CT.3:** Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome. **9.4.8.IML.2:** Identify specific examples of distortion, exaggeration, or misrepresentation of information. **9.4.8.TL.3:** Select appropriate tools to organize and present information digitally.
Computer Science & Design Thinking *(CS & DT)*: The practices describe the behaviors and ways of thinking that computationally literate students use to fully engage in today's data-rich and interconnected world. Computational thinking is at the heart of the practices and refers to the thought processes involved in expressing solutions as computational steps that can be carried out by a computer. It requires understanding the capabilities of computers, formulating problems addressed by a computer, and designing algorithms that a computer can execute. Curriculum writers and educators will want to consider how they can design learning experiences that will enable their students to develop these skills in conjunction with the content knowledge reflected in the core ideas and performance expectations. components

(hardware) and instructions (software) that make up a computing system communicate and process information in digital form.

8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.

8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.

Learning Targets

Unit Essential Questions:

- What can proportional relationships and slope teach you about linear relationships?
- How do equations, tables, and graphs of linear relationships connect to one another?
- What does it mean for an ordered pair to be a solution to a linear equation?

Unit Enduring Understandings:

- Proportional relationships and slope help us recognize and describe linear relationships, revealing patterns in how quantities change in relation to one another.
- Equations, tables, and graphs of linear relationships are interconnected representations that describe the same relationship in different ways.
- An ordered pair is a solution to a linear equation if it makes the equation true, meaning the point lies on the graph of the equation.

Vocabulary: horizontal intercept (x-intercept), linear relationship, solution, vertical intercept (y-intercept)

Students will be able to:

- **Lesson 1 "Turtle Time Trials" - Understanding Proportional Relationships**
  Explore a proportional relationship context with multiple representations.
  8.EE.B.5, MP1, MP4

- **Lesson 2 “Water Tank” - Graphs of Proportional Relationships**
  Compare slopes of proportional relationship graphs and write equations.
  8.EE.B.5, 8.EE.B.6, MP1, MP2, MP3
- **Lesson 3 “Proportional Posters” - Comparing Proportional Relationships**
  Analyze a real-world situation and compare proportional relationships in context.
  8.EE.B.5, MP1, MP3, MP5
- **Lesson 4 “Flags” - Introduction to Linear Relationships**
  Examine proportional and non-proportional relationships in context and identify rates of change and initial values.
  8.EE.B, 8.F.B.4, MP1, MP2, MP6
- **Lesson 5 “Water Cooler” - Slopes Don’t Have to Be Positive**
  Explore lines with decreasing slope through a context.
  8.F.B.4, MP1, MP2, MP8
- **Lesson 6 “Ups and Downs” - Analyzing Linear Relationships**
  Explore linear relationships in context and match them to representations.
  8.EE.B.6, 8.F.B.4, MP2, MP6
- **Lesson 7 “Stacking Cups” - More With Linear Relationships**
  Use a linear relationship to make a prediction.
  8.F.B.4, MP4
- **Lesson 8 “Translations” - Translating y = mx + b**
  Make sense of translated lines of proportional relationships to understand linear equations.
  8.EE.B.6, 8.G.A.1, MP1, MP7
- **Lesson 9 “Landing Planes” - Calculating Slope**
  Determine strategies for calculating slope given two points on a line.
  8.EE.B.6, MP7, MP8

- **Lesson 10 “Coin Capture” - Horizontal and Vertical Lines:**
  Write equations for vertical and horizontal lines.
  8.EE.B, MP3, MP6, MP7,
- **Lesson 11 “Why Intercepts” - Equations of All Kinds of Lines**
  Write an equation for a line that passes through two points.
  8.EE.B, 8.F.B.4, MP1, MP3, MP6
- **Lesson 12 “Solutions” - Solutions to Linear Equations**
  Explore solutions to linear equations shown in different forms.
  8.F.B.4, MP3, MP6
- **Lesson 13 “Pennies and Quarters” - Using Linear Relationships to Solve Problems**
  Determine solutions to real world relationships using multiple representations of linear relationships.
  8.F.B.4, MP4, MP7

Learning Activities: *Suggested or Potential Learning Activities*

Math IXL Skill Practice and Group Jams based on each lesson. IXL Learning engages students in an authentic way, encouraging them to own their learning, embrace new challenges, and build skills and confidence that last. The program offers personalized skills recommendations based on what each student has been practicing and what they are ready to learn next.

DeltaMath practice based on each lesson. DeltaMath includes a variety of interactive features and student response types which enable teachers to effectively scaffold and differentiate concepts to meet the needs of all students.

Students will work in Math IXL and DeltaMath completing recommended skills from their teacher and based on their diagnostic results.

Amplify Desmos 8.3 Sub-Unit 1: Proportionality Revisited (Lessons 1-3):

- Education.com Aligned Practice Worksheets:
  - Constant of Proportionality Tables, Graphs, and Equations
  - Find the Constant of Proportionality from Graphs
  - Graphing Proportional Relationships

    - Graph Proportional Relationships 1 & 2
    - Comparing Proportional Relationships
- IXL Aligned Practice Skills:
    - X.2 Write equations for proportional relationships from tables (S69)
    - X.5 Write equations for proportional relationships from graphs (G7N)
    - X.9 Graph proportional relationships and find the slope (MQD)
- DeltaMath Aligned Practice:
    - Compare Rate of Change, Proportional Representations
    - Equation of a Proportional Graph
    - Proportional Equation With Table/Context

Amplify Desmos 8.3 Sub-Unit 2: Linear Relationships (Lessons 4-8):

- Education.com Aligned Practice Worksheets:
    - Slope Review Graphs
    - Slope Intercept Form Writing Equations
    - Write Equations in Slope Intercept Form
    - Slope Intercept Form Graphing Lines
- IXL Aligned Practice Skills:
    - AA.6 Write a linear equation from a slope and y-intercept (WHP)
    - AA.7 Write a linear equation from a graph (WHM)
    - AA.4 Graph a line from an equation in slope-intercept form (W5E)
    - Z.1 Find the slope from a graph (D7M)
    - CC.6 Interpret the slope and y-intercept of a linear function (H5B)
    - CC.10 Write linear functions: word problems (YK6)
    - CC.11 Evaluate a linear function: word problems (DA6)
- DeltaMath Aligned Practice:
    - Graph Line from Slope/Y-intercept
    - Find Slope/Y-Intercept from Equation (Slope Intercept Form)

- Writing Equations of Lines
- Interpret Linear Equation in Context (MC)
- Interpret Linear Graph in Context (MC)
- Make Table and Equation Given Linear Situation

Amplify Desmos 8.3 Sub-Unit 3: Linear Equations and Points (Lessons 9-13):

- Education.com Aligned Practice Worksheets:
  - Finding Slope from Two Points
  - Finding Slope from Two Points Practice
  - Finding Slope from Two Points Card Sort
  - Rate of Change: Tables
  - Slope Review Points
  - Finding Slope from a Graph Card Sort
  - Write Equations in Slope Intercept Form from a Table
  - Write a Linear Equation from Two Points
  - Write a Linear Equation from the Slope and a Point
  - Linear Function Word Problems
- IXL Aligned Practice Skills:
  - Z.2 Find the slope from two points (ZAC)
  - Z.4 Find a missing coordinate using slope (R5P)
  - AA.12 Graph a horizontal or vertical line (ZWP)
  - CC.7 Write a linear function from a table (UYY)
  - AA.8 Write a linear equation from a slope and a point (VKP)
  - AA.9 Write a linear equation from two points (2R9)
  - AA.11 Graph a line from an equation in standard form (7MZ)
  - CC.6 Interpret the slope and y-intercept of a linear function (H5B)
  - CC.10 Write linear functions: word problems (YK6)
  - CC.11 Evaluate a linear function: word problems (DA6)

- DeltaMath Aligned Practice:
    - Finding the Slope from Points
    - Table to Linear Equation (Level 1, Level 2, Level 3)
    - Find Rates (Linear Representations)
    - Find Rates in Context
    - Vertical and Horizontal Lines
    - Lines from Point/Slope (Diagonal Only)
    - Line Equations from Point/Slope
    - Lines from Two Points (Diagonal Only)
    - Line Equation from Two Points

Additional Activities:

- Amplify Desmos 8.3 Sub-Unit 1: Proportionality Revisited (Lessons 1-3):
    - 8.3.02 Mini-Lesson: Writing Equations to Represent Proportional Relationships (Amplify)
    - Performance Task: Block Party Planning (Education.com)
    - 8.3 Sub-Unit 1 Extensions: Proportionality Revisited (Amplify)
- Amplify Desmos 8.3 Sub-Unit 2: Linear Relationships (Lessons 4-8)
    - 8.3.05 Mini-Lesson: Interpreting Slope and Intercepts of Linear Relationships (Amplify)
    - 8.3.08 Boost: Write the Equations of Translated Lines (Amplify)
    - 8.3 Sub-Unit 2 Extensions: Linear Relationships (Amplify)
    - 8.3 Practice Day 1 (Amplify)
- Amplify Desmos 8.3 Sub-Unit 3: Linear Equations and Points (Lessons 9-13):
    - 8.3.09 Mini-Lesson: Calculating Slope Given Two Points (Amplify)
    - 8.3.09 Boost: Find Slope Using Two Points (Amplify)
    - 8.3 Sub-Unit 3 Extensions: Linear Equations and Points (Amplify)
    - 8.3 Practice Day 2 (Amplify)
    - Candy Jar Task
    - 8.3 Unit Synthesis and Reflection (Amplify)

Assessment Evidence

Formative Assessments: Pre-Unit Check (optional), Sub-Unit Quiz, Show What You Know

Summative Assessments: End-of-Unit Assessment

Common Benchmark Assessments: Common Cumulative Assessment

Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials

Core Instructional Program: Amplify Desmos Math Online Platform

Desmos Materials by Lesson: • calculators (as needed) (Lessons 10, 13) • coloring tools (Lessons 1–6, 8, 11) • highlighters (Lessons 5, 8) • Desmos graphing calculator (as needed) (Lesson 3) • graph paper (Lessons 3, 7, 9, 11) • poster paper (Lesson 3) • stackable cups with a lip, like foam cups (as needed) (Lesson 7) • straightedges (Lessons 1–5, 8–12) • tracing paper (as needed) (Lesson 8) • U.S. coins, photos of U.S. coins, or coin manipulatives (as needed) (Lesson 13)

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Accommodations and Modifications:

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Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Students at Risk of Failure:

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online

Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice

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Unit 4

Desired Results

Unit 4 Title: Linear Equations and Linear Systems

Unit Summary: Students solve linear equations and determine the number of possible solutions. They also solve systems of two linear equations algebraically and graphically.

Sub-Unit 1: Solving Linear Equations (Lessons 1–8 + Practice Day + Quiz)

- Write and solve equations with variables on both sides of the equal sign.
- Determine the number of solutions to a linear equation.

Sub-Unit 2: Systems of Linear Equations (Lessons 9–14 + Practice Day)

- Solve systems of linear equations in two variables graphically and algebraically.
- Determine the number of solutions to a system of linear equations.

Learning Standards

NJSLS Math:

8.EE Expressions and Equations
C. Analyze and solve linear equations and pairs of simultaneous linear equations

7. Solve linear equations in one variable.

a. 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). **8.EE.C.7a**

b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. **8.EE.C.7b**

C. Analyze and solve linear equations and pairs of simultaneous linear equations

8. Analyze and solve pairs of simultaneous linear equations.

a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. **8.EE.C.8.a**

b. Solve systems of two linear equations in two variables using the substitution method and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example: by inspection, conclude that* $3x + 2y = 5$ *and* $3x + 2y = 6$ *have no solution because* $3x + 2y$ *cannot simultaneously be 5 and 6. Solve* $3x + y = 30$ *and* $y = 2x$ *using the substitution method; Solve* $y = 3x + 1$ *and* $y = -2x + 7$ *using the substitution method.* **8.EE.C.8.b**

c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersec*ts the line through the second pair. **8.EE.C.8.c**

Math Practices: MP1, MP2, MP3, MP4, MP5, MP6, MP7, MP8

Interdisciplinary Connections
Career Readiness, Life Literacies, & Key Skills *(CLKS)*: ● Act as a responsible and contributing community members and employee ● Attend to financial well-being ● Consider the environmental, social and economic impacts of decisions ● Demonstrate creativity and innovation ● Utilize critical thinking to make sense of problems and persevere in solving them ● Model integrity, ethical leadership and effective management ● Plan education and career paths aligned to personal goals ● Use technology to enhance productivity increase collaboration and communicate effectively ● Work productively in teams while using cultural/global competence **9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MSETS1-4, 6.1.8.CivicsDP.1). **9.4.8.CT.3:** Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome. **9.4.8.IML.2:** Identify specific examples of distortion, exaggeration, or misrepresentation of information. **9.4.8.TL.3:** Select appropriate tools to organize and present information digitally.
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(hardware) and instructions (software) that make up a computing system communicate and process information in digital form.

8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.

8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**
• How can you solve an equation with variables on both sides of the equal sign? • How can systems of equations be used to represent situations and solve problems? • What does it mean for an equation or system of equations to have no, one, or infinitely many solutions?	• Equations with variables on both sides can be solved by using properties of equality to isolate the variable and maintain balance in the equation. • Systems of equations can model real-world situations and be used to find solutions that satisfy multiple conditions at the same time. • An equation or system of equations can have no solution, one solution, or infinitely many solutions, depending on the relationships between the equations involved.

Vocabulary: equivalent equations, infinitely many solutions, point of intersection, solution to a system of equations, system of equations

Students will be able to:

- **Lesson 1 “Numbers Machines” - Exploring Inputs and Outputs**
  Explore the input and output of number machines with given steps.
  Building Toward: 8.EE.C.7, 8.F.A.1, MP7
- **Lesson 2 “Keep it Balanced” - Creating Equivalent Equations**
  Utilize hanger diagrams from prior grades to calculate the weight of an unknown object and explain the strategy used.
  8.EE.C, MP2, MP3
- **Lesson 3 “Balanced Moves” - Creating More Equivalent Equations**
  Connect the moves made on balanced hangers with the moves used to create equivalent equations.
  8.EE.C.7, MP2, MP3
- **Lesson 4 “More Balanced Moves” - Solving Equations**
  Develop fluency with solving linear equations with parentheses and variables on both sides.
  8.EE.C.7, 8.EE.C.7.B, MP3, MP6, MP7
- **Lesson 5 “Equation Roundtable” - Analyzing Unbalanced Equations**
  Develop fluency in solving equations by analyzing solving steps, including strategies for linear equations with rational number coefficients.
  8.EE.C.7, 8.EE.C.7.B, MP3, MP6
- **Lesson 6 “All, Some, or None? Part 1” - How Many Solutions?**
  Explore the idea of equations with no solution and infinitely many solutions using number machines.
  8.EE.C.7.A, MP3, MP7
- **Lesson 7 “Strategic Solving Part 1” - Solving Many Types of Equations**
  Make sense of and solve equations with no solution, one solution, and infinitely many solutions.
  8.EE.C.7, 8.EE.C.7.B, MP1, MP7
- **Lesson 8 “When Will They Meet” - Solving Linear Equations in Context**
  Apply knowledge of solving equations by considering two vehicles moving on a road.
  8.EE.C.7, MP2

- **Lesson 9 “On or Off the Line?” - Interpreting Points On or Off the Line**
  Consider pairs of linear equations in various contexts and interpret the meaning of points on and off the lines.
  8.EE.C.8, MP2, MP3, MP6, MP7
- **Lesson 10 “On Both Lines” - Representing Systems of Linear Equations**
  Analyze two linear relationships and graphs of lines in context.
  8.EE.C.8, 8.EE.C.8.B, 8.EE.C.8.C, MP1, MP4, MP6
- **Lesson 11 “Make Them Balance” - Graphing Systems of Linear Equations**
  Explore the concept of a system of equations and its solution(s) using the familiar context of balanced hangers.
  8.EE.C.8, 8.EE.C.8.A, 8.EE.C.8.B, MP7
- **Lesson 12 “Line Zapper” - Solving Systems of Linear Equations**
  Continue to explore systems where both equations are of the form y = mx + b.
  8.EE.C.8, 8.EE.C.8.B, MP6, MP7
- **Lesson 13 “All, Some, or None? Part 1” - Systems of Equations With No, One, or Many Solutions**
  Connect algebraic and graphical representations of systems and determine the number of solutions from both representations.
  8.EE.C.8, 8.EE.C.8.B, MP7
- **Lesson 14 “Strategic Solving Part 2” -Solving More Systems of Equations**
  Identify, describe, and employ strategies for solving linear systems of equations with different structures.
  8.EE.C.8, 8.EE.C.8.B, MP3, MP7

Learning Activities:
Math IXL Skill Practice and Group Jams based on each lesson. IXL Learning engages students in an authentic way, encouraging them to own their learning, embrace new challenges, and build skills and confidence that last. The program offers personalized skills recommendations based on what each student has been practicing and what they are ready to learn next.
DeltaMath practice based on each lesson. DeltaMath includes a variety of interactive features and student

response types which enable teachers to effectively scaffold and differentiate concepts to meet the needs of all students.
Students will work in Math IXL and DeltaMath completing recommended skills from their teacher and based on their diagnostic results.

Amplify Desmos 8.4 Sub-Unit 1: Solving Linear Equations (Lessons 1-8):

- Education.com Aligned Practice Worksheets:
  - Evaluating Expressions using Variables
  - Solving Two-Step Equations Levels 1 & 2
  - Solve Equations with Variables on Both Sides
  - Solve Equations with Like Terms Level 2
  - Solve Equations with the Distributive Property
  - Solving Multi-Step Equations Part 1
  - Solving Multi-Step Equations Part 2
  - Multi-Step Equations Tic-Tac-Toe
  - Linear Equations Number of Solutions
  - Solutions to Linear Equations
  - Linear Equations One solution No solution Infinitely many solutions Card Sort
- IXL Aligned Practice Skills:
  - M.8 Solve two-step equations (JXD)
  - M.11 Solve equations involving like terms (Q2B)
  - M.12 Solve equations with variables on both sides (ZYL)
  - M.13 Solve equations with variables on both sides: fractional coefficients (UEM)
  - M.11 Solve equations involving like terms (Q2B)
  - M.12 Solve equations with variables on both sides (ZYL)
  - M.15 Solve equations with the distributive property (8RP)
  - M.16 Solve multi-step equations (55K)
  - M.17 Solve multi-step equations with fractional coefficients (2AZ)

- M.18 Solve equations: mixed review (HZZ)
- M.14 Solve equations with variables on both sides: word problems (BRX)
- M.20 Find the number of solutions (XDE)
- M.21 Create equations with no solutions or infinitely many solutions (7TY)
- GG.13 Solve a system of equations using any method: word problems (VHE)
- GG.14 Checkpoint: Systems of equations (MFL)

- DeltaMath Aligned Practice:
  - Make Table, Plot, Graph - Linear (Level 1, Level 2, Level 3)
  - Two Step Equations
  - Two Step Equations with Decimals
  - Two Step Equations with Fractional Coefficients (Level 1, Level 2)
  - Three Step Linear Equations
  - Value that Makes Equation True (Multiple Choice) (Level 1 ,Level 2)
  - Use Structure: 1, 0, Infinite Solutions (Level 1, Level 2)
  - One Var Equations: 1, 0, Infinite Solutions (Level 1, Level 2)
  - Solve Equations in Context (Unwinding), (MC)

Amplify Desmos 8.4 Sub-Unit 2: Systems of Linear Equations (Lessons 9-14):

- Education.com Aligned Practice Worksheets:
  - Solving Systems of Linear Equations: Graphing
  - Systems of Equations: Graphing #1, #2, #3
  - Systems of Linear Equations Word Problems: Graphing
  - Solving Systems of Linear Equations: Substitution
  - Systems of Equations: Substitution #1, #2, #3
  - Systems of Linear Equations Word Problems: Substitution
  - Systems of Equations Substitution Maze
  - Systems of Linear Equations: Word Problems
  - Solving Systems of Linear Equations: Elimination

    - Systems of Equations: Elimination #1, #2, #3
    - Systems of Linear Equations Word Problems: Elimination
    - Solutions to Systems of Equations
    - Systems of Equations: Number of Solutions
    - Systems of Equations Elimination Maze
    - Solving Systems of Equations: Any Method
- IXL Aligned Practice Skills:
    - AA.1 Is (x, y) a solution to the linear equation? (5BD)
    - GG.1 Is (x, y) a solution to the system of equations? (N46)
    - GG.2 Solve a system of equations by graphing (WV5)
    - GG.8 Solve a system of equations using substitution (J8X)
    - GG.10 Solve a system of equations using elimination (ZQV)
    - GG.12 Solve a system of equations using any method (AM5)
    - GG.13 Solve a system of equations using any method: word problems (VHE)
    - GG.14 Checkpoint: Systems of equations (MFL)
- DeltaMath Aligned Practice:
    - System of Equations from Context Graphically (Guided)
    - Solve Linear System Graphically (Graphs Given)
    - Solve Linear System Graphically (Level 1, Level 2)
    - Determine Number of Solutions in System
    - Elimination Strategy
    - Elimination (Level 1)
    - Substitution (Level 1, Level 2)
    - Write System of Equations from Context

Additional Activities:

Amplify Desmos 8.4 Sub-Unit 1: Solving Linear Equations (Lessons 1-8):

- 8.4.04 Mini-Lesson: Solving Equations Using Parentheses (Amplify)

- 8.4 Sub-Unit 1 Extensions: Solving Linear Equations (Amplify)
- 8.4 Practice Day 1 (Amplify)
- 8.4 Sub-Unit 1 Extensions: Solving Linear Equations (Amplify)
- Solving Multi Step Equations Google Slide Digital pack
- Halloween Pixel - Solving Multi-Step Equations With Variables on Both Sides

Amplify Desmos 8.4 Sub-Unit 2: Systems of Linear Equations (Lessons 9-14):

- 8.4.11 Mini-Lesson: Solving Systems of Linear Equations by Graphing (Amplify)
- 8.4.12 Boost: Solve a System of Equations Algebraically (Amplify)
- 8.4.13 Boost Personalized Learning Activity: Graph System of Equations with No, One, or Many Solutions (Amplify)
- 8.4 Sub-Unit 2 Extensions: Systems of Linear Equations (Amplify)
- 8.4 Practice Day 2 (Amplify)
- Performance Task: Find the Treasure (Education.com)
- Systems of Equations Digital Task Cards Mystery Puzzle
- Graphing Systems Digital Activity
- 8.4 Unit Synthesis and Reflection (Amplify)

Assessment Evidence
Formative Assessments: Pre-Unit Check (optional), Sub-Unit Quiz, Show What You Know
Summative Assessments: End-of-Unit Assessment
Common Benchmark Assessments: Common Cumulative Assessment
Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials

Core Instructional Program: Amplify Desmos Math Online Platform

Desmos Materials by Lesson: • coloring tools (Lessons 2, 5, 10, 12) • graph paper (Lesson 10, Practice Day 2) • poster paper (Lesson 10) • scrap paper (Lessons 7, 12) • straightedges (Lessons 10, 13–14) • calculators (as needed) (Lessons 4–5, 7, 11, Practice Days 1–2) • coins or coin manipulatives (as needed) (Lesson 9) • graphing calculators (as needed) (Lesson 13) • highlighters (as needed) (Lesson 12)

Math IXL Flex Diagnostic & Practice, Education.com, DeltaMath, LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one - Additional time - Review of directions - Student restates information - Space for movement or breaks - Extra visual and verbal cues and prompts - Preferential seating - Follow a routine/schedule - Rest breaks - Verbal and visual cues regarding directions and staying on task -

Checklists - Immediate feedback - Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Specific Strategies and Practices that Support English Language Learners:

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts - Personal Glossary - Extended Time - Simplified/Verbal Instructions - Frequent Breaks - Visual learning, including graphic organizers - Use of cognates to increase comprehension - Teacher modeling - Pairing students with beginning English language skills with students who have more advanced English language skills - Scaffolding - Word walls - Think-pair-share - Cooperative learning groups - Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Students at Risk of Failure:

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments - Opportunities for make-up work or reduce number of assignments - Provide access to extra help when possible

Students with 504 Plans:

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan. 504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students:

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Homogenous Grouping - Small Group In-Depth Instruction - Differentiated Online Practice - Alternative Assessments - Pre-Assess to provide Differentiated Instruction to Accelerate Learning
-Enrichment/Extension Activities within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Unit 5

Desired Results

Unit 5 Title: Functions and Volume

Unit Summary: Students learn about functions for the first time, analyze representations of functions, and examine functions in the context of the volume of cylinders, cones, and spheres.

Sub-Unit 1: Introduction to Functions (Lessons 1–4 + Quiz)

- Determine whether graphs, tables, or rules represent functions.
- Describe situations using terms such as *function*, *input*, and *output*.

Sub-Unit 2: Representing and Interpreting Functions (Lessons 5–9 + Practice Day + Quiz)

- Create and compare graphs of functions that represent stories.
- Describe graphs of functions that represent situations.

Sub-Unit 3: Volume (Lessons 10–15 + Practice Day)

- Calculate and compare the volumes of cylinders, cones, and spheres.
- Explain the relationship between the volumes of cylinders, cones, and spheres.

Learning Standards

NJSLS Math:

8.F Functions
A. Define, evaluate and compare functions

1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. ***(Clarification: Function notation is not required in Grade 8)*** **8.F.A.1**

2. Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.* **8.F.A.2**

3. Interpret the equation
$y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function* $A = s^2$ *giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.* **8.F.A.3**

B. Use functions to model relationships between quantities

4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. **8.F.B.4**

5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. **8.F.B.5**

8.G Geometry
C. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres

9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems. **8.G.C9**

Math Practices: MP1, MP2, MP3, MP4, MP5, MP6, MP7, MP8

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- Act as a responsible and contributing community members and employee
- Attend to financial well-being
- Consider the environmental, social and economic impacts of decisions
- Demonstrate creativity and innovation
- Utilize critical thinking to make sense of problems and persevere in solving them
- Model integrity, ethical leadership and effective management
- Plan education and career paths aligned to personal goals
- Use technology to enhance productivity increase collaboration and communicate effectively
- Work productively in teams while using cultural/global competence

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MSETS1-4, 6.1.8.CivicsDP.1).

9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
9.4.8.DC.2: Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8).
9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).
9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information.
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Computer Science & Design Thinking *(CS & DT)*:

The practices describe the behaviors and ways of thinking that computationally literate students use to fully engage in today's data-rich and interconnected world. Computational thinking is at the heart of the practices and refers to the thought processes involved in expressing solutions as computational steps that can be carried out by a computer. It requires understanding the capabilities of computers, formulating problems addressed by a computer, and designing algorithms that a computer can execute. Curriculum writers and educators will want to consider how they can design learning experiences that will enable their students to develop these skills in conjunction with the content knowledge reflected in the core ideas and performance expectations. components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form.

8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.

8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**
• What makes a relationship a function?	

• How are functions useful in representing situations? • What are some relationships between a cylinder, a cone, and a sphere with common dimensions?	• A relationship is a function when each input has exactly one output, allowing for consistent and predictable associations between variables. • Functions are useful tools for modeling and analyzing real-world situations where one quantity depends on another. • Cylinders, cones, and spheres with common dimensions share proportional relationships in volume and surface area that help us understand geometric structure and spatial reasoning.
Vocabulary: cone, cylinder, dependent variable (output), function, independent variable (input), linear function, non-linear, sphere	
Students will be able to: • ***Lesson 1 "Turtle Crossing" - Making Sense of Graphs** Make connections between scenarios and graphs that represent them. Building Toward: 8.F.A.1, 8.F.B.5, MP2 **Optional Lesson* • **Lesson 2 "Guess My Rule" - Introduction to Functions** Write rules based on input-output pairs represented in tables, and introduce the concept of a function. 8.F.A.1, MP3, MP6 • **Lesson 3 "Function or Not" - Graphs of Functions and Non-Functions** Determine whether a graph represents a function and use function language to describe a situation. 8.F.A.1, MP3, MP8	

- **Lesson 4 “Window Frames” - Functions and Equations**
  Explore equations of functions and understand that an equation may look different depending on how the independent and dependent variables are defined.
  8.F.A, 8.F.A.1, MP3, MP4
- **Lesson 5 “The Tortoise and the Hare” - Interpreting Graphs of Functions**
  Interpret qualitative features of functions, specific points in context, and the meaning of rate of change over given intervals.
  8.F.B.5, MP2, MP3, MP6
- **Lesson 6 “Graphing Stories” - Creating Graphs of Functions**
  Draw the graph of a function representing a real-world situation.
  8.F.B.5, MP1, MP2, MP4
- **Lesson 7 “Comparing Linear Functions” - Comparing Representations of Functions**
  Compare and contrast relationships represented in different ways.
  8.F.A.2, 8.F.B.3, 8.F.B.4, MP2. MP6
- **Lesson 8 “Charge!” - Modeling With Linear Functions**
  Use data points to model a linear function and decide when it is reasonable to model a relationship with a linear function.
  8.F.B.4, 8.F.B.5, MP3, MP4, MP5
- ***Lesson 9 “Piecing it Together” - Modeling With Functions**
  Use linear segments to model real-world data sets presented as graphs.
  8.F.B.5 MP1 MP2 MP4
  ***Optional Lesson*
- **Lesson 10 “Volume Lab” - Exploring Volume**
  Estimate the volumes of cylinders, cones, cubes, and spheres.
  8.G.C, MP1, MP7

- **Lesson 11 “Cylinders” - Volumes of Cylinders**
  Explore and use strategies to calculate the volume of a cylinder.
  8.G.C.9, MP6, MP7, MP8
- **Lesson 12 “Scaling Cylinders” - Scaling Cylinders**
  Using Functions Use functions to explore how changing a cylinder’s radius or height impacts its volume.
  8.F.A.3 8.F.B 8.G.C.9 MP1 MP2
- **Lesson 13 “Cones” - Volumes of Cones**
  Recognize that the volume of a cone is one-third the volume of a cylinder with the same radius and the same height.
  8.G.C.9, MP1, MP3, MP8
- **Lesson 14 “Unknown Dimensions” - Determining Cylinder and Cone Dimensions**
  Calculate unknown dimensions of cylinders and cones given the volume and another dimension.
  8.G.C.9, MP3, MP7, MP8
- **Lesson 15 “Spheres” - Volumes of Spheres**
  Develop and use a formula for the volume of a sphere.
  8.G.C.9, MP1, MP8

Learning Activities:

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DeltaMath practice based on each lesson. DeltaMath includes a variety of interactive features and student response types which enable teachers to effectively scaffold and differentiate concepts to meet the needs of all students.

Students will work in Math IXL and DeltaMath completing recommended skills from their teacher and based on their diagnostic results.

Amplify Desmos 8.5 Sub-Unit 1: Introduction to Functions (Lessons 1-4):

- Education.com Aligned Practice Worksheets:
    - What Is a Function?
    - Is the Relation a Function?
    - Check for the Functions
    - Identify Functions From Ordered Pairs
    - Identify Functions From Graphs
    - Identify Functions From Tables
    - Identify Linear and Nonlinear Functions From Equations
    - Linear vs. Nonlinear: Graphs and Equations
    - Identify Linear and Nonlinear Functions From Graphs
    - Identify Linear and Nonlinear Functions From Tables
    - Card Sort: Linear and Nonlinear Functions
- IXL Aligned Practice Skills:
    - BB.1 Identify functions (ELJ)
    - BB.2 Identify functions: graphs (AEB)
    - BB.3 Identify independent and dependent variables (FSF)
- DeltaMath Aligned Practice:
    - Determine if Set of Points is a Function
    - Determine if a Graph is a Function (Level 1)

Amplify Desmos 8.5 Sub-Unit 2: Representing and Interpreting Functions (Lessons 5-9):

- Education.com Aligned Practice Worksheets:
    - Describing Function Relationships
    - Interpreting Function Relationship
    - Comparing Linear Functions: Tables, Graphs, and Equations
    - Compare Rates of Change
- IXL Aligned Practice Skills:
    - EE.3 Identify graphs: word problems (HWC)

    - EE.4 Checkpoint: Sketch and describe graphs (K7A)
    - CC.9 Compare linear functions: tables, graphs, and equations (N7D)
    - CC.13 Checkpoint: Compare linear functions (XQJ)
    - II.14 Checkpoint: Linear models: interpret and solve (9YQ)
- DeltaMath Aligned Practice:
    - Graph Stories (Level 1, Level 2)
    - Interpreting Graph Stories
    - Increasing/Decreasing & Linear/Non-Linear
    - Compare Rates (Linear Representations)
    - Compare Rates in Context

Amplify Desmos 8.5 Sub-Unit 3: Volume (Lessons 10-15):

- Education.com Aligned Practice Worksheets:
    - Volume of cylinders
    - Volume of cones
    - Volume of spheres
    - Finding the volume of cylinders
    - Finding the volume of cones
    - Finding the volume of spheres
    - Volume of Cylinders, Cones, and Spheres Handout
    - Volume of Cylinders, Cones, and Spheres #1, #2, #3
- IXL Aligned Practice Skills:
    - W.3 Volume of cylinders (9F3)
    - W.4 Volume of cones (YYR)
    - W.7 Volume of spheres (QX7)
- DeltaMath Aligned Practice:
    - Volume of a Cylinder
    - Volume of a Cone (Level 1, Level 2)

- Volume of a Sphere (Level 1, Level 2)
- Calculating Volume (Mixed)
- Compare Volume of Water Tanks
- Volume Word Problems (Basic)

Additional Activities:

Amplify Desmos 8.5 Sub-Unit 1: Introduction to Functions (Lessons 1-4):

- 8.5.03 Mini-Lesson: Justifying Whether a Graph Represents a Function (Amplify)
- 8.5 Sub-Unit 1 Extensions: Introduction to Functions (Amplify)
- Dino Crunch: Linear vs. Nonlinear Graphs and Equations Game (Education.com)

Amplify Desmos 8.5 Sub-Unit 2: Representing and Interpreting Functions (Lessons 5-9):

- 8.5.05 Boost: Sketch a Graph of a Function in Context (Amplify)
- 8.5.07 Mini-Lesson: Comparing Properties of Linear Functions (Amplify)
- 8.5 Sub-Unit 2 Extensions: Representing and Interpreting Functions (Amplify)
- 8.5 Practice Day 1 (Amplify)
- Dash for Dogs: Functions Performance Task (Education.com)

Amplify Desmos 8.5 Sub-Unit 3: Volume (Lessons 10-15):

- 8.5.11 Mini-Lesson: Calculating Volumes of Cylinders (Amplify)
- 8.5.13 Boost: Volume of a Cone (Amplify)
- 8.5 Sub-Unit 3 Extensions: Volume (Amplify)
- 8.5 Practice Day 2 (Amplify)
- 8.5 Unit Synthesis and Reflection (Amplify)

Climate Change Activities:

G.C.9 Climate Change Example: Students may use the formula for the volume of a sphere to approximate the volume of hailstones to consider how climate change may affect the size of hailstones over time.

Assessment Evidence
Formative Assessments: Pre-Unit Check (optional), Sub-Unit Quiz, Show What You Know
Summative Assessments: End-of-Unit Assessment
Common Benchmark Assessments: Common Cumulative Assessment
Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials
Core Instructional Program: Amplify Desmos Math Online Platform
Desmos Materials by Lesson: • coloring tools (Lessons 6–7) • graph paper (Lessons 6, 8) • three-dimensional solids (Lessons 10–11, 15) • calculators (as needed) (Lessons 11, 13) • index cards (as needed) (Lesson 5) • scissors (as needed) (Lesson 13) • straightedges (as needed) (Lessons 8–9)
Math IXL Flex Diagnostic & Practice, Education.com, DeltaMath, LinkIt!

Accommodations and Modifications:
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Students at Risk of Failure:

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice - Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments - Opportunities for make-up work or reduce number of assignments - Provide access to extra help when possible

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-Enrichment/Extension Activities within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Unit 6

Desired Results

Unit 6 Title: Associations in Data

Unit Summary: Students analyze data with two variables. They use scatter plots and fitted lines to analyze numerical data and use two-way tables, bar graphs, and segmented bar graphs to analyze categorical data.

Sub-Unit 1: Organizing Numerical Data (Lessons 1–3)

- Compare different ways to organize numerical data with two variables, including scatter plots.

Sub-Unit 2: Analyzing Numerical Data (Lessons 4–9 + Practice Day + Quiz)

- Use scatter plots and linear models to identify associations and make predictions.

Sub-Unit 3: Categorical Data (Lessons 10–11 + Practice Day)

- Use two-way tables and bar graphs to identify associations in categorical data.

Learning Standards

NJSLS Math:

8.SP Statistics and Probability

A. Investigate patterns of association in bivariate data

1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. **8.SP.A.1**

2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line. **8.SP.A.2**

3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.* **8.SP.A.3**

4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?* **8.SP.A.4**

Math Practices: MP1, MP2, MP3, MP4, MP5, MP6, MP7, MP8

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- Act as a responsible and contributing community members and employee

- Attend to financial well-being
- Consider the environmental, social and economic impacts of decisions
- Demonstrate creativity and innovation
- Utilize critical thinking to make sense of problems and persevere in solving them
- Model integrity, ethical leadership and effective management
- Plan education and career paths aligned to personal goals
- Use technology to enhance productivity increase collaboration and communicate effectively
- Work productively in teams while using cultural/global competence

9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).
9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MSETS1-4, 6.1.8.CivicsDP.1).
9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information.
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Computer Science & Design Thinking *(CS & DT)*:

The practices describe the behaviors and ways of thinking that computationally literate students use to fully engage in today's data-rich and interconnected world. Computational thinking is at the heart of the practices and refers to the thought processes involved in expressing solutions as computational steps that can be carried out by a computer. It requires understanding the capabilities of computers, formulating problems addressed by a computer, and designing algorithms that a computer can execute. Curriculum writers and educators will want to consider how they can design learning experiences that will enable their students to develop these skills in

conjunction with the content knowledge reflected in the core ideas and performance expectations. components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form.

8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.

8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**
• What is a scatter plot and what can it tell you? • How can lines help you model data on a scatter plot? • How can you analyze data with two variables that are categories instead of numbers?	• A scatter plot displays the relationship between two numerical variables, helping us identify patterns, trends, and possible correlations in data. • Lines, such as lines of best fit, can model data in a scatter plot and help make predictions or describe the strength and direction of a relationship. • Data with two categorical variables can be analyzed using frequency tables and two-way tables, which help reveal patterns and associations between the categories.

Vocabulary: association, clusters, frequency, linear model (line of fit), outlier, relative frequency, scatter plot, segmented bar graph, two-way table

Students will be able to:

- **Lesson 1 “Click Battle” - Organizing Data**
  Generate bivariate data, organize it, and use it to spot patterns and make predictions.
  8.SP.A.1, MP7
- **Lesson 2 “Wingspan” - Plotting Data**
  Compare two data representations, dot plots and scatter plots, and consider the advantages and limitations of each.
  8.SP.A.1, MP6, MP7
- **Lesson 3 “Robots” - What a Point on a Scatter Plot Means**
  Interpret points on a scatter plot in terms of a context and plot points given specific criteria.
  8.SP.A.1, MP1, MP2, MP6
- **Lesson 4 “Dapper Cats” - Linear Models and Outliers**
  Use a linear model to predict values not given in the data and identify potential outliers in a scatter plot.
  8.SP.A.1, 8.SP.A.2, 8.SP.A.3, MP2, MP7
- **Lesson 5 “Interpreting Scatter Plots” - Showing Patterns in Data**
  Construct a scatter plot, make predictions, and interpret points on a scatter plot in context.
  8.SP.A.1, MP1, MP4
- **Lesson 6 “Find the Fit” - Fitting a Line to Data**
  Compare linear models and informally evaluate how well a line fits a set of data on a scatter plot.
  8.SP.A.1, 8.SP.A.2, MP3, MP6
- **Lesson 7 “Interpreting Slope” - The Slope of a Linear Model**
  Determine and interpret the slopes of linear models in context and identify positive and negative associations.
  8.SP.A, 8.SP.A.1, 8.SP.A.2, 8.SP.A.3, MP2, MP6, MP7
- **Lesson 8 “Scatter Plot City” - Observing More Patterns in Scatter Plots**
  Determine whether a scatter plot has a linear or non-linear association and identify any clusters in the data.
  8.SP.A.1, MP6

- **Lesson 9 “Animal Brains” - Analyzing Bivariate Data**
  Analyze and interpret bivariate data in context. Use a line of fit to make predictions then compare actual and predicted values.
  8.SP.A.1, 8.SP.A.2, 8.SP.A.3, MP2, MP6
- **Lesson 10 “Tasty Fruit” - Two-Way Tables and Bar Graphs**
  Connect knowledge of scatter plots to interpret two-way tables and bar graphs and explore ways to analyze relationships in categorical data.
  8.SP.A.4, MP1
- **Lesson 11 “Finding Associations” - Using Data Displays to Find Associations**
  Use relative frequencies and segmented bar graphs to identify possible associations between variables.
  8.SP.A.4, MP3

Learning Activities:

Math IXL Skill Practice and Group Jams based on each lesson. IXL Learning engages students in an authentic way, encouraging them to own their learning, embrace new challenges, and build skills and confidence that last. The program offers personalized skills recommendations based on what each student has been practicing and what they are ready to learn next.

DeltaMath practice based on each lesson. DeltaMath includes a variety of interactive features and student response types which enable teachers to effectively scaffold and differentiate concepts to meet the needs of all students.

Students will work in Math IXL and DeltaMath completing recommended skills from their teacher and based on their diagnostic results.

Amplify Desmos 8.6 Sub-Unit 1: Organizing Numerical Data (Lessons 1-3):

- Education.com Aligned Practice Worksheets:
  - Scatter Plots
  - Constructing Scatter Plots
- IXL Aligned Practice Skills:
  - II.4 Create scatter plots (AVL)

    - II.5 Identify trends with scatter plots (GZE)
    - II.3 Interpret scatter plots (66P)
- DeltaMath Aligned Practice:
    - Create Scatter Plot from Data Table
    - Association/Correlation (Scatter Plot)

Amplify Desmos 8.6 Sub-Unit 2: Analyzing Numerical Data (Lessons 4-9):

- Education.com Aligned Practice Worksheets:
    - Estimating Lines of Best Fit
    - Interpreting Slopes and y-Intercepts of Lines of Best Fit
- IXL Aligned Practice Skills:
    - II.8 Identify lines of best fit (BG7)
    - II.3 Interpret scatter plots (66P)
    - II.9 Write equations for lines of best fit (ZQ6)
    - I.10 Interpret lines of best fit: word problems (9DW)
    - II.12 Checkpoint:Scatterplots (DDR)
    - JJ.11 Checkpoint: Two-way frequency tables (HJG)
- DeltaMath Aligned Practice:
    - Interpret Line of Best Fit
    - Draw Line of Best Fit
    - Prediction from Line of Best Fit

Amplify Desmos 8.6 Sub-Unit 3: Categorical Data (Lessons 10-11):

- Education.com Aligned Practice Worksheets:
    - Constructing Two-Way Frequency Tables
    - Interpreting Two-Way Frequency Tables
    - Constructing Two-Way Relative Frequency Tables
- IXL Aligned Practice Skills:
    - J.11 Checkpoint: Two-way frequency tables (HJG)

    - II.14 Checkpoint: Linear models: interpret and solve (9YQ)
- DeltaMath Aligned Practice:
    - Interpret Two-Way Tables
    - Percents Two-Way Tables
    - Fill in Values, Two-Way Tables (Level 1, Level 2)

Additional Activities:

Amplify Desmos 8.6 Sub-Unit 1: Organizing Numerical Data (Lessons 1-3):

- 8.6.03 Mini-Lesson: Interpreting Points on a Scatter Plot (Amplify)
- 8.6 Sub-Unit 1 Extensions: Organizing Numerical Data (Amplify)

Amplify Desmos 8.6 Sub-Unit 2: Analyzing Numerical Data (Lessons 4-9):

- Feline Delights: Scatter Plots Performance Task (Education.com)
- 8.6.04 Boost: Linear Models (Amplify)
- 8.6.09 Mini-Lesson: Using Lines of Fit to Make Predictions (Amplify)
- 8.6 Sub-Unit 2 Extensions: Analyzing Numerical Data (Amplify)
- 8.6 Practice Day 1 (Amplify)

Amplify Desmos 8.6 Sub-Unit 3: Categorical Data (Lessons 10-11):

- 8.6.10 Mini-Lesson: Calculating Missing Values in Two-Way Tables
- 8.6.10 Boost: Two-Way Tables
- 8.6 Sub-Unit 3 Extensions: Categorical Data
- 8.6 Practice Day 2
- 8.6 Unit Synthesis and Reflection

Climate Change Activities:

SP.A.1 Climate Change Example: Students may construct and interpret scatterplots of measurement data to investigate patterns of association in bivariate data involving the amount of a greenhouse gas in the atmosphere and its effect on temperature.

SP.A.3 Climate Change Example: Students may use the equation of a linear model to interpret the slope when comparing local and global precipitation rates for rainfall in different regions.

Assessment Evidence
Formative Assessments: Pre-Unit Check (optional), Sub-Unit Quiz, Show What You Know
Summative Assessments: End-of-Unit Assessment
Common Benchmark Assessments: Common Cumulative Assessment
Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials
Core Instructional Program: Amplify Desmos Math Online Platform
Desmos Materials by Lesson: • calculators (Lesson 10) • measuring tools (in inches) (Lesson 2) • rulers (Lessons 6, 9, Practice Day 1) • timers (stopwatches or a displayed timer) (Lesson 1) • coloring tools (as needed) (Lessons 3, 10, Practice Day 1)
Math IXL Flex Diagnostic & Practice, Education.com, DeltaMath, LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one - Additional time - Review of directions - Student restates information - Space for movement or breaks - Extra visual and verbal cues and prompts - Preferential seating - Follow a routine/schedule - Rest breaks - Verbal and visual cues regarding directions and staying on task - Checklists - Immediate feedback

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Specific Strategies and Practices that Support English Language Learners:

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts - Personal Glossary - Extended Time - Simplified/Verbal Instructions - Frequent Breaks - Visual learning, including graphic organizers - Use of cognates to increase comprehension - Teacher modeling - Pairing students with beginning English language skills with students who have more advanced English language skills - Scaffolding - Word walls - Think-pair-share - Cooperative learning groups

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Students at Risk of Failure:

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice - Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments - Opportunities for make-up work or reduce number of assignments - Provide access to extra help when possible

Students with 504 Plans:
Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan. 504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan. -
Specific Strategies and Practices that Support Gifted & Talented Students:
It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Homogenous Grouping - Small Group In-Depth Instruction - Differentiated Online Practice - Alternative Assessments - Pre-Assess to provide Differentiated Instruction to Accelerate Learning

-Enrichment/Extension Activities within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Unit 7

Desired Results

Unit 7 Title: Exponents and Scientific Notation

Unit Summary: Students develop fluency with expressions involving exponents, powers of 10, and scientific notation.

Sub-Unit 1: Exponent Properties (Lessons 1–6 + Practice Day + Quiz)

- Identify and create equivalent expressions involving positive, negative, and zero exponents.

Sub-Unit 2: Scientific Notation (Lessons 7–14 + Practice Day)

- Express and perform operations with very large or very small quantities using powers of `10` and scientific notation.

Learning Standards

NJSLS Math:

8.EE Expressions and Equations
A. Work with radicals and integer exponents

1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example*, $3^2 \times 3^{-5} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$. **8.EE.A.1**

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. *For example, estimate the population of the United States as* 3×10^8 *and the population of the world as* 7×10^9 *and determine that the world population is more than 20 times larger.* **8.EE.A.3**

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. **8.EE.A.4**

Math Practices: MP1, MP2, MP3, MP4, MP5, MP6, MP7, MP8

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- Act as a responsible and contributing community members and employee
- Attend to financial well-being
- Consider the environmental, social and economic impacts of decisions
- Demonstrate creativity and innovation
- Utilize critical thinking to make sense of problems and persevere in solving them
- Model integrity, ethical leadership and effective management
- Plan education and career paths aligned to personal goals
- Use technology to enhance productivity increase collaboration and communicate effectively

- Work productively in teams while using cultural/global competence

9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MSETS1-4, 6.1.8.CivicsDP.1).
9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information.
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Computer Science & Design Thinking *(CS & DT)*:

The practices describe the behaviors and ways of thinking that computationally literate students use to fully engage in today's data-rich and interconnected world. Computational thinking is at the heart of the practices and refers to the thought processes involved in expressing solutions as computational steps that can be carried out by a computer. It requires understanding the capabilities of computers, formulating problems addressed by a computer, and designing algorithms that a computer can execute. Curriculum writers and educators will want to consider how they can design learning experiences that will enable their students to develop these skills in conjunction with the content knowledge reflected in the core ideas and performance expectations. components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form.

8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices.

8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**
• How can we use the properties of exponents to make connections between expressions? • What is scientific notation and how can it be used to represent small and large numbers?	• The properties of exponents allow us to simplify, compare, and manipulate expressions, revealing deeper connections between mathematical relationships. • Scientific notation is a compact way to represent very large or very small numbers, making it easier to compare, calculate, and communicate values across different contexts.
Vocabulary: power of ten, scientific notation, equivalent, exponent	
Students will be able to: • **Lesson 1 "Circles: - Exponent Review** Access prior understanding of exponents by analyzing patterns that grow exponentially. 8.EE.A.1, MP8 • **Lesson 2 "Combining Exponents" - Equivalent Expressions with Exponents** Make use of structure to discover ways to write equivalent expressions involving products of powers and powers of powers. 8.EE.A.1, MP7 • **Lesson 3 "Power Pairs" - Multiplying Powers and Powers of Powers** Justify strategies for determining whether two expressions with exponents are equivalent. 8.EE.A.1, MP3, MP7	

- **Lesson 4 “Rewriting Powers” - Rewriting Exponential Expressions as a Single Power**
  Develop strategies for rewriting exponential expressions as a single power and work with division of powers.
  8.EE.A.1, MP7
- **Lesson 5 “Negative and Zero Powers” - Using Patterns to Understand Negative and Zero Exponents**
  Identify and use patterns to reason and generalize about negative and zero exponents.
  8.EE.A.1, MP1, MP7
- **Lesson 6 “Write a rule” - Generalizing Exponent Properties**
  Develop rules for rewriting exponential expressions and use mathematical reasoning to justify.
  8.EE.A.1, MP3, MP7, MP8
- **Lesson 7 “Scales and Weights, Part 1” - Describing Large Numbers Using Powers of 10**
  Explore different ways to write large numbers using a combination of powers of 10.
  8.EE.A.3 MP3
- **Lesson 8 “Scales and Weights, Part 2” - Describing Small Numbers Using Powers of 10**
  Rewrite small and large numbers as both sums of combinations and single combinations of powers of 10.
  8.EE.A.3, MP3
- **Lesson 9 “Specific and Scientific” - Definition of Scientific Notation**
  Identify expressions written in scientific notation, and use scientific notation to write very large and very small numbers.
  8.EE.A.4, MP7
- **Lesson 10 “Multiplying and Dividing” - Multiplying and Dividing With Scientific Notation**
  Compare and contrast strategies to multiply and divide numbers written in scientific notation.
  8.EE.A.4, MP6
- **Lesson 11 “Balance the Scale” - Multiplying, Dividing, and Estimating with Scientific Notation**

Use multiplication and division to estimate how many times larger one very large or very small quantity is than another.

8.EE.A.3, 8.EE.A.4, MP2, MP3, MP6

- ***Lesson 12 "Use Your Powers" - Applications of Arithmetic With Scientific Notation**

  Apply scientific notation and exponent rules to solve problems in context.

  8.EE.A.3, 8.EE.A.4, MP1, MP2, MP4

  ***Optional Lesson*
- **Lesson 13 "City Lights" Adding and Subtracting With Scientific Notation**

  Add and subtract numbers - written in scientific notation to answer questions in context.

  8.EE.A.4, MP1, MP6
- **Lesson 14 "Star Power" - Let's Put It to Work**

  Use scientific notation as a tool for comparing, combining, and operating on the net worths of different celebrities.

  8.EE.A.3, 8.EE.A.4, MP2, MP6

Learning Activities:

Math IXL Skill Practice and Group Jams based on each lesson. IXL Learning engages students in an authentic way, encouraging them to own their learning, embrace new challenges, and build skills and confidence that last. The program offers personalized skills recommendations based on what each student has been practicing and what they are ready to learn next.

DeltaMath practice based on each lesson. DeltaMath includes a variety of interactive features and student response types which enable teachers to effectively scaffold and differentiate concepts to meet the needs of all students.

Students will work in Math IXL and DeltaMath completing recommended skills from their teacher and based on their diagnostic results.

Amplify Desmos 8.7 Sub-Unit 1: Exponent Properties (Lessons 1-6):

- Education.com Aligned Practice Worksheets:
  - Write Multiplication Expressions Using Exponents #1
  - Evaluating Exponents
  - Properties of Exponents Practice
  - Properties of Exponents
  - Properties of Exponents Handout
  - Properties of Exponents: True or False
  - Product of Powers
  - Negative Exponents and Zero Exponents
  - Power of a Power
  - Quotient of Powers
  - Properties of Exponents: Matching #1, #2, #3
- IXL Aligned Practice Skills:
  - C.1 Understanding exponents (VFV)
  - C.2 Evaluate powers (EYR)
  - C.4 Powers with negative bases (ZQC)
  - C.5 Powers with decimal and fractional bases (8CT)
  - C.6 Understanding negative exponents (YBB)
  - C.7 Evaluate powers with negative exponents (WGS)
  - C.8 Evaluate powers with negative or zero exponents (5MA)
  - C.11 Multiply and divide powers: integer bases (L2J)
  - C.12 Power of a power: integer bases (AEQ)
  - C.13 Evaluate expressions using properties of exponents (UTY)
  - C.14 Identify equivalent expressions involving exponents I (VLM)
  - C.15 Identify equivalent expressions involving exponents II (QDM)
- DeltaMath Aligned Practice:
  - Basic Exponent Rules

- Exponents: Expand/Condense (Whole Number Base, Negative Base)
- Evaluate Exponents, Pos/Neg Base
- Exponents: Expand/Condense (Fractional Base)
- Negative / Zero Exponents (Level 1, Level2)

Amplify Desmos 8.7 Sub-Unit 2: Scientific Notation (Lessons 7-14):

- Education.com Aligned Practice Worksheets:
  - Scientific Notation
  - Scientific Notation Handout
  - Numbers in Scientific Notation
  - Matching Numbers in Scientific Notation and Standard Form
  - Let's Convert! Numbers in Standard Form and Scientific Notation #1, #2, #3
  - Compare Numbers in Scientific Notation
  - Multiply Numbers in Scientific Notation #1,#2
  - Divide Numbers in Scientific Notation #1,#2
  - Operations With Numbers in Scientific Notation
  - Multiplying and Dividing Numbers in Scientific Notation
  - Matching: Multiply and Divide Numbers in Scientific Notation
  - Add Numbers in Scientific Notation #1, #2
  - Subtract Numbers in Scientific Notation #1, #2
  - Adding and Subtracting Numbers in Scientific Notation
  - Matching: Add and Subtract Numbers in Scientific Notation
- IXL Aligned Practice Skills:
  - D.1 Convert between standard and scientific notation (H8A)
  - D.2 Scientific notation on calculators (62V)
  - D.3 Compare numbers written in scientific notation (RHT)
  - D.5 Multiply numbers written in scientific notation (YZU)
  - D.6 Divide numbers written in scientific notation (SGT)

    - D.4 Add and subtract numbers written in scientific notation (HUR)
    - D.7 Checkpoint: Scientific notation (D2U)
- DeltaMath Aligned Practice:
    - Convert Scientific Notation to Standard Form
    - Convert Number to Scientific Notation
    - Multiply/Divide in Scientific Notation
    - Add/Subtract in Scientific Notation (Level 1, Level 2)
    - Greater vs. Times Greater, Scientific Notation
    - Mixed Word Problems Scientific Notation

Additional Activities:

Amplify Desmos 8.7 Sub-Unit 1: Exponent Properties (Lessons 1-6):

- 8.7.02 Boost: Write Equivalent Exponential Expressions (Amplify)
- 8.7.03 Mini-Lesson: Multiplying Powers (Amplify)
- 8.7 Sub-Unit 1 Extensions: Exponent Properties (Amplify)
- 8.7 Practice Day 1 (Amplify)
- Match: Properties of Exponents Game (Education.com)
- Properties of Exponents Puzzle (Education.com)

Amplify Desmos 8.7 Sub-Unit 2: Scientific Notation (Lessons 7-14):

- 8.7.09 Mini-Lesson: Writing Numbers in Scientific Notation (Amplify)
- 8.7.11 Boost: Multiplying, Dividing and Estimating With Scientific Notation (Amplify)
- 8.7 Sub-Unit 2 Extensions: Scientific Notation (Amplify)
- 8.7 Practice Day 2 (Amplify)
- Scientific Notation Maze (Education.com)
- Operations With Numbers in Scientific Notation: Matching Activity (Education.com)
- Find the Error: Operations With Numbers in Scientific Notation (Education.com)
- 8.7 Unit Synthesis and Reflection (Amplify)

Assessment Evidence
Formative Assessments: Pre-Unit Check (optional), Sub-Unit Quiz, Show What You Know
Summative Assessments: End-of-Unit Assessment
Common Benchmark Assessments: Common Cumulative Assessment
Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials
Core Instructional Program: Amplify Desmos Math Online Platform
Desmos Materials by Lesson: • blank paper or index cards (Lesson 4) • coloring tools (Lesson 12) • poster paper (Lesson 12) • scientific calculators (optional) (Lessons 12, 14) • sticky notes (optional) (Lessons 4, 12) • tape (Lesson 12)
Math IXL Flex Diagnostic & Practice, Education.com, DeltaMath, LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

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Unit 8

Desired Results

Unit 8 Title: The Pythagorean Theorem and Irrational Numbers

Unit Summary: Students explore the Pythagorean theorem and different types of numbers (square roots and cube roots, rational and irrational numbers).

Sub-Unit 1: Square Roots and Cube Roots (Lessons 1–5 + Practice Day + Quiz)

- Approximate the value of square roots and cube roots.

Sub-Unit 2: The Pythagorean Theorem (Lessons 6–11)

- Use the Pythagorean theorem and its converse to reason about right triangles and calculate unknown measurements.

Sub-Unit 3: Rational and Irrational Numbers (Lessons 12–14 + Practice Day)

- Express rational and irrational numbers as fractions and decimal approximations.

Learning Standards

NJSLS Math:

8.EE Expressions and Equations
A. Work with radicals and integer exponents

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. **8.EE.A.2**

a. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that is irrational. **8.EE.A.2a**

b. Simplify numerical radicals, limiting to square roots (i.e. nonperfect squares). *For example*, *simplify* $\sqrt{8}$ *to* $2\sqrt{2}$. **8.EE.A.2b**

8.G Geometry
B. Understand and apply the Pythagorean Theorem

6. Explain a proof of the Pythagorean Theorem and its converse. **8.G.B.6**

7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. **8.G.B.7**

8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. **8.G.B.8**

8.NS The Number System
A. Know that there are numbers that are not rational and approximate them by rational numbers
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. **8.NS.A1**

2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of* $\sqrt{2}$ *, show that* $\sqrt{2}$ *is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.* **8.NS.A2**

3. Understand that the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. **8.NS.A.3**

Math Practices: MP1, MP2, MP3, MP4, MP5, MP6, MP7, MP8

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- Act as a responsible and contributing community members and employee
- Attend to financial well-being
- Consider the environmental, social and economic impacts of decisions
- Demonstrate creativity and innovation
- Utilize critical thinking to make sense of problems and persevere in solving them
- Model integrity, ethical leadership and effective management
- Plan education and career paths aligned to personal goals
- Use technology to enhance productivity increase collaboration and communicate effectively
- Work productively in teams while using cultural/global competence

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MSETS1–4, 6.1.8.CivicsDP.1).
9.4.8.DC.2: Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8).
9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information.

9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
Computer Science & Design Thinking *(CS & DT)*: The practices describe the behaviors and ways of thinking that computationally literate students use to fully engage in today's data-rich and interconnected world. Computational thinking is at the heart of the practices and refers to the thought processes involved in expressing solutions as computational steps that can be carried out by a computer. It requires understanding the capabilities of computers, formulating problems addressed by a computer, and designing algorithms that a computer can execute. Curriculum writers and educators will want to consider how they can design learning experiences that will enable their students to develop these skills in conjunction with the content knowledge reflected in the core ideas and performance expectations. components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form. **8.1.8.CS.1:** Recommend improvements to computing devices in order to improve the ways users interact with the devices. **8.2.8.NT.1:** Examine a malfunctioning tool, product, or system and propose solutions to the problem.

Learning Targets	
Unit Essential Questions: • How can you estimate the square root of a number? • What does the square root of a number represent? • Is it true that leg^2 + leg^2 = hypotenuse^2 for all right triangles? If so, can you prove it?	**Unit Enduring Understandings:** • Estimating the square root of a number involves finding the two closest perfect squares and using reasoning to approximate its value. • The square root of a number represents the value that, when multiplied by itself, gives the original number.

• What is the difference between a rational number and an irrational number?	• In all right triangles, the relationship leg^2 + leg^2 = hypotenuse^2 holds true and can be proven using the Pythagorean Theorem. • Rational numbers can be expressed as a ratio of two integers, while irrational numbers cannot be written as exact fractions and have non-repeating, non-terminating decimal forms.
Vocabulary: bar notation, cube root, hypotenuse, irrational number, legs, perfect square, pythagorean theorem, rational number, square root	
Students will be able to: • **Lesson 1 "Tilted Squares" - The Areas of Tilted Squares** Use the structure of a tilted square to determine areas of squares with vertices at intersection points. Building Toward 8.EE.A.2, 8.G.B, 8.G.B.6, 8.NS.A.2, MP7 • **Lesson 2 "From Squares to Roots" - Side Lengths and Areas** Use the connection between the side length of a square and its area to write precise side lengths with square root notation. 8.NS.A, MP6, MP7 • **Lesson 3 "Between Squares" - Approximating Square Roots** Develop strategies for approximating square root values. 8.EE.A.2, 8.NS.A.2, MP1, MP7 • **Lesson 4 "Root Down" - Reasoning About Square Roots** Develop strategies for approximating and plotting square roots on a number line. 8.EE.A.2, 8.NS.A.2, MP2, MP3, MP6 • **Lesson 5 "Filling Cubes" - Edge Lengths, Volumes, and Cube Roots**	

Use a cube root to determine the solution to x3 = p and plot the solution on a number line.
8.EE.A.2, 8.NS.A.2, MP3, MP6

- **Lesson 6 “The Pythagorean Theorem” - Squares of Side Lengths**
  Identify and use a^2 + b^2 = c^2 to recognize the relationship is only true for some triangles.
  8.G.B, MP1, MP3, MP7
- **Lesson 7 “Pictures to Prove it” - A Proof of the Pythagorean Theorem**
  Work through an algebraic proof of the Pythagorean theorem and use it to determine unknown sides.
  8.G.B, 8.G.B.6, 8.G.B.7, MP1, MP3
- **Lesson 8 “Triangle Tracing Turtle” - Finding Unknown Side Lengths**
  Practice using the Pythagorean theorem to calculate side lengths of right triangles.
  8.G.B.7, MP3, MP6
- **Lesson 9 “Make it Right” - The Converse of the Pythagorean Theorem**
  Develop and apply understanding of the converse of the Pythagorean theorem.
  8.G.B, 8.G.B.6, MP3, MP7
- **Lesson 10 “Taco Truck” - Applications of the Pythagorean Theorem**
  Use the Pythagorean theorem and reason about distance, speed, and time to solve problems in context.
  8.EE.A.2, 8.G.B.7, MP1, MP2
- **Lesson 11 “Pond Hopper” - Finding Distances on the Coordinate Plane**
  Apply the Pythagorean theorem to find distances between points on the coordinate plane.
  8.G.B.8, MP3, MP7
- **Lesson 12 “Fractions to Decimals” - Decimal Representations of Rational Numbers**
  Express fractions as decimals and determine whether a fraction will be a terminating or repeating decimal.
  8.NS.A.1, MP1, MP6, MP7
- **Lesson 13 “Decimals to Fractions” - Infinite Decimal Expansions**

Develop strategies for writing repeating and terminating decimals as fractions.
8.NS.A.1, MP2, MP7

- **Lesson 14 "Hit the Target" - Rational and Irrational Numbers**
  Describe characteristics of numbers that are not rational and reason whether a number is rational or irrational.
  8.EE.A.2, 8.NS.A, 8.NS.A.1, 8.NS.A.2, MP2, MP3, MP6
- **Lesson 15 Square and Cube Roots** *(not in amplify)*
  Evaluate square roots of small perfect squares and cube roots of small perfect cubes and determine whether rational or irrational.
  8.EE.A.2a
- **Lesson 16 Simplifying Radicals** *(not in amplify)*
  Simplify square roots of non-perfect squares.
  8.EE.A.2b
- **Lesson 17 Adding and Multiplying Rationals and Irrationals** *(not in amplify)*
  Determine whether sums and products of rationals and irrationals are rational or irrational.
  8.NS.A.3

Learning Activities:
Math IXL Skill Practice and Group Jams based on each lesson. IXL Learning engages students in an authentic way, encouraging them to own their learning, embrace new challenges, and build skills and confidence that last. The program offers personalized skills recommendations based on what each student has been practicing and what they are ready to learn next.
DeltaMath practice based on each lesson. DeltaMath includes a variety of interactive features and student response types which enable teachers to effectively scaffold and differentiate concepts to meet the needs of all students.

Students will work in Math IXL and DeltaMath completing recommended skills from their teacher and based on their diagnostic results.

Amplify Desmos 8.8 Sub-Unit 1: Square Roots and Cube Roots (Lessons 1-5):

- Education.com Aligned Practice Worksheets:
  - Square root and cube root practice
  - Approximating square roots
  - Cube roots of perfect cubes
  - Estimate cube roots
- IXL Aligned Practice Skills:
  - E.1 Square roots of perfect squares (9RS)
  - E.2 Estimate positive square roots (XWJ)
  - E.3 Positive and Negative square roots (8TF)
  - E.4 Estimate positive and negative square roots (96T)
  - E.5 Relationship between squares and square roots (8W2)
  - E.7 Cube roots of perfect cubes (RYG)
  - E.8 Cube roots of positive and negative cube roots (J7K)
  - E.10 Estimate cube roots (RLC)
- DeltaMath Aligned Practice:
  - Simplifying radicals
  - Squares, Cubes and Roots
  - Approximating Square roots

Amplify Desmos 8.8 Sub-Unit 2: The Pythagorean Theorem (Lessons 6-11):

- Education.com Aligned Practice Worksheets:
  - Pythagorean Theorem: mixed practice
  - Pythagorean Theorem: Find the missing
  - Pythagorean Theorem: crack the code
  - Pythagorean Theorem: word problems

    - Find the distance between two points 1
    - Find the distance between two points 2
- IXL Aligned Practice Skills:
    - T.1 Pythagorean Theorem: find the length of the hypotenuse (7ZL)
    - T.2 Pythagorean Theorem: find the missing leg length (Y9C)
    - T.3 Pythagorean Theorem: find the missing hypotenuse or leg length (MTM)
    - T.4 Pythagorean Theorem: find the perimeter (VGE)
    - T.5 Pythagorean Theorem: word problems (87U)
    - T.6 Converse of the Pythagorean Theorem: is it a right triangle (EQZ)
- DeltaMath Aligned Practice:
    - Pythagorean Theorem (rounding)
    - Pythagorean Theorem (radicals)
    - Coordinate Distance, Pythagorean Theorem (Rounding)

Amplify Desmos 8.8 Sub-Unit 3: Rational and Irrational Numbers (Lessons 12-17):

- Education.com Aligned Practice Worksheets:
    - Approximating Irrational numbers on the number line
    - Rational vs Irrational numbers
    - Real numbers card sort
    - Real numbers true/false
    - Real numbers always, sometimes, never
    - Identifying irrational numbers maze
- IXL Aligned Practice Skills:
    - B.1 Convert between repeating decimals and fractions (WD6)
    - F.1 Identify rational and irrational square roots (UGE)
    - F.2 Identify rational and irrational numbers (NV6)
    - F.3 Classify numbers (VR7)
    - F.4 Irrational numbers on the number line (83E)

    - F.6 Checkpoint: Rational and irrational numbers (SNE)
    - EE.1 Simplify radical expressions (ZFF)
- DeltaMath Aligned Practice:
    - Determine if number is rational/irrational
    - Simplifying Radicals (Guided)
    - Squares, Cubes, and Roots
    - Sum and Product of Rational and Irrational Numbers

Additional Activities:

Amplify Desmos 8.8 Sub-Unit 1: Square Roots and Cube Roots (Lessons 1-5):

- 8.8.02 Boost: Side Lengths of Tilted Squares (Amplify)
- 8.8.03 Mini-Lesson: Approximating Square Roots (Amplify)
- 8.8 Sub-Unit 1 Extensions: Square Roots and Cube Roots (Amplify)
- 8.8 Practice Day 1 (Amplify)

Amplify Desmos 8.8 Sub-Unit 2: The Pythagorean Theorem (Lessons 6-11):

- 8.8.08 Mini-Lesson: Calculating Unknown Side Lengths (Amplify)
- 8.8.11 Boost: Finding Distances on the Coordinate Plane (Amplify)
- 8.8 Sub-Unit 2 Extensions: The Pythagorean Theorem (Amplify)

Amplify Desmos 8.8 Sub-Unit 3: Rational and Irrational Numbers (Lessons 12-14):

- 8.8.14 Mini-Lesson: Identifying Rational and Irrational Numbers (Amplify)
- 8.8 Sub-Unit 3 Extensions: Rational and Irrational Numbers (Amplify)
- 8.8 Practice Day 2 (Amplify)
- 8.8 Unit Synthesis and Reflection (Amplify)

Assessment Evidence

Formative Assessments: Pre-Unit Check (optional), Sub-Unit Quiz, Show What You Know

Summative Assessments: End-of-Unit Assessment
Common Benchmark Assessments: Common Cumulative Assessment
Alternative Assessments: Modified Unit Assessments, Modified Projects, Other Modified Assessments

Core Instructional & Supplemental Materials

Core Instructional Program: Amplify Desmos Math Online Platform
Desmos Materials by Lesson: • calculators (Lessons 3, 5, 7, 14, Practice Day 2) • scissors (Lessons 7, 9) • tracing paper (Lesson 9) • four function calculators (as needed) (Lesson 13)
Math IXL Flex Diagnostic & Practice, Education.com, DeltaMath, LinkIt!

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the

instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one - Additional time - Review of directions - Student restates information - Space for movement or breaks - Extra visual and verbal cues and prompts - Preferential seating - Follow a routine/schedule - Rest breaks - Verbal and visual cues regarding directions and staying on task - Checklists - Immediate feedback

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Specific Strategies and Practices that Support English Language Learners:

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts - Personal Glossary - Extended Time - Simplified/Verbal Instructions - Frequent Breaks - Visual learning, including graphic organizers - Use of cognates to increase comprehension - Teacher modeling - Pairing students with beginning English language skills with students who have more advanced English language skills - Scaffolding - Word walls - Think-pair-share - Cooperative learning groups

Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Students at Risk of Failure:

- Home/School Connection - Alternative Assessments - Learning Contracts - Homogenous Grouping - Supplemental Instruction - Think-Pair-Share by Readiness - Homework Options - Differentiated Online Practice - Leveled Rubrics - Tiered Level of Supports - Tiered Activities - Small Group Instruction - Work Alone Choice - Group Work Choice - Alternate or reduced work within Digital Platforms such as Math IXL, Delta Math, and Link It assignments - Opportunities for make-up work or reduce number of assignments - Provide access to extra help when possible

Students with 504 Plans:

Teachers are responsible for implementing designated services and strategies identified on a student’s 504 Plan. 504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan. -

Specific Strategies and Practices that Support Gifted & Talented Students:
It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Homogenous Grouping - Small Group In-Depth Instruction - Differentiated Online Practice - Alternative Assessments - Pre-Assess to provide Differentiated Instruction to Accelerate Learning
-Enrichment/Extension Activities within Digital Platforms such as Math IXL, Delta Math, and Link It assignments

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them

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.

2. Reason abstractly and quantitatively

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3. Construct viable arguments and critique the reasoning of others

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make

sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4. Model with mathematics

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically

proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered$7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$ older students can see the 14 as $2 \times 7$and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

8. Look for and express regularity in repeated reasoning

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same

calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $\frac{(y-2)}{(x-1)} = 3$.

Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)\left(x^2 + x + 1\right)$ and $(x - 1)\left(x^3 + x^2 + x + 1\right)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Mathematics Content Emphases

Some clusters of standards were written to require greater emphasis than others. This varied emphasis is based on the depth of the mathematical ideas in the cluster, the time that they take to master, and/or their importance to future mathematics or the demands of college and career readiness. More time in these particular areas is also necessary for students to meet the Standards for Mathematical Practice. Therefore, not all content in a given grade is emphasized equally in the standards.

To say that some things have greater emphasis is not to say that anything in the Standards can be neglected or omitted in instruction. Neglecting material will leave gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade.

Students should spend the majority of their time on the major work of the grade (M). Supporting work (S) and, where appropriate, additional work (A) can engage students in the major work of the grade.

Grade 8 Content Emphases

Major, Supporting, and Additional Clusters

Emphases are given at the cluster level. Refer to the New Jersey Student Learning Standards for Mathematics for the specific standards that fall within each cluster.

Key: **M** — Major, **S** — Supporting Clusters, **A** — Additional Clusters

Grade 8: Major, Supporting, and Additional Clusters

Indicator	Type	Cluster Heading
8.NS.A	S	Know that there are numbers that are not rational, and approximate them by rational numbers
8.EE.A	M	Work with radicals and integer exponents
8.EE.B	M	Understand the connections between proportional relationships, lines, and linear equations
8.EE.C	M	Analyze and solve linear equations and pairs of simultaneous linear equations
8.F.A	M	Define, evaluate and compare functions
8.F.B	M	Use functions to model relationships between quantities
8.G.A	M	Understand congruence and similarity using physical models, transparencies, or geometry software
8.G.B	M	Understand and apply the Pythagorean Theorem
8.G.C	A	Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.
8.SP.A	S	Investigate patterns of association in bivariate data