

CTECS Mathematics Department

Geometry Curriculum



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Vision of the Graduate

The Vision of a Graduate (VoG) at the Connecticut Technical Education and Career System (CTECS) embodies our commitment to preparing students for success in Connecticut’s workforce.

Developed in collaboration with students, parents, staff, and employers, the VoG ensures that CTECS students are not only job-ready but also equipped to lead, innovate, and adapt in a dynamic world.

As educators, we are dedicated to developing these qualities by providing a comprehensive education that empowers our students to achieve their fullest potential and make meaningful contributions to society.

Connecticut Technical Education and Career System
Vision of a Graduate
A CTECS Graduate is...



-  **A Problem Solver**
-  **Work Ready**
-  **Respectful**
-  **Skilled Socially**
-  **A Critical Thinker**
-  **An Effective Communicator**

A Problem Solver

Problem solvers tackle challenges by identifying root causes of issues, brainstorming solutions, implementing effective strategies, and demonstrating adaptability.

- Engage students with open-ended, creative thinking tasks that require both conventional and innovative solutions.
- Facilitate group discussions and collaborative projects.
- Use real-world scenarios and hands-on activities.
- Highlight the importance of effort, persistence, and continuous learning.
- Provide regular feedback and encourage reflection.

Work Ready

To be work-ready includes a combination of technical expertise, soft skills, and personal qualities that ensure a graduate can effectively contribute to the workplace from day one.

- Set high standards for punctuality, responsibility, professionalism, and task completion.
- Use project-based learning and collaborative assignments.
- Emphasize clear written and verbal communication.
- Offer practical exercises like mock interviews and resume workshops.
- Integrate technology and teach digital literacy.

Respectful

Graduates who embody respectfulness emphasize the importance of treating others with dignity, valuing

Skilled Socially

Graduates who are skilled socially are equipped to navigate social environments, build relationships, and

diversity, and fostering an inclusive and positive environment, both personally and professionally.

- Demonstrate personal, interpersonal, and professional skills.
- Show respect for diversity.
- Model respect through active listening and empathy.
- Set clear expectations for respectful interactions.
- Promote collaboration and group discussions.
- Celebrate respectful behavior.
- Address disrespect promptly and constructively.

contribute positively to their communities and workplaces.

- Show awareness of global responsibility to others and the environment.
- Participate in community involvement.
- Design cooperative group projects and team activities
- Set expectations for respect and give regular feedback.
- Facilitate discussions on inclusivity, kindness, and respect.
- Model positive interactions and recognize strong social skills.

A Critical Thinker

Critical thinkers approach problems systematically by analyzing, evaluating, and synthesizing information to make well-informed decisions and contribute to innovative solutions.

- Encourage critical thinking individually and collaboratively.
- Design lessons that challenge assumptions and explore diverse viewpoints.
- Use open-ended questions, rigorous activities, and cross-curricular projects.
- Integrate project-based learning and real-world problem-solving.
- Offer reflective opportunities like journaling and discussions.
- Cultivate an environment that values curiosity and inquiry.

An Effective Communicator

Effective communicators convey ideas, information, and emotions accurately and persuasively, fostering understanding and collaboration.

- Communicate effectively using oral, written, visual, artistic, and technical modes.
- Include group discussions, presentations, and peer reviews.
- Promote active listening and thoughtful responses.
- Offer clear guidelines and constructive feedback.
- Stress clear, respectful, and purposeful communication.

CTECS Instructional Model

CTECS uses the Marzano Compendium to guide research-based instructional strategies that differentiate learning and promote access, engagement, and success for all students. Teachers apply these strategies to support diverse learners (including multilingual learners, students with disabilities, and students with varied academic or technical backgrounds) through scaffolds, modeling, guided practice, and multiple ways to participate and show understanding. This approach ensures every

student can work toward proficiency in the Priority Standards and the competencies outlined in the CTECS Vision of a Graduate.

Feedback	Content	Context
<p>Providing and Communicating Clear Learning Goals</p> <ol style="list-style-type: none"> 1. Providing scales and rubrics 2. Tracking student progress 3. Celebrating success <p>Using Assessments</p> <ol style="list-style-type: none"> 4. Using informal assessments of the whole class 5. Using formal assessments of individual students 	<p>Conducting Direct Instruction Lessons</p> <ol style="list-style-type: none"> 6. Chunking content 7. Processing content 8. Recording and representing content <p>Conducting Practicing and Deepening Lessons</p> <ol style="list-style-type: none"> 9. Using structured practice sessions 10. Examining similarities and differences 11. Examining errors in reasoning <p>Conducting Knowledge Application Lessons</p> <ol style="list-style-type: none"> 12. Engaging students in cognitively complex tasks 13. Providing resources and guidance 14. Generating and defending claims <p>Using Strategies That Appear in All Types of Lessons</p> <ol style="list-style-type: none"> 15. Previewing strategies 16. Highlighting critical information 17. Reviewing content 18. Revising knowledge 19. Reflecting on learning 20. Assigning purposeful homework 21. Elaborating on information 22. Organizing students to interact 	<p>Using Engagement Strategies</p> <ol style="list-style-type: none"> 23. Noticing and reacting when students are not engaged 24. Increasing response rates 25. Using physical movement 26. Maintaining a lively pace 27. Demonstrating intensity and enthusiasm 28. Presenting unusual information 29. Using friendly controversy 30. Using academic games 31. Providing opportunities for students to talk about themselves 32. Motivating and inspiring students <p>Implementing Rules and Procedures</p> <ol style="list-style-type: none"> 33. Establishing rules and procedures 34. Organizing the physical layout of the classroom 35. Demonstrating withitness 36. Acknowledging adherence to rules and procedures 37. Acknowledging lack of adherence to rules and procedures <p>Building Relationships</p> <ol style="list-style-type: none"> 38. Using verbal and nonverbal behaviors that indicate affection for students 39. Understanding students' backgrounds and interests 40. Displaying objectivity and control <p>Communicating High Expectations</p> <ol style="list-style-type: none"> 41. Demonstrating value and respect for reluctant learners 42. Asking in-depth questions of reluctant learners 43. Probing incorrect answers with reluctant learners

Curriculum Introduction

The **Geometry Curriculum** is designed to develop students into effective collaborators, critical thinkers, and problem solvers by applying reasoning skills to solve novel mathematical problems. This course builds upon foundational knowledge from Grade 8 and Algebra 1, such as the coordinate plane and linear equations, to establish a formal logical structure for geometry.

A central theme of the curriculum is the transition from **inductive reasoning to deductive reasoning**. Students often begin by investigating geometric properties through experimentation and

formulating conjectures; however, the curriculum emphasizes that while evidence supports a conjecture, a formal **proof** is required for mathematical certainty. The "Big Idea" across multiple units is that theorems about polygons and triangles are interconnected, as they are all proved based on a foundation of postulates and previously established theorems

The course is organized into specialized units that build in complexity:

- **Coordinates and Transformations:** The curriculum begins by using **coordinate geometry** to find distances and explore transformations like reflections, rotations, and translations. These rigid motions provide the basis for the formal definition of **congruence**.
- **Triangles and Congruence:** Students learn to prove triangles congruent using criteria such as SAS, ASA, and SSS. This stage also introduces **Euclidean constructions** using a compass and straightedge.
- **Polygons and Quadrilaterals:** This area focuses on the properties and classifications of various polygons. Students prove theorems about **parallelograms, rectangles, rhombi, and trapezoids**, often using coordinate geometry to verify these properties algebraically.
- **Right Triangles and Trigonometry:** Building on the concept of **similarity**, students develop trigonometric ratios to solve real-world problems. This includes applying the **Pythagorean Theorem** and the Laws of Sines and Cosines.
- **Two- and Three-Dimensional Geometry:** The final stages of the curriculum involve an in-depth study of **surface area and volume** for polyhedral and other solid figures, such as cylinders, cones, and spheres.

Learning Goals and Standards

Throughout the curriculum, students are expected to master several **Standards for Mathematical Practice**, including:

- **Constructing viable arguments** and critiquing the reasoning of others.
- **Using appropriate tools strategically**, such as dynamic geometry software, compasses, and calculators.
- **Modeling with mathematics** to describe and solve real-world situations.

By the end of the course, students will be able to perform complex geometric constructions, use coordinates to prove geometric theorems, and apply measurement formulas to model physical objects and solve design problems.

Course Map

This course map outlines the progression of the Geometry curriculum, organized by units, marking periods, and key instructional modules.

Unit 1: Coordinates, Lines, and Transformations

- **Timeframe:** Marking Period 1
- **Key Concepts:** This introductory unit focuses on coordinate geometry and representing transformations (isometries) in the coordinate plane.
- **Core Topics:**
 - The Pythagorean Theorem and Distance Formula.
 - Rigid motions: Translations (vectors), rotations, and reflections.
 - Compositions of transformations and symmetry.
 - Slope criteria for parallel and perpendicular lines.

Unit 2: Triangles, Angles, and Congruence

- **Timeframe:** Marking Period 2
- **Key Concepts:** Congruence is formally defined through rigid motions. Students begin constructing a formal logical system of geometry using postulates and theorems.
- **Core Topics:**
 - Angles formed by parallel lines and transversals.
 - Triangle congruence criteria (SSS, SAS, and ASA).
 - Properties of isosceles triangles.
 - Euclidean constructions using a compass, straightedge, and dynamic software.

Unit 3: Triangle Relationships and Polygons

- **Timeframe:** Quarter 3 (approximately 23 days)
- **Key Concepts:** An in-depth study of the properties of polygons, emphasizing the transition from inductive reasoning (conjectures) to deductive reasoning (proofs).
- **Core Topics:**

- **Relationships in Triangles (Module 6):** Perpendicular and angle bisectors, medians, altitudes, and triangle inequalities.
- **Quadrilaterals (Module 7):** Properties and tests for parallelograms, rectangles, rhombi, squares, trapezoids, and kites.

Unit 4: Polygons

- **Timeframe:** Marking Period 4
- **Key Concepts:** This unit continues the study of polygons with a focus on interior/exterior angles and the distinction between theorems and their converses.
- **Core Topics:**
 - Sums of interior and exterior angles of polygons.
 - Construction of regular polygons (equilateral triangles, squares, and regular hexagons).
 - Introduction to tessellations and tiling the plane.
 - Coordinate proofs for special quadrilaterals.

Unit 5: Right Triangles and Trigonometry

- **Timeframe:** Quarter 4 (11 days)
- **Key Concepts:** Building on similarity, this unit explores geometric relationships and applies trigonometric ratios to solve real-world problems.
- **Core Topics:**
 - Geometric mean and the Pythagorean Theorem.
 - Special right triangles (30° - 60° - 90° and 45° - 45° - 90°).
 - Trigonometric ratios (Sine, Cosine, Tangent) and their inverses.
 - Real-world applications involving angles of elevation and depression.
 - The Law of Sines and the Law of Cosines.

Unit 6: Two and Three-Dimensional Geometry

- **Timeframe:** Quarter 4 (9 days)
- **Key Concepts:** An in-depth study of measurement formulas for solid figures, establishing how they relate to each other and to plane figures.
- **Core Topics:**
 - **Measurement (Module 11):** Areas of quadrilaterals, regular polygons, and circles.

- Surface area and volume of polyhedra and solids (prisms, pyramids, cylinders, cones, and spheres).
- Two-dimensional cross-sections of three-dimensional objects.
- Applications of density and design problems.

The course concludes with a **Final Exam Review** (2 days) and a **Final Exam** (1 day)

Instructional Approach

The instructional approach of the Geometry Curriculum is designed to transform students into **effective collaborators, critical thinkers, and problem solvers**. It bridges foundational knowledge from Grade 8 and Algebra 1 with a formal logical system of geometry.

1. Three-Phase Instructional Plan

The curriculum leverages a specific lesson plan structure centered on **collaboration and argumentative discourse**. This plan consists of three distinct phases:

- **Launch:** This phase stimulates engagement by having students focus on a "big concept". Students explore patterns, observe, wonder, and make initial predictions or hypotheses through "math talk" routines and collaborative grouping.
- **Exploration and Development:** Students "dive deep" into their hypotheses through guided questions and activities. This phase incorporates direct instruction, math workstations, testing evidence, and evidence-based writing.
- **Practice and Reflection:** Students engage in group or independent practice. They are encouraged to reflect on their initial questions and the lesson's outcomes. Formative evaluations, such as exit tickets or written reflections, are embedded here to assess understanding.

2. Reasoning: From Inductive to Deductive

A core pedagogical strategy is the transition from **inductive reasoning** to **deductive reasoning**.

- **Inductive Phase:** Students begin by investigating geometric properties through experimentation and formulating conjectures.
- **Deductive Phase:** Teachers emphasize that evidence-based conjectures (inductive) do not constitute a formal proof (deductive). Students are taught to construct a sequence of theorems

based on established postulates and previously proved theorems to achieve mathematical certainty.

3. Strategic Use of Tools and Technology

The curriculum prioritizes the strategic use of tools to model and solve problems.

- **Physical Tools:** Students use compasses and straightedges for formal Euclidean constructions, such as bisecting angles or constructing regular polygons.
- **Technology:** Dynamic geometry software (such as **GeoGebra** or **Desmos**) and other digital resources (like **Reveal Math**, **Gizmos**, and **Jamboard**) are used to represent transformations, discover trigonometric ratios, and create reflections.

4. Differentiation and Intervention

To ensure all students succeed, the curriculum provides tiered strategies based on learner needs:

- **Non-mastery Support:** Includes reteaching through multiple intelligences, scaffolding, graphic organizers, small group study, and daily math reviews.
- **Enrichment:** High-performing students are challenged with increased rigor, deepened concept learning, tiered assignments, and more argumentative writing.
- **ELL Support:** Strategies include connecting concepts to primary language and culture, using reference charts (word webs/pictures), increasing processing time, and daily vocabulary review.

5. Evidence of Learning (Assessment)

Success is measured through a mix of formative and summative assessments. Formative checks—such as warm-ups, observations, student discourse, and anecdotal notes—occur throughout all phases of the learning plan. Summative assessments, like **Module Tests**, are provided in multiple forms (On Level, Approaching Level, and Beyond Level) to align with student proficiency scales. Additionally, **Performance Tasks** (e.g., "Designing Shape Blocks" or "YouTube Viral Videos") allow students to demonstrate their understanding through real-world modeling.

Vertical Alignment

The vertical alignment of the geometry curriculum establishes a continuous learning path that begins with foundational middle school concepts, builds into a formal logical system during the course, and prepares students for advanced mathematical modeling and real-world problem-solving.

1. Foundational Layer: Grade 8 and Algebra 1

The curriculum builds directly upon students' prior exposure to geometry and algebra. Students enter the course with several key competencies:

- **Grade 8 Core:** Students are expected to have a background in computing **area and perimeter**, identifying geometric figures, and an intuitive understanding of **transformations**. They specifically bring knowledge of the **Pythagorean Theorem** and its applications to find distances in coordinate systems (8.G.B.7, 8.G.B.8).
- **Algebra 1:** Students transition into Geometry with an understanding of the **coordinate plane**, equations of lines, and the meaning of **slope**. This allows them to use coordinate geometry as a tool for proving geometric theorems algebraically.

2. Internal Progression: The Geometry Sequence

Within the Geometry course, each unit acts as a prerequisite for the next, moving from informal discovery to formal deduction:

- **From Transformations to Postulates:** Unit 1 focuses on informal explorations of rigid motions and coordinate geometry. These discoveries then become the **postulates** that form the foundation for the formal logical structure of the course beginning in Unit 2.
- **From Congruence to Polygons:** Unit 2 defines **congruence** through rigid motions. This knowledge is used in Units 3 and 4 to construct sequences of theorems about **triangles and quadrilaterals**, such as proving that the diagonals of a parallelogram bisect each other.
- **From Similarity to Trigonometry:** Unit 5 builds on previous experiences with transformations and congruence to explore **similarity**. This progression allows students to develop **trigonometric ratios** (Sine, Cosine, Tangent) based on angle properties in similar right triangles.
- **From 2D to 3D Geometry:** The final unit connects area formulas for plane figures (established in earlier units) to the properties and formulas for the surface area and volume of **polyhedra and solid figures**.

3. Cognitive Development: Reasoning and Proof

A critical vertical thread throughout the curriculum is the transition in mathematical reasoning:

- **Inductive to Deductive:** Early in the units, students formulate **conjectures** through experimentation (inductive reasoning). The curriculum then shifts to emphasize that evidence alone is not enough, requiring students to construct formal **deductive proofs** to achieve mathematical certainty.
- **Increasing Rigor:** As students progress, they move from identifying rigid motions (Level 1 Retrieval) to analyzing and specifying the composition of transformations (Level 3 Analysis).

4. Future Readiness and Interdisciplinary Transfer

The curriculum is designed to foster skills that extend beyond the classroom into future coursework and careers:

- **Modeling and Design:** Students apply geometric methods to solve **design problems**, such as minimizing costs or working within physical constraints.
- **Technological Proficiency:** Students move from using physical tools (compass and straightedge) to mastering **dynamic geometry software** (like GeoGebra or Desmos) to discover and model complex relationships.
- **Collaborative Problem Solving:** Throughout all units, the curriculum emphasizes becoming **effective collaborators** and critical thinkers by using number sense and reasoning skills to solve novel math problems.

Vocabulary

The vocabulary in the geometry curriculum is categorized by unit and module, progressing from the foundational language of coordinates and transformations to the complex terminology used in trigonometry and three-dimensional modeling.

Foundational Terms: Coordinates and Transformations

In the early stages of the curriculum, students focus on the language of **isometries** (rigid motions) and coordinate geometry.

- **Key Terms:** Transformation, translation, reflection, rotation, and **dilation**.

- **Coordinate Concepts:** Distance formula, midpoint, slope, parallel, and perpendicular lines.
- **Geometric Elements:** Point, line, ray, segment, and undefined terms such as plane.

Logical Structure: Congruence and Proof

As the course moves into a formal logical structure, the vocabulary shifts to describe relationships between figures and the components of mathematical arguments.

- **Triangles and Angles:** Vertical angles, linear pairs, **transversal**, alternate interior angles, and corresponding angles.
- **Congruence Criteria:** SAS (Side-Angle-Side), ASA (Angle-Side-Angle), and SSS (Side-Side-Side).
- **Reasoning:** Conjectures, **inductive reasoning** (based on evidence), **deductive reasoning** (formal proof), and the distinction between a theorem and its **converse**.

Relationships and Polygons

Units 3 and 4 introduce specific terminology for the internal relationships within triangles and the classification of complex polygons.

- **Triangle Segments:** **Altitude**, **median**, perpendicular bisector, and angle bisector.
- **Points of Concurrency:** Centroid, circumcenter, incenter, and orthocenter.
- **Polygons:** Parallelogram, rhombus, kite, trapezoid (including isosceles trapezoids, bases, and legs), and regular polygons like the hexagon or octagon.
- **Specialized Concepts:** **Tessellation** (or tiling), convex and non-convex polygons, and interior vs. exterior angles.

Trigonometry and Right Triangles

Unit 5 focuses on the vocabulary required for analyzing right triangles and applying trigonometric functions to real-world scenarios.

- **Core Ratios:** **Sine**, **cosine**, and **tangent**, along with their inverse functions.
- **Triangles:** 30° - 60° - 90° and 45° - 45° - 90° special right triangles.

- **Applications:** Angle of elevation, **angle of depression**, geometric mean, and the Law of Sines and Law of Cosines.

Two- and Three-Dimensional Geometry

The final stages of the curriculum involve the study of polyhedra and measurement.

- **3D Elements:** Polyhedra, **cross section**, faces, edges, and solids of revolution.
- **Measurement:** **Lateral area**, surface area, volume, **apothem** (for regular polygons), and slant height.
- **Modeling:** Density (area and volume-based) and the use of geometric shapes to describe physical objects.

Vocabulary Support for Learners

To assist students in mastering this extensive list of terms, the curriculum includes specific strategies for **ELL students**, such as the creation of **reference charts** (word webs or pictures), daily vocabulary reviews, and increased repetition of key terms

The importance of this vocabulary extends to constructing viable arguments and providing evidence-based writing throughout the instructional framework. Students use academic vocabulary to justify each step of solving equations and to orally defend mathematical choices, such as identifying restricted domains or explaining why a value is a zero. Furthermore, the curriculum emphasizes increased repetition and daily reviews of academic terms to ensure students can perform high-level tasks, such as using argumentative reflection to explain why exponential growth eventually overtakes polynomial growth.

Resources

The geometry curriculum is supported by a wide range of digital platforms, instructional frameworks, and physical tools designed to facilitate collaborative learning and mathematical modeling.

Digital and Interactive Technology

A primary component of the curriculum is the integration of diverse digital resources to enhance engagement and visualization.

- **Instructional Platforms:** Teachers utilize tools like **Reveal Math, Smart Boards, PowerPoints**, and **Google Suite** to deliver content.
- **Interactive Engagement:** Platforms such as Reveal Math, Kahoot.com, Google Suites, Khan Academy and IXL are used for "math talk" routines and collaborative activities.
- **Dynamic Modeling:** Students use **dynamic geometry software** (such as **GeoGebra** or **Desmos**) to explore transformations, discover trigonometric ratios, and create Euclidean constructions.
- **Supplemental Learning:** Targeted skill practice and video instruction are supported through **Khan Academy, Gizmos**, and **IXL**.

Curricular Frameworks and Instructional Guides

The curriculum provides structured paths for each unit to ensure alignment with state and national standards.

- **Module Structure:** The course is organized through **Reveal Math modules** (e.g., Module 6 for triangle relationships and Module 11 for measurement), which include specific lesson plans for Launching, Exploring, and Practice.
- **Activity Suggestions and Investigations:** Each unit includes a "Connecticut Core Standards Link" that leads to targeted investigations, such as "The Construction Games" or "Sums of Interior Angles of Polygons".
- **Standards Alignment:** Resources are explicitly aligned with **Common Core State Standards (CCSS)** and **Standards for Mathematical Practice**, focusing on constructing viable arguments and using tools strategically.

Assessment

To measure success and support diverse learners, the curriculum includes tiered assessment materials.

- **Summative Assessments:** Units feature **Module Tests** provided in multiple formats: **Form A (On Level)**, **Form B (Approaching Level)**, and **Form C (Beyond Level)**.
- **Performance Tasks:** Real-world application projects, such as "**Designing Shape Blocks**" or "**YouTube Viral Videos**," allow students to demonstrate proficiency through modeling.
- **Differentiation Resources:** The curriculum provides specific strategies for **Non-mastery** (graphic organizers, reteaching), **Enrichment** (argumentative writing, increased rigor), and **ELL support** (word webs, reference charts).

Physical and Mathematical Tools

Beyond digital resources, students employ traditional and scientific tools for geometric exploration.

- **Construction Tools:** Formal geometric constructions require the use of a **compass**, **straightedge**, **string**, **reflective devices**, and **paper folding**.
- **Calculation:** The **TI-84 Calculator** is a standard resource for applying reasoning skills to solve novel math problems and for work in coordinate geometry.

CTECS Mathematics Department Philosophy

The Mathematics Department at the Connecticut Technical Education and Career System (CTECS) is committed to delivering a rigorous and relevant math education that prepares students for both their technical trade programs and postsecondary opportunities. The department emphasizes real-world application, helping students connect mathematical concepts to industry practices while building strong problem-solving and critical thinking skills.

The department fosters an inclusive learning environment that supports all students through vertically aligned curricula, differentiated instruction, and data-informed practices. By prioritizing both conceptual understanding and procedural fluency, and integrating technology and industry-aligned resources, CTECS aims to develop confident, mathematically literate graduates ready for college, careers, and lifelong learning.

Geometry Unit 1 Coordinates, Lines and Angles

Name of the Unit: Coordinates, Lines and Angles Reveal Modules 1, 2 and 3	Quarter 1: 45 days Length of the Unit: 45 days
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Big Ideas:

Geometric transformations may be explored through the application of concrete materials, coordinate geometry, and the use of dynamic geometric software

Essential Questions:

(engaging, open-ended questions to spark student interest and sharply focus instruction and assessment)

- **How is coordinate geometry used to find distances and determine parallel and perpendicular lines?**
- **How are points, lines, and segments used to model the real world? (M1)**
- **How are angles and two-dimensional figures used to model the real world? (M2)**
- **What makes a logical argument, and how are logical arguments used in geometry? (M3)**

Purpose of the Unit:

This introductory unit builds on the background students bring to this course. Ideally students should have had considerable exposure to geometry in the Grade 8 Core Curriculum. In practice we realize that in the mid-teens of this century this will not yet be the case for most students. However, we do expect students to be familiar with the names of geometric figures, methods for computing area and perimeter, and some intuitive understanding of geometric transformations. Furthermore, from their Algebra 1 course they will be familiar with the coordinate plane, equations of lines and the meaning of slope. Therefore, in this informal introduction to geometry we will focus on coordinate geometry and the representation of transformations in the coordinate plane. As students discover the properties of transformations, they will establish the basis for a series of postulates that will become the foundation of the logical structure of geometry beginning in Unit 2.

Activity Suggestions:

[Connecticut Core Standards Link: Transformations and Coordinates](#)

Investigation 1: The Pythagorean Theorem and the Distance Formula

Investigation 2: Vectors and Translations

Investigation 3: Angles and Rotations

Investigation 4: Reflections

Reveal Module 1: Tools of Geometry - 14 days

Lesson 1: The Geometric System

Lesson 2: Points, Lines and Plans

Lesson 3: Line Segments

Lesson 4: Distance

Lesson 5: Locating Points on a Number Line

Lesson 6: Locating Points on a Coordinate Plane

Lesson 7: Midpoints and Bisectors

Reveal Module 2: Angles and Geometric Figures - 12 days

Lesson 1: Angles and Congruence

Lesson 2: Angle Relationships

Lesson 3: Two-Dimensional Figures

Lesson 4: Transformations in the Plane

Lesson 5: Three-Dimensional Figures

Lesson 6: Two-Dimensional Representations of Three-Dimensional Figures

Reveal Mod 3: Logical Arguments and Line Relationships - 19 days

Lesson 1: Conjectures and Counterexamples

Lesson 2: Statements, Conditionals, and BiConditionals

Lesson 3: Deductive Reasoning

Lesson 5: Proving Segment Relationships

Lesson 6: Proving Angle Relationships

Lesson 7: Parallel Lines and Transversals

Lesson 8: Slope and Equations of Lines

Lesson 9: Proving Lines Parallel

Key vocabulary/terms:

M1: analytic geometry, axiom, axiomatic system, betweenness of points, bisect, collinear, congruent, congruent segments, constructions, coplanar, defined term, definition, directed line segment, distance, equidistant, fractional distance, intersection, line, line segment, midpoint, plane, point, postulate, segment bisector, space, synthetic geometry, theorem, undefined terms

M2: accuracy, adjacent angles, angle, angle bisector, angle of rotation, approximate error, area, base of a pyramid or cone, bases of a prism or cylinder, center of rotation, circumference, complementary angles, component form, concave polygon, cone, congruent angles, convex polygon, cylinder, edge of a polyhedron, equiangular polygon, equilateral polygon, exterior, face of a polyhedron, geometric model, image, interior, linear pair, line of reflection, net, opposite rays, orthographic drawing, perimeter, perpendicular, Platonic solid, polygon, polyhedron, precision, preimage, prism, pyramid, ray, reflection, regular polygon, regular polyhedron, rigid motion, rotation, sides, significant figures, sphere, straight angle, supplementary angles, surface area,

transformation, translation, translation vector, vertex, vertical angles, vertex of a polyhedron, volume

M3: alternate exterior angles, alternate interior angles, biconditional statement, compound statement, conclusion, conditional statement, conjecture, conjunction, consecutive interior angles, contrapositive, converse, corresponding angles, counterexample, deductive argument, deductive reasoning, disjunction, equidistant, exterior angles, flow proof, hypothesis, if-then statement, inductive reasoning, interior angles, inverse, logically equivalent, negation, paragraph proof, parallel lines, parallel planes, proof, skew lines, slope, slope criteria, statement, transversal, truth value, two-column proof, valid argument

Differentiation/Intervention Strategies		
<u>Non-mastery</u> (Provide items for struggling learners)	<u>Enrichment</u> (Provide items for high performing students)	<u>ELL</u> (Provide items to support ELL students)
<ul style="list-style-type: none"> • Reteach addressing multiple intelligence • Scaffolding • Graphic organizers • Small group or independent direct study • Varied guided questions • Tiered assignments • Daily math review 	<ul style="list-style-type: none"> • Tiered assignments • Extend or deepen concept learning • Increased rigor • More argumentative writing 	<ul style="list-style-type: none"> • Scaffolding (simplify task with structured guidance) • Connect to primary language and culture • Create reference charts (picture or word web) • Increase processing time • Daily vocabulary review • Varied guided questions • Increase repetition

Evidence of Success: What Will Students Be Able to Do?

Students will be able to:

- understand the basic elements of geometry, including points, lines, segments, planes, and angles. (M1)
- measure distances and compute midpoints on number lines and the coordinate plane.(M1)
- find measures of angles. (M2)
- find measures of two- and three-dimensional figures.(M2)
- use precision and accuracy when reporting measurements.(M2)
- look for patterns and write conjectures based on those patterns.(M3)
- prove conjectures using logical arguments or disprove conjectures using counterexamples.(M3)
- apply logical arguments to basic line and angle relationships.(M3)

[CELP](#)

(Emphasize standards in **bold**)

[CELP and CCSSM Alignment](#)

[Standards for Mathematical Practice](#)

(Emphasize practices in **bold**)

Common Core Standards Addressed in this unit:

(M1) G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

(M1) G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

(M1) G.GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

(M1) G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

(M2) G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

(M2) G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

(M2) G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

(M2) G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

(M2) G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

(M2) G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

(M3)G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

(M3)G.CO.9 Prove theorems about lines and angles.

(M3)G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

(M3)G.GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

(M3)G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Geometry Unit 2 Transformations, Triangles, and Congruence

Name of the Unit: Transformations, Triangles and Congruence Reveal Modules 4, 5 and 6	Quarter 2: 46 days Length of the Unit: 41 days Midterm Review: 3 days Midterm Exam: 2 days
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Big Ideas:

(can be broad [interdisciplinary], topical [content focused] or both)

(Big ideas helps students make connections among disciplines or units of study within a content area)

(What is the value or benefit of learning the concepts in this goal)

- Theorems about congruent triangles may be proved using transformations and applied to justify constructions.
- Geometric transformations may be explored through the application of concrete materials, coordinate geometry, and the use of dynamic geometric software.

Essential Questions:

(engaging, open-ended questions to spark student interest and sharply focus instruction and assessment)

- What are transformations?
- What properties are preserved by various transformations?
- What are the properties of congruent figures?
- How can two triangles be proved congruent?
- What relationships hold among angles formed by parallel lines and a transversal?
- How can you construct geometric figures with a compass and straightedge?
- How can you prove the constructions work?
- How are rigid transformations used to show geometric relationships?(M4)

- How can you prove congruence and use congruent figures in real-world situations? (M5)
- How can relationships in triangles be used in real-world situations?(M6)

Purpose of the Unit:

In keeping with the Common Core Standards, the fundamental idea of congruence is defined in terms of transformations. The properties of transformations discovered in Unit 1 become postulates as we begin to construct a formal system of geometry.

Activity Suggestions:

[Connecticut Core Standards Link: Unit 1 Coordinates and Transformations](#)

Investigation 1: The Pythagorean Theorem and the Distance Formula

Investigation 2: Vectors and Translations

Investigation 3: Angles and Rotations

Investigation 4: Reflections

[Connecticut Core Standards Link: Unit 2 Congruence, Constructions and Proofs](#)

Investigation 1: Identifying Congruent Figures

Investigation 2: Congruent Triangles: SAS and ASA

Investigation 3: Isosceles Triangles

Investigation 4: Congruent Triangles SSS

Investigation 5: Vertical Angles and Parallel Lines

Reveal Module 4: Transformations and Symmetry- 12 days

Lesson 1: Reflections

Lesson 2: Translations

Lesson 3: Rotations

Lesson 6: Symmetry

Reveal Module 5 Triangles and Congruence - 14 days

Lesson 1: Area of Triangles

Lesson 2: Congruent Triangles

Lesson 3: Proving Triangles Congruent: SSS, SAS

Lesson 4: Proving Triangles Congruent: ASA, AAS

Lesson 5: Proving Right Triangles Congruent

Lesson 6: Isosceles and Equilateral Triangles

Reveal Module 6 - Relationships in Triangles - 13 days

Lesson 1: Perpendicular Bisectors

Lesson 2: Angle Bisectors

Lesson 3: Medians and Altitudes of Triangles

Lesson 4: Inequalities in One Triangle

Lesson 6: The Triangle Inequality

Midterm Review - 3 days

Midterm Exam - 2 days

Key vocabulary/terms:

M4: center of symmetry, composition of transformations, glide reflection, line of symmetry, line symmetry, magnitude, magnitude of symmetry, order of symmetry, point of symmetry, point symmetry, regular tessellation, rotational symmetry, semiregular tessellation, symmetry, tessellation, uniform tessellation

M5: auxiliary line, base angles of an isosceles triangle, congruent polygons, coordinate proofs, corollary, corresponding parts, exterior angle of a triangle, included angle, included side, interior angle of a triangle, isosceles triangle, legs of an isosceles triangle, principle of superposition, remote interior angles, vertex angle of an isosceles triangle

M6: altitude of a triangle, centroid, circumcenter, concurrent lines, incenter, indirect proof, indirect reasoning, median, orthocenter, perpendicular bisector, point of concurrency, proof by contradiction

Differentiation/Intervention Strategies		
<u>Non-mastery</u> (Provide items for struggling learners)	<u>Enrichment</u> (Provide items for high performing students)	<u>ELL</u> (Provide items to support ELL students)
<ul style="list-style-type: none"> • Reteach addressing multiple intelligence • Scaffolding • Graphic organizers • Small group or independent direct study • Varied guided questions • Tiered assignments • Daily math review 	<ul style="list-style-type: none"> • Tiered assignments • Extend or deepen concept learning • Increased rigor • More argumentative writing 	<ul style="list-style-type: none"> • Scaffolding (simplify task with structured guidance) • Connect to primary language and culture • Create reference charts (picture or word web) • Increase processing time • Daily vocabulary review • Varied guided questions • Increase repetition

Evidence of Success: What Will Students Be Able to Do?

Students will be able to:

- **perform and use rigid motions including rotations, translations, and reflections.(M4)**
- **perform and use compositions of transformations. (M4)**
- **explore symmetry using transformations. (M4)**
- **use triangle sum theorems to solve problems. (M5)**
- **prove triangles congruent using different congruence criteria.(M5)**
- **use congruent triangles to solve problems.(M5)**

- explore the relationships in triangles that result from the bisectors, medians, and altitudes of triangles.(M6)
- recognize and apply the properties of inequalities to the measures of the angles and sides of a triangle.(M6)
- apply the Hinge Theorem or its converse to make comparisons in two triangles.(M6)

CELP

(Emphasize standards in **bold**)

CLEP and Math Practice Standards Alignment

Standards for Mathematical Practice

(Emphasize practices in **bold**)

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.

Common Core Standards Addressed in this unit:

(M4)G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

(M4) G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

(M4) G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

(M4) G.CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

(M5) G.CO.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

(M5) G.CO.8 Explain how the criteria for triangle congruence (ASA, SAS, SSS, and Hypotenuse-Leg) follow from the definition of congruence in terms of rigid motions.

(M5) G.CO.10 Prove theorems about triangles.

(M5) G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

(M5) G.GPE.4 Use coordinates to prove simple geometric theorems algebraically.

(M6) G.CO.9 Prove theorems about lines and angles.

(M6) G.CO.10 Prove theorems about triangles.

(M6) G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

Interdisciplinary Knowledge Transfer (from prior to future courses):

Learners will become effective collaborators, technology users, critical thinkers, and problem solvers. They will develop these skills through the application of sound number sense, exponential expressions, arithmetic and reasoning skills to solve novel math problems.

<u>Concepts</u>	<u>Skills</u>	<u>Marzano's Taxonomy</u>
<p>Nouns or noun phrases (Teachable Ideas)</p> <p>M4: Transformations and Symmetry</p> <ul style="list-style-type: none"> • reflection • line of symmetry • magnitude, • point symmetry <p>M5 Triangles and Congruence</p> <ul style="list-style-type: none"> • isosceles triangle • polygons • corresponding parts • exterior angle of a triangle • included angle • included side • interior angle 	<p>Verbs (What students are able to do) Align with I know and I can statements</p> <ul style="list-style-type: none"> • M4-1: I can draw a geometric figure transformed by a reflection, and I can determine that two figures are congruent by using reflections. • M4-2: I can draw a geometric figure transformed by a translation, and I can determine that two figures are congruent by using translations. • M4-3: I can draw a geometric figure transformed by a rotation, and I can determine that two figures are congruent by using rotations. • M4-6: I can describe the two- and three-dimensional symmetry of figures and objects using rotations and reflections. • M5-1: I can prove theorems about the interior and exterior angles of triangles • M5-2: I can use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if every pair of corresponding parts are congruent, and I can use congruent triangles to solve problems and prove relationships in geometric figures. • M5-3: I can use the definition of congruence in terms of rigid motions to show that two triangles 	<p>Levels and category for learning</p>

<ul style="list-style-type: none"> • vertex <p>M6 - Relationships in Triangles</p> <ul style="list-style-type: none"> • altitude • triangle • centroid • concurrent lines • perpendicular bisector 	<p>are congruent if each pair of corresponding sides is congruent or if two pairs of corresponding sides are congruent and the included angles are congruent, and I can use congruent triangles to solve problems and prove relationships in geometric figures.</p> <ul style="list-style-type: none"> • M5-4: I can explain how the criteria for triangle congruence follow from the definition of congruence in terms of rigid motions, and I can use triangle congruence to solve problems and prove relationships in geometric figures. • M5-5: I can prove theorems about congruent right triangles, and I can use the congruence criteria for right triangles to solve problems and to prove relationships in geometric figures. • M5-6: I can prove theorems about isosceles and equilateral triangles, and I can use congruence criteria for triangles to solve problems and to prove relationships in geometric figures. <ul style="list-style-type: none"> • 6-1: I can prove theorems about the relationships formed by perpendicular bisectors within triangles. • 6-2: I can prove theorems about the relationships formed by angle bisectors within triangles. • 6-3: I can prove theorems about the relationships formed by the medians and altitudes of triangles, and I can make formal geometric constructions using a variety of tools. 	
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	<ul style="list-style-type: none"> • 6-4: I can prove theorems about inequalities in one triangle. • 6-6: I can prove the Triangle Inequality Theorem, and I can use the Triangle Inequality Theorem to prove other theorems. 	
Refer to the links below: Depth of Knowledge LA Depth of Knowledge Math/Science	Refer to the links below: Depth of Knowledge LA Depth of Knowledge Math/Science	Refer to the links below: Depth of Knowledge LA Depth of Knowledge Math/Science

Geometry Unit 3 Polygons

Name of the Unit: Unit 3 Polygons Reveal Module: 7	Quarter 3: 45 days Length of the Unit: 14 days
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Big Ideas:
<p>(can be broad [interdisciplinary], topical [content focused] or both) (Big ideas helps students make connections among disciplines or units of study within a content area) (What is the value or benefit of learning the concepts in this goal)</p> <ul style="list-style-type: none"> • Theorems about polygons are related to each other in that all are proved based on postulates and previously proved theorems.
Essential Questions:

(engaging, open-ended questions to spark student interest and sharply focus instruction and assessment)

- **What are the different types of quadrilaterals, and how can their characteristics be used to model real-world situations?**

Purpose of the Unit:

An in depth study of the properties of polygons provides students with the opportunity to construct a sequence of theorems based on the postulates and theorems introduced in unit 2. Many of the properties studied will first be introduced through experimentation as students formulate conjectures. The teacher should continually emphasize that supporting a conjecture by evidence (inductive reasoning) does not constitute a proof (deductive reasoning).

Activity Suggestions:

[Connecticut Core Standards Link: Polygons](#)

Investigation 1: Sums of Interior Angles of Polygons

Investigation 2: Inequalities in Triangles

Investigation 3: Parallel and Perpendicular Lines

Investigation 4: Regular Polygons

Investigation 5: Properties of Quadrilaterals

Investigation 6: Polygons with Coordinates

Reveal Module 7: Quadrilaterals - 8 days

Lesson 1: Angles of Polygons

Lesson 2: Parallelograms

Lesson 3: Tests for Parallelograms

Lesson 4: Rectangles

Lesson 5: Rhombi and Squares

Lesson 6: Trapezoids and Kites

Key vocabulary/terms:

M7: base angle of a trapezoid, bases of a trapezoid, diagonal, isosceles trapezoid, kite, legs of a trapezoid, midsegment of a trapezoid, parallelogram, rectangle, rhombus, square, trapezoid

Differentiation/Intervention Strategies

Non-mastery (Provide items for struggling learners)	Enrichment (Provide items for high performing students)	ELL (Provide items to support ELL students)
<ul style="list-style-type: none"> • Reteach addressing multiple intelligence • Scaffolding • Graphic organizers • Small group or independent direct study • Varied guided questions • Tiered assignments • Daily math review 	<ul style="list-style-type: none"> • Tiered assignments • Extend or deepen concept learning • Increased rigor • More argumentative writing 	<ul style="list-style-type: none"> • Scaffolding (simplify task with structured guidance) • Connect to primary language and culture • Create reference charts (picture or word web) • Increase processing time • Daily vocabulary review • Varied guided questions • Increase repetition

Evidence of Success: What Will Students Be Able to Do?

Students will be able to:

- **prove theorems and solve problems about polygons and parallelograms.(M7)**
- **recognize and apply the properties of rectangles, rhombi, squares, kites, and trapezoids.(M7)**
- **determine whether quadrilaterals are parallelograms and whether parallelograms are rectangles.(M7)**

CELP

(Emphasize standards in **bold**)

[CLEP and Math Practice Standards Alignment](#)

Standards for Mathematical Practice

(Emphasize practices in **bold**)

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.

Common Core Standards Addressed in this unit:

- (M7)G.CO.11 Prove theorems about parallelograms.**
(M7)G.GPE.4 Use coordinates to prove simple geometric theorems algebraically.
(M7)G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Interdisciplinary Knowledge Transfer (from prior to future courses):

Learners will become effective collaborators, technology users, critical thinkers, and problem solvers. They will develop these skills through the application of sound number sense, exponential expressions, arithmetic and reasoning skills to solve novel math problems.

<u>Concepts</u>	<u>Skills</u>	<u>Marzano's Taxonomy</u>
<p>Nouns or noun phrases (Teachable Ideas)</p> <p>M7: Quadrilaterals</p> <ul style="list-style-type: none"> • trapezoid • diagonal • kite • midsegment • parallelogram • rectangle • rhombus • square • trapezoid 	<p>Verbs (What students are able to do) Align with I know and I can statements</p> <ul style="list-style-type: none"> • M7-1: I can model real-world objects with polygons and find missing angle measures. • M7-2: I can use previously learned theorems to prove properties of parallelograms • M7-3: I can use previously proved theorems to determine if a quadrilateral is a parallelogram, and I can use coordinates to prove that a quadrilateral satisfies the tests for parallelograms. • M7-4: I can use properties to determine if a parallelogram is a rectangle. I can use coordinate geometry to determine whether a parallelogram is a rectangle. • M7-5: I can use theorems and coordinate geometry to determine whether a parallelogram is a rhombus or square. • M7-6: I can learn how to apply the properties of trapezoids and kites to solve real-world and mathematical problems. 	<p>Levels and category for learning</p>

Geometry Unit 4 Similarity, Right Triangles, & Trigonometry

Name of the Unit: Similarity, Right Triangles, & Trigonometry Reveal Modules 8 and 9	Quarter 3: 45 days Length of the Unit: 31 days
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Big Ideas:

(can be broad [interdisciplinary], topical [content focused] or both)

(Big ideas helps students make connections among disciplines or units of study within a content area)

(What is the value or benefit of learning the concepts in this goal)

- The concept of similarity enables us to explore geometric relationships and apply trigonometric ratios to solve real world problems.

Essential Questions:

(engaging, open-ended questions to spark student interest and sharply focus instruction and assessment)

- What does it mean for objects to be similar, and how is similarity useful for modeling in the real world? (M8)
- How are right triangle relationships useful in solving real-world problems? (M9)

Purpose of the Unit:

This unit builds on students' experiences with transformations and proving triangles congruent. Students continue to discover a pattern, make a conjecture, and then prove the theorem. This unit is also designed to help students to strengthen their understanding of proof. Students will use techniques learned in Unit 2 to prove triangles congruent to now prove triangles similar. These new theorems are then used to prove additional theorems. Right triangle trigonometry is then developed from similarity and used in the analysis of special right triangles and applications to real world problems.

This unit builds on students' experiences with transformations and proving triangles congruent. Students continue to discover a pattern, make a conjecture, and then prove the theorem. This unit is also designed to help students to strengthen their understanding of proof. Students will use techniques learned in Unit 2 to prove triangles congruent to now prove triangles similar. These new theorems are then used to prove additional theorems. Right triangle trigonometry is then developed from similarity and used in the analysis of special right triangles and applications to real world problems.

Activity Suggestions:

[Common Core Standards Link: Similarity, Right Triangles, & Trigonometry](#)

Investigation 1: Properties of Dilations

Investigation 2: Similar Figures

Investigation 4: Parallel Lines in Triangles

Investigation 5: Similarity in Right Triangles

Investigation 6: Right Triangle Trigonometry

Investigation 7: Special Right Triangles

Reveal Module 8 Similarity - 11 days

Lesson 1: Dilations

Lesson 2: Similar Polygons

Lesson 3: Similar Triangles: AA Similarity

Lesson 4 Similar Triangles: SSS and SAS Similarity

Reveal Module 9 Right Triangles and Trigonometry - 20 days

Lesson 1: Geometric Mean

Lesson 2: Pythagorean Theorem and Its Converse

Lesson 3: Coordinates in Space

Lesson 4: Special Right Triangles

Lesson 5: Trigonometry

Lesson 6: Applying Trigonometry

Lesson 7: The Law of Sines

Lesson 8: The Law of Cosines

Key vocabulary/terms:

M8: center of dilation, dilation, enlargement, midsegment of a triangle, nonrigid motion, reduction, scale factor of dilation, similar polygons, similarity ratio, similarity transformation, similar triangles

M9: 30°-60°-90° triangle, 45°-45°-90° triangle, ambiguous case, angle of depression, angle of elevation, cosine, geometric mean, indirect measurement, inverse cosine, inverse sine, inverse tangent, octant, ordered triple, Pythagorean triple, sine, solving a triangle, tangent, trigonometric ratio, trigonometry

Differentiation/Intervention Strategies		
Non-mastery (Provide items for struggling learners)	Enrichment (Provide items for high performing students)	ELL (Provide items to support ELL students)
<ul style="list-style-type: none"> • Reteach addressing multiple intelligence • Scaffolding • Graphic organizers • Small group or independent direct study • Varied guided questions • Tiered assignments • Daily math review 	<ul style="list-style-type: none"> • Tiered assignments • Extend or deepen concept learning • Increased rigor • More argumentative writing 	<ul style="list-style-type: none"> • Scaffolding (simplify task with structured guidance) • Connect to primary language and culture • Create reference charts (picture or word web) • Increase processing time • Daily vocabulary review • Varied guided questions • Increase repetition

Evidence of Success: What Will Students Be Able to Do?
<p>Students will be able to:</p> <ul style="list-style-type: none"> • identify similar polygons and use ratios and proportions to solve problems.(M8) • use the AA Similarity Postulate and the SSS and SAS Similarity Theorems to solve problems. (M8) • use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.(M9) • explain and use the relationship between the sine and cosine of complementary angles.(M9) • prove the Laws of Sines and Cosines and use them to solve problems.(M9)

<p>CELP (Emphasize standards in bold)</p>	<p>Standards for Mathematical Practice (Emphasize practices in bold)</p>
<p>CLEP and Math Practice Standards Alignment</p>	<p>Common Core Standards <i>Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. Practices in bold are to be emphasized in the unit.</i></p> <ol style="list-style-type: none"> 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.

[MP1, MP2, MP3, MP4, MP5, MP6](#)
(see the full description of each standard here)

Common Core Standards Addressed in this unit:

(M8) G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

(M8) G.CO.10 Prove theorems about triangles.

(M8) G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

(M8) G.SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor:

a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

(M8) G.SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

(M8) G.SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

(M8) G.SRT.4 Prove theorems about triangles.

(M8) G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

(M8) G.GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

(M9) G.SRT.4 Prove theorems about triangles.

(M9) G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

(M9) G.SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

(M9) G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.

(M9) G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

(M9) G.SRT.9 Derive the formula $A = \frac{1}{2}ab\sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

(M9) G.SRT.10 Prove the Laws of Sines and Cosines and use them to solve problems.
(M9) G.SRT.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Interdisciplinary Knowledge Transfer (from prior to future courses):

Learners will become effective collaborators, technology users, critical thinkers, and problem solvers. They will develop these skills through the application of sound number sense, exponential expressions, arithmetic and reasoning skills to solve novel math problems.

<u>Concepts</u>	<u>Skills</u>	<u>Marzano's Taxonomy</u>
<p>Nouns or noun phrases (Teachable Ideas)</p> <p>M8: Similarity</p> <ul style="list-style-type: none"> • dilation • midsegment • scale factor of dilation • similar polygons <p>M9: Right Triangles and Trigonometry</p> <ul style="list-style-type: none"> • triangle • ambiguous case 	<p>Verbs (What students are able to do) Align with I know and I can statements</p> <ul style="list-style-type: none"> • M8-1: I can use dynamic geometry software to discover the properties of dilations when given a center and scale factor. I can also learn how to find the coordinates of the vertices of an image when dilating a figure. • M8-2: I can use dynamic geometry software to determine whether two figures are similar by performing dilations and rigid motions. • M8-3: I can determine whether two triangles are similar by using the definition of similarity transformations. I can also use the similarity criteria to prove triangles similar and then use the properties of similar triangles to solve problems. • M8-4: I can determine whether two triangles are similar by using the definition of similarity transformations. I can also use the similarity criteria to prove triangles similar and then use the properties of similar triangles to solve problems. • 9-1: I can find missing side lengths in right triangles using similar triangles and geometric means. I can also 	<p>Levels and category for learning</p>

<ul style="list-style-type: none"> • angle of depression • angle of elevation • cosine • geometric mean • sine • Pythagorean triple • tangent • trigonometric ratio • trigonometry 	<ul style="list-style-type: none"> • prove theorems involving geometric means and right triangles. • 9-2: I can prove the Pythagorean Theorem by using triangle similarity and use the Pythagorean Theorem to solve real-world problems involving right triangles. • 9-3: I can apply mathematical concepts to solve problems arising in everyday life. • 9-4: I can explore the relationships between the side ratios and angles in special right triangles. I can also explain that by similarity, all special right triangles will have side lengths in the same ratio. • 9-5: I can use dynamic geometry software to discover three common trigonometric ratios and explore the relationship between the sine and cosine of complementary angles. I can also use trigonometric ratios to solve real-world problems that involve right triangles. • 9-6: I can use trigonometric ratios to solve problems involving angles of elevation and depression. I can use trigonometric ratios to determine the area of a triangle. • 9-7: I can use the Law of Sines to solve triangles and to solve real-world problems involving missing lengths and angle measures of triangles. • 9-8: I can use the Law of Cosines to solve real world problems involving missing lengths and angle measures of triangles. 	
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10th Geometry Unit 5 Two and Three-Dimensional Geometry

Name of the Unit: Two and Three-Dimensional Geometry Reveal Module 11	Quarter 4: 46 days Length of the Unit: 14 days
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Big Ideas:

(can be broad [interdisciplinary], topical [content focused] or both)
(Big ideas helps students make connections among disciplines or units of study within a content area)

(What is the value or benefit of learning the concepts in this goal)

- Formulas for solid figures relate to each other in meaningful ways, just as area formulas for plane figures connect to each other.

Essential Questions:

(engaging, open-ended questions to spark student interest and sharply focus instruction and assessment)

- What kinds of solid geometric figures are there?
- What are some of the properties of these solids?
- How can we find surface areas and volumes for these solids?
- Where do the formulas come from?
- How can we use these formulas to solve problems we might face in the real world?
- Is there only one kind of geometry, the Euclidean Geometry with which we are familiar?
- How are measurements of two- and three-dimensional figures useful for modeling situations in the real world? (M11)

Purpose of the Unit:

This unit provides an in-depth study of the vocabulary, properties and formulas for the surface area and volumes of polyhedra and other solid figures. Students make informal arguments for the formulas for surface area and volume. The unit explores several real world applications of surface area and volume

Activity Suggestions:

Common Core Standards Link: Three-Dimensional Geometry

Investigation 1: Polygons and Polyhedra

Investigation 2: Nets and Surface Area

Investigation 3: Volume

Reveal Module 11 - Measurement - 14 days

Lesson 1: Areas of Quadrilaterals

Lesson 2: Areas of Regular Polygons

Lesson 3: Areas of Circles and Sectors (cover only Area of Circles)

Lesson 4: Surface Area

Lesson 6: Volumes of Prisms and Pyramids

Lesson 7: Volumes of Cylinders, Cones and Spheres

Key vocabulary/terms:

M11: altitude of a parallelogram, altitude of a prism or cylinder, altitude of a pyramid or cone, apothem, axis of a cone, axis of a cylinder, axis symmetry, base edge, base of a parallelogram, center of a regular polygon, central angle of a regular polygon, chord of a sphere, composite figure, composite solid, congruent solids, conic sections, cross section, decomposition, density, diameter of a sphere, height of a parallelogram, height of a solid, height of a trapezoid, lateral area, lateral edges, lateral faces, lateral surface of a cone, lateral surface of a cylinder, plane symmetry, radius of a regular polygon, radius of a sphere, regular pyramid, sector, similar solids, slant height of a pyramid or right cone, solid of revolution, tangent to a sphere

Differentiation/Intervention Strategies

<u>Non-mastery</u> (Provide items for struggling learners)	<u>Enrichment</u> (Provide items for high performing students)	<u>ELL</u> (Provide items to support ELL students)
<ul style="list-style-type: none"> • Reteach addressing multiple intelligence • Scaffolding • Graphic organizers • Small group or independent direct study • Varied guided questions • Tiered assignments • Daily math review 	<ul style="list-style-type: none"> • Tiered assignments • Extend or deepen concept learning • Increased rigor • More argumentative writing 	<ul style="list-style-type: none"> • Scaffolding (simplify task with structured guidance) • Connect to primary language and culture • Create reference charts (picture or word web) • Increase processing time • Daily vocabulary review • Varied guided questions • Increase repetition

Evidence of Success: What Will Students Be Able to Do?

Students will be able to:

- give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.(M11)
- identify the shapes of two-dimensional cross sections of three-dimensional objects.(M11)
- use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.(M11)

<u>CELP</u> (Emphasize standards in bold)	<u>Standards for Mathematical Practice</u> (Emphasize practices in bold)
CLEP and Math Practice Standards Alignment	<p><i>Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning.</i></p> <ol style="list-style-type: none">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. <p style="text-align: center;">MP1, MP2, MP3, MP4, MP5, MP6 (see the full description of each standard here)</p>

Common Core Standards Addressed in this unit:

(M11)G.C.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

(M11)G.GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.

(M11)G.GMD.2 Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

(M11)G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

(M11)G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

(M11)G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

(M11)G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Interdisciplinary Knowledge Transfer (from prior to future courses):

Learners will become effective collaborators, technology users, critical thinkers, and problem solvers. They will develop these skills through the application of sound number sense, exponential expressions, arithmetic and reasoning skills to solve novel math problems.

<u>Concepts</u>	Skills	<u>Marzano's Taxonomy</u>
<p>Nouns or noun phrases (Teachable Ideas)</p> <p>M11: Measurement</p> <ul style="list-style-type: none"> • altitude • axis • axis symmetry • base edge • parallelogram • regular polygon • central angle • regular polygon • chord of a sphere • parallelogram • trapezoid • edges • faces • polygon • sphere • pyramid • slant height 	<p>Verbs (What students are able to do) Align with I know and I can statements</p> <ul style="list-style-type: none"> • 11-1: I can see complicated things as being composed of several objects. • 11-2: I can use regular polygons to design objects and solve problems. • 11-3: I can derive the formula for the area of a circle. • 11-4: I can approximate the surface areas of different solids to determine the amount of materials needed to construct the solids. • 11-6: I can derive the formula for the volume of a pyramid by using dissection arguments, Cavalieri's principle, and informal limit arguments, and use the formula to solve problems. • 11-7: I can derive the formulas for the volume of cylinders, cones, and spheres and use the formulas to solve problems. 	

Geometry Unit 6 Probability

Name of the Unit: Probability Reveal Module 12	Quarter 4: 46 Length of the Unit: 14 days
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Big Ideas:

(can be broad [interdisciplinary], topical [content focused] or both)

(Big ideas helps students make connections among disciplines or units of study within a content area)

(What is the value or benefit of learning the concepts in this goal)

- Understand that it is not possible to predict with certainty short-term behavior of random phenomena but it is possible to use probability to predict long-run patterns.
- Probability models are useful tools for making decisions, choices, or predictions.

Essential Questions:

(engaging, open-ended questions to spark student interest and sharply focus instruction and assessment)

- What is probability?
- How are events defined?
- What is meant by independent/dependent events?
- How are probabilities, including compound probabilities, calculated?
- What is conditional probability and how does conditional probability apply to real-life events?
- How are two-way frequency tables used to model real-life data?
- What is expected value?
- How can you use measurements to find probabilities? (M12)

Purpose of the Unit:

This unit on probability builds on the background students bring to this course. Ideally, students have had some experience with probability in the Grade 7 and 8 Core Curriculum. In practice, we realize that probability may be a new topic for many students and teachers. However, we expect students to understand that probability measures the likelihood that a chance event occurs.

Activity Suggestions:

[Connecticut Core Standards Link: Probability](#)

Investigation 1 Sample Spaces

Investigation 2 Theoretical and Experimental Probability

Investigation 3 Independent Events and the Multiplication Rule

Investigation 4 Conditional Probability

Investigation 5 Interpreting Two-Way Frequency Tables

Investigation 6 Using Probability to Make Decisions

Reveal Module 12 - Probability - 14 days

Lesson 1 Sample Spaces

Lesson 2 Probability and Counting

Lesson 3 Geometric Probability

Lesson 4 Probability with Permutations and Combinations

Lesson 5 Probability and the Multiplication Rule

Lesson 6 Probability and the Addition Rule

Key vocabulary/terms:

M12: combination, complement of A , compound event, conditional probability, dependent events, event, experiment, factorial of n , finite sample space, geometric probability, independent events, infinite sample space, intersection of A and B , joint frequencies, marginal frequencies, mutually exclusive, outcome, permutation, relative frequency, sample space, two-way frequency table, union of A and B

Differentiation/Intervention Strategies		
<u>Non-mastery</u> (Provide items for struggling learners)	<u>Enrichment</u> (Provide items for high performing students)	<u>ELL</u> (Provide items to support ELL students)
<ul style="list-style-type: none"> • Reteach addressing multiple intelligence • Scaffolding 	<ul style="list-style-type: none"> • Tiered assignments • Extend or deepen concept learning 	<ul style="list-style-type: none"> • Scaffolding (simplify task with structured guidance)

<ul style="list-style-type: none"> • Graphic organizers • Small group or independent direct study • Varied guided questions • Tiered assignments • Daily math review 	<ul style="list-style-type: none"> • Increased rigor • More argumentative writing 	<ul style="list-style-type: none"> • Connect to primary language and culture • Create reference charts (picture or word web) • Increase processing time • Daily vocabulary review • Varied guided questions • Increase repetition
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Evidence of Success: What Will Students Be Able to Do?
<p><u>Students will be able to:</u></p> <ul style="list-style-type: none"> • represent sample spaces.(M12) • use permutations and combinations with probability.(M12) • find probabilities of compound events.(M12) • solve real-world problems involving probability.(M12)

<p><u>CELP</u> (Emphasize standards in bold)</p> <p><u>CELP and CCSSM Alignment</u></p>	<p><u>Standards for Mathematical Practice</u> (Emphasize practices in bold)</p> <ol style="list-style-type: none"> 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. <p style="text-align: center;"><u>MP1, MP2, MP3, MP4, MP5, MP6</u> (<u>see the full description of each standard here</u>)</p>
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Common Core Standards Addressed in this unit:
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(M12)S.CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).

(M12)S.CP.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

(M12)S.CP.3 Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A , and the conditional probability of B given A is the same as the probability of B .

(M12)S.CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

(M12)S.CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

(M12)S.CP.6 Find the conditional probability of A given B as the fraction of B 's outcomes that also belong to A , and interpret the answer in terms of the model.

(M12)S.CP.7 Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.

(M12)S.CP.8 Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model.

(M12)S.CP.9 Use permutations and combinations to compute probabilities of compound events and solve problems.

(M12)S.MD.6 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

(M12)S.MD.7 Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Interdisciplinary Knowledge Transfer (from prior to future courses):

Learners will become effective collaborators, technology users, critical thinkers, and problem solvers. They will develop these skills through the application of sound number sense, exponential expressions, arithmetic and reasoning skills to solve novel math problems.

<u>Concepts</u>	<u>Skills</u>	<u>Marzano's Taxonomy</u>
<p>Nouns or noun phrases (Teachable Ideas)</p> <p>M12: Probability</p> <ul style="list-style-type: none"> • combination • complement 	<p>Verbs</p> <p>(What students are able to do)</p> <p>Align with I know and I can statements</p> <ul style="list-style-type: none"> • M12-1: I can use an organized list, a table, or a tree diagram to represent the sample space of an experiment. I can also use the Fundamental 	<p>Levels and category for learning</p>

<ul style="list-style-type: none"> • probability • events • experiment • factorial • sample space • geometric probability • permutation 	<p>Counting Principle to determine the number of outcomes of an event.</p> <ul style="list-style-type: none"> • M12-2: I can describe outcomes that are in the union, intersection, or complement of a probability event. • M12-3: I can use length and area models to determine the probability of an event. • M12-4: I can use rules to determine whether an arrangement is a permutation or combination, and then use the appropriate formula to determine probability. • M12-5: I can determine whether two or more events are independent or dependent and use the associated multiplication rule to compute the probability. • M12-6: I can determine whether two or more events are mutually exclusive and use the addition rule to compute probabilities. 	
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10th Geometry Unit 7 Pre-Algebra, Algebra Review

<p>Name of the Unit: Pre-Algebra, Algebra Review</p>	<p>Quarter 4: 46 days Length of the Unit: 13 days Final Review: 3 days Final Exam: 2 days</p>
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<p>Big Ideas:</p>
<p>(can be broad [interdisciplinary], topical [content focused] or both) (Big ideas helps students make connections among disciplines or units of study within a content area) (What is the value or benefit of learning the concepts in this goal)</p> <ul style="list-style-type: none"> • Equations can be used to solve real life application problems. • Percents are used in the real world for a variety of situations, including discount, sales tax, tip, and markup. • Proportional relationships express how quantities change in relationship to each other.

Essential Questions:

(engaging, open-ended questions to spark student interest and sharply focus instruction and assessment)

- How can mathematical operations with rational numbers help us make real-life decisions?
- How can solving equations be useful in real life?
- When and why do I use proportional comparisons?
- How does comparing quantities describe the relationship between them?

Purpose of the Unit:

The unit deepens students' understanding and use of unit rates; develops their understandings of proportional relationships as represented in words tables, equations, graphs and diagrams; and engages them in multi-step ratio and percent problem-solving. Instruction is being done through problem-based learning.

Activity Suggestions:

Ratios and Unit Rates: [Unit 3: Fractions Decimals and Percents](#) - 6 days

Rounding to tenths, hundredths, thousandths

Fractions: Add, Subtract, Multiply, Divide

Equivalents Fractions

Ordering Decimals

Finding Unit Rates

Percents: [Unit 4: Rates and Proportional Relationships](#) - 7 days

Converting a decimal to a fraction

Converting a fraction to a percent

Converting a decimal to a percent

Finding a percentage of a number with and without a calculator

Solving a percent equation

Find whole, part, and percent using percent proportions and percent equation

Key vocabulary/terms:

integer, absolute value, opposites, additive inverse, rational number, terminating decimal, repeating decimal, simplest form, ratio, rate, unit rate, complex fraction, proportion, proportional, cross

products, slope, direct variation, constant of proportionality, percent of change, percent of increase, percent of decrease, percent error, discount, markup, interest, principal, simple interest

Differentiation/Intervention Strategies		
<u>Non-mastery</u> (Provide items for struggling learners)	<u>Enrichment</u> (Provide items for high performing students)	<u>ELL</u> (Provide items to support ELL students)
<ul style="list-style-type: none"> • Reteach addressing multiple intelligence • Scaffolding • Graphic organizers • Small group or independent direct study • Varied guided questions • Tiered assignments • Daily math review 	<ul style="list-style-type: none"> • Tiered assignments • Extend or deepen concept learning • Increased rigor • More argumentative writing 	<ul style="list-style-type: none"> • Scaffolding (simplify task with structured guidance) • Connect to primary language and culture • Create reference charts (picture or word web) • Increase processing time • Daily vocabulary review • Varied guided questions • Increase repetition

Evidence of Success: What Will Students Be Able to Do?

Students will be able to:

- add, subtract, multiply and divide fractions.
- convert between percents and decimals.
- compare and order less common percents, decimals, and fractions.
- analyze proportional relationships and use them to solve real-world and mathematical problems.
- solve multi-step percent problems.
- determine rates given words and tables.
- additionally verbally explain the process of determining rates to someone else
- use multiplication and division, and the Cross Products Property to decide if two ratios are equal.
- write and solve a proportion using mental math, cross products property, and multiplication and division.
- find whole, part, and percent using percent proportions and percent equation.
- use a percent of change formula to solve problems.
- find discounts and markups of items.
- use the simple interest formula and knowledge of equation solving to solve for different variables in the formula.

- apply knowledge of ratios, proportions, and percents to solve real life application problems.

<p><u>CELP</u> (Emphasize standards in bold)</p>	<p><u>Standards for Mathematical Practice</u> (Emphasize practices in bold)</p>
<p><u>CLEP and Math Practice Standards Alignment</u></p>	<p><i>Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning.</i></p> <ol style="list-style-type: none"> 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. <p style="text-align: center;">MP1, MP2, MP3, MP4, MP5, MP6 (see the full description of each standard here)</p>

Common Core Standards Addressed in this unit:

Operations with Rational Numbers

7.NS.1 - Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

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

7.NS.2a - Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

7.NS.2b - Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.

7.NS.2c -Apply properties of operations as strategies to multiply and divide rational numbers.

7.NS.2d - Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in Os or eventually repeats.

7.NS.3 - Solve real-world and mathematical problems involving the four operations with rational numbers.

Ratio and Proportional Relationships

7. RP.1 - Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

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

7.RP.2a - Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

7.RP.2b - Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

7.RP.2c - Represent proportional relationships by equations.

7. RP.3 - Use proportional relationships to solve multistep ratio and percent problems.

Interdisciplinary Knowledge Transfer (from prior to future courses):

Learners will become effective collaborators, technology users, critical thinkers, and problem solvers. They will develop these skills through the application of sound number sense, exponential expressions, arithmetic and reasoning skills to solve novel math problems.

Nouns or noun phrases (Teachable Ideas)	Verbs (What students are able to do) Align with I know and I can statements	Levels and category for learning
<ul style="list-style-type: none"> • decimals • unit rate • proportion • fractions • cross product • percent 	<ul style="list-style-type: none"> • I can use integers to represent real-life situations. • I can convert a fraction to a decimal. • I can convert a mixed number to a decimal. • I can add, subtract, multiply and divide fractions. • I can write ratios in simplest form. • I can compute a unit rate. • I can use a table to see if a relationship is proportional. • I can determine whether 2 ratios form a proportion. • I can solve a proportion that contains a variable. • I can write a proportion to solve real world problems. • I can convert a decimal to a percent. • I can convert a percent to a decimal. • I can convert a fraction to a percent. • I can convert a percent to a fraction. 	

	<ul style="list-style-type: none">• I can write and solve percent proportions.• I can write and solve percent equations.• I can find whole, part, and percent using percent proportions and percent equation.	
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