Grade 10 - Mathematics (Geometry)
Expressing Geometric Properties with Equations (2017-18) (20 - 25 Days)
Aug - Sep

Last Updated: 6/12/2017

Overview

How do relationships of lines and angles affect the world around you?
Students will be able to connect algebra and geometry through equations.

Students will explore a variety of angle types and use equations to support those relationships. In addition, students will use equations to represent distance relationships. Students will use the coordinate plane as a tool to model geometric concepts in regards to lines, parallel and perpendicular, and shapes, perimeter and area. Technology will be used to explore basic geometric constructions. Students will be required to use precise mathematical language to communicate their thinking around the relationships explored in this unit.

Standards:

- Standard 2: Patterns, Functions, and Algebraic Structures
  - GLE 4: Solutions to equations, inequalities and systems of equations are found using a variety of tools
    - EO a.i: Create equations and inequalities in one variable and use them to solve problems. (CCSS: A-CED.1)
    - EO a.ii: Create equations in two or more variables to represent relationships between quantities and graph equations on coordinate axes with labels and scales. (CCSS: A-CED.2)
    - EO b: Understand solving equations as a process of reasoning and explain the reasoning. (CCSS: A-REI)
    - EO b.i: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. (CCSS: A-REI.1)
    - EO d: Solve systems of equations. (CCSS: A-REI)
- Standard 4: Shape, Dimension, and Geometric Relationships
  - GLE 1: Objects in the plane can be transformed, and those transformations can be described and analyzed mathematically
    - EO a.i: State 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. (CCSS: G-CO.1)
    - EO c: Prove geometric theorems. (CCSS: G-CO)
    - EO c.i: Prove theorems about lines and angles. (CCSS: G-CO.9)
    - EO c.ii: Prove theorems about triangles. (CCSS: G-CO.10)
    - EO c.iii: Prove theorems about parallelograms. (CCSS: G-CO.11)
    - EO d.i: Make formal geometric constructions with a variety of tools and methods. (CCSS: G-CO.12)
  - GLE 3: Objects in the plane can be described and analyzed algebraically
    - EO a: Express Geometric Properties with Equations. (CCSS: G-GPE)
    - EO a.ii.2: Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. (CCSS: G-GPE.5)
    - EO a.ii.3: Find the point on a directed line segment between two given points that partitions the segment in a given ratio. (CCSS: G-GPE.6)
    - EO a.ii.4: Use coordinates and the distance formula to compute perimeters of polygons and areas of triangles and rectangles.* (CCSS: G-GPE.7)
  - GLE 5: Objects in the real world can be modeled using geometric concepts

District Unit of Study Updates:

Date	Comments
6/9/2017 7:02:09 PM	Added Unit Overview

Desired Results

Big Ideas:

- Reasoning/Proof, Modeling, Relationships, Transformations, Connections,

Overarching Understandings:

- Effective mathematical reasoning and proof involves making claims about relationships and justifying those claims by relying on the properties that are the structure of mathematics.
- Geometric relationships, expressed through words, pictures, graphs and numeric and algebraic expressions are used to explain and model the physical world and phenomena.
- Real world objects have attributes of space, shape and structure which can be measured, classified and analyzed.

Overarching Essential Questions:

- How are solving and proving different?
- What is the best way to show my reasoning?
- How can math help us describe the world?
- How do geometric relationships help us describe the world around us?
- How does a coordinate grid help us solve real world problems?
- How does what we measure influence how we measure?
- Which attributes should I use?

Organizing Concepts

Congruence: Proof

Students will understand that...

- Constructions help us visualize geometric problems and determine effective solutions.
- Deriving and analyzing geometric relationships develops reasoning and justification skills.
- Problem solvers construct viable arguments and critique the reasoning of others when developing and analyzing congruency proofs
- Relationships exist among the angles, sides, and lengths which can be used to justify theorems.

Essential Questions

- How can objects be described using geometry terms?
- How can the idea of congruency be used outside of mathematics?
- What structures are required to justify the geometric relationship.
- Why are proofs important in the development of geometry concepts?

Students will know...

- Appropriate markings on diagrams to show angle congruence, segment congruence, parallel lines, and right angles.
- Concept of angles, perpendicular lines, parallel lines and line segments based on undefined notions of point, line, and distance along a line.
- Key vocabulary: Postulate, theorem, complementary angles, supplementary angles, vertical angles, adjacent, linear pair, transversal, inductive reasoning, deductive reasoning
- Methods and tools for constructions (compass and straightedge, string, reflective devices, paper folding, geometry software).

Students will be able to...

- Use construction as a tool to model geometric relationships and justify your reasoning.
- Justify theorems regarding lines and angles (include vertical angles congruent, parallel lines cut by transversal, points on a perpendicular bisector of a line equidistant from endpoints).
- Make formal arguments to justify reasoning.
- Properties of equality (addition, subtraction, multiplication, division, reflexive, symmetric, transitive, substitution, and distributive) to justify geometric and algebraic relationships.
- Use angle and segment properties to justify geometric relationships.

Expressing Geometric Properties with Equations

Students will understand that...

- Algebraic properties and modeling are connected to Geometric properties and formulas.
- Algebraic properties and modeling are connected to geometric properties.
- Problem solvers model with mathematics by describing geometric shapes with algebraic equations.
- Solving equations is a process of reasoning and explaining reasoning.

Students will know...

- Graphing parallel and perpendicular lines using technology.
- Equations of lines.
- How to create equations to represent distance.
- Midpoint Formula
- Polygon sum theorem and polygon exterior angle theorem.
- Slope formula, slope of parallel lines, slope of perpendicular lines
- Substitution of variables in context.
- Triangle sum theorem.

Essential Questions

- How can you create and solve algebraic equations based on geometric relationships.
- How can you write an equation to represent geometric properties?
- Why do different types of equations require different types of solution processes?

Students will be able to...

- Create and graph equations in two or more variables to represent relationships between quantities.
- Create and solve algebraic equations based on congruence between angles, segments and theorems in quadrilaterals and polygons.
- Create equations in two variables to represent relationships between quantities and graph equations on coordinate axes with labels and scales.
- Find the point on a directed line segment, between two given points, that partitions the segment in a given ratio.
- Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric properities.
- Use coordinates and the distance formula to compute perimeters of polygons and areas of triangles and rectangles.

Grade 10 - Mathematics (Geometry)
Congruence (2017-18) (20 - 25 Days)
Sep - Oct

Last Updated: 6/12/2017

Overview

What is appealing about congruent figures?
Students will be able to explore theorems of congruency and relationships within triangles and other polygons.

Students will be able to perform, compare, and describe transformations of rigid geometric figures. Students establish triangle congruence criteria, based on analyses or rigid motions and formal constructions. They solve problems about triangles, quadrilaterals and other polygons. They apply reasoning to complete geometric constructions and have a good foundation of geometric proofs.

Standards:

- Standard 1: Number Sense, Properties, and Operations
  - GLE 2: Quantitative reasoning is used to make sense of quantities and their relationships in problem situations
    - EO a.ii: Define appropriate quantities for the purpose of descriptive modeling. (CCSS: N-Q.2)
- Standard 2: Patterns, Functions, and Algebraic Structures
  - GLE 3: Expressions can be represented in multiple, equivalent forms
    - EO a.i: Interpret expressions that represent a quantity in terms of its context.* (CCSS: A-SSE.1)
    - EO b: Write expressions in equivalent forms to solve problems. (CCSS: A-SSE)
  - GLE 4: Solutions to equations, inequalities and systems of equations are found using a variety of tools
    - EO a: Create equations that describe numbers or relationships. (CCSS: A-CED)
    - EO a.i: Create equations and inequalities in one variable and use them to solve problems. (CCSS: A-CED.1)
    - EO b: Understand solving equations as a process of reasoning and explain the reasoning. (CCSS: A-REI)
    - EO c: Solve equations and inequalities in one variable. (CCSS: A-REI)
- Standard 4: Shape, Dimension, and Geometric Relationships
  - GLE 1: Objects in the plane can be transformed, and those transformations can be described and analyzed mathematically
    - EO a: Experiment with transformations in the plane. (CCSS: G-CO)
    - EO a.ii: Represent transformations in the plane using appropriate tools. (CCSS: G-CO.2)
    - EO a.iii: Describe transformations as functions that take points in the plane as inputs and give other points as outputs. (CCSS: G-CO.2)
    - EO a.iv: Compare transformations that preserve distance and angle to those that do not. (CCSS: G-CO.2)
    - EO a.v: Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. (CCSS: G-CO.3)
    - EO a.vi: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. (CCSS: G-CO.4)
    - EO a.vii: Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using appropriate tools. (CCSS: G-CO.5)
    - EO a.viii: Specify a sequence of transformations that will carry a given figure onto another. (CCSS: G-CO.5)
    - EO b: Understand congruence in terms of rigid motions. (CCSS: G-CO)
    - EO b.i: Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure. (CCSS: G-CO.6)
    - EO b.ii: Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. (CCSS: G-CO.6)
    - EO b.iii: 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. (CCSS: G-CO.7)
    - EO b.iv: Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. (CCSS: G-CO.8)
    - EO c: Prove geometric theorems. (CCSS: G-CO)
    - EO c.ii: Prove theorems about triangles. (CCSS: G-CO.10)
    - EO d.i: Make formal geometric constructions with a variety of tools and methods. (CCSS: G-CO.12)
  - GLE 2: Concepts of similarity are foundational to geometry and its applications
    - EO b.iii: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. (CCSS: G-SRT.5)
  - GLE 3: Objects in the plane can be described and analyzed algebraically
    - EO a.i: Translate between the geometric description and the equation for a conic section. (CCSS: G-GPE)
    - EO a.ii: Use coordinates to prove simple geometric theorems algebraically. (CCSS: G-GPE.4)
    - EO a.ii.1: Use coordinates to prove simple geometric theorems algebraically. (CCSS: G-GPE)
  - GLE 5: Objects in the real world can be modeled using geometric concepts
    - EO a: Apply geometric concepts in modeling situations. (CCSS: G-MG)
    - EO a.i: Use geometric shapes, their measures, and their properties to describe objects. * (CCSS: G-MG.1)
    - EO a.iii: Apply geometric methods to solve design problems. * (CCSS: G-MG.3)

District Unit of Study Updates:

Date	Comments
6/9/2017 6:58:44 PM	Added Unit Overview

Desired Results

Big Ideas:

- Reasoning/Proof, Equivalence, Modeling, Relationships, Transformations,

Overarching Understandings:

- Effective mathematical reasoning and proof involves making claims about relationships and justifying those claims by relying on the properties that are the structure of mathematics.
- Geometric relationships, expressed through words, pictures, graphs and numeric and algebraic expressions are used to explain and model the physical world and phenomena.
- Real world objects have attributes of space, shape and structure which can be measured, classified and analyzed.

Overarching Essential Questions:

- How are solving and proving different?
- How does proof look the same or different based on the content?
- What is the best way to show my reasoning?
- How do geometric relationships help us describe the world around us?
- Which geometric objects model the real world best?

Organizing Concepts

Congruence: Proof

Students will understand that...

- Justify congruent triangles by comparing corresponding parts.
- Problem solvers look for and make use of structure by seeing patterns in how to organize a proof
- Problem solvers construct viable arguments and critique the reasoning of others when developing and analyzing congruency proofs
- Constructions help us visualize geometric problems and determine effective solutions.
- Proof allows us to communicate in a precise and efficient manner.

Students will know...

- Corresponding parts of congruent triangles are congruent.
- Notation and properties for writing congruence statements.
- SAS, ASA, AAS, SSS, and HL postulates to show congruence.
- Triangle Inequality Theorem
- Key vocabulary: cooresponding parts, vertex angle, base angle, midsegment, median, altitude.
- Rigid transformations (rotations, reflections, rotations).

Essential Questions

- How can you Justify two triangles are congruent?
- How do constructions help justify and model congruence?
- How is a perpendicular bisector like an angle bisector? How is it different?
- Why are proofs important in the development of geometry concepts?

Students will be able to...

- Apply triangle congruence properties to constructions.
- Explore properties about triangles (measures of interior angles, base angles of isosceles triangles are congruent, the segment joining the midpoints of two sides of a triangle is parallel to the third side and is half the length, and the medians of a triangle meet at a point).
- Properties of equality/congruence: (reflexive, symmetric, transitive) to justify a geometric property.
- Use construction as a tool to model geometric relationships and justify your reasoning.
- Use congruence criteria (SAS, ASA, AAS, SSS, and HL) for triangles to justify relationships in geometric figures.

Congruence: Transformations

Students will understand that...

- Rigid transformations are used to replicate a figure without changing its size and shape.
- Rigid transformations are used to show congruence between two figures.
- The triangle has one special characteristic that is shared by no other plane shape-rigidity.
- Transformations aid in generating innovative and creative products such as animation

Students will know...

- Composition of transformations.
- Definitions of rigid transformations (rotations, reflections, and translations) in terms of angles, line segments, perpendicular lines, and parallel lines.
- Key vocabulary: refection, rotation, translation, preimage, image
- Notation for transformed figures on a plane.
- Rigid transformations that carry a triangle onto another triangle.

Essential Questions

- How can transformations be used to represent different situations?
- How can you change a figure's position without changing its shape or size?
- How can you represent a transformation in the coordinate plane?
- How do transformations help us compare real-world objects?

Students will be able to...

- Use the definition of congruence in terms of rigid motions (through technology, graph paper, or tracing paper) to show that two or more figures are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
- Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
- Compare transformations that preserve congruence and/or slope to those that do not.
- Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using appropriate tools (e.g graph papaer, tracing paper, transparencies, or geometry software).
- Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent
- Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure.

Expressing Geometric Properties with Equations

Students will understand that...

- Algebraic properties and modeling are connected to Geometric properties and formulas.
- Algebraic properties and modeling are connected to geometric properties.
- Problem solvers model with mathematics by describing geometric shapes with algebraic equations.
- The coordinate plane is used to identify and verify properties of Geometric figures.
- The coordinate plane is useful to greatly simplify models of objects and structures.

Students will know...

- Triangle sum theorem.
- Finding distance on a coordinate grid.
- How to create equations to represent distance.
- Midpoint Formula
- Solving systems of equations by substitution.

Essential Questions

- How can an equation help find the solution to a problem?
- How can you create and solve algebraic equations based on geometric relationships.
- How can you write an equation to represent geometric properties?
- What roles do the properties of equality play in establishing triangle congruence?

Students will be able to...

- Create and solve algebraic equations in one variable based on congruence.
- Use coordinates to prove simple geometric theorems algebraically (e.g. triangle mid-segment theorem or SSS).
- Use the geometric relationship within a triangle (i.e. congruence, triangle sum thm, exterior angle sum thm., angle bisector, perpendicular bisector, etc...) to represent algebraic relationships.
- Using congruent trianlges to find an indirect measurement (i.e. distance across a river)

Grade 10 - Mathematics (Geometry)
Similarity, Right Triangles, and Trigonometry (2017-18) (25 - 30 Days)
Nov - Dec

Last Updated: 6/12/2017

Overview

What are the dimensions of a perfect design of a skateboard kicker ramp?
Students will be able to recognize and apply the concept of similarity to solve problems.

Students will build on their knowledge of rigid transformation from unit two to similarity transformations. Identifying criteria for similarity of polygons, with particular attention to right triangles, and use equations to solve problems. Pythagorean Theorem and special right triangles will be applied to build an equation for the solution. Students will explain and use relationships between tangent, sine, cosine in problem solving situations, including the use of angles of depression and elevation.

Standards:

- Standard 4: Shape, Dimension, and Geometric Relationships
  - GLE 1: Objects in the plane can be transformed, and those transformations can be described and analyzed mathematically
    - EO a: Experiment with transformations in the plane. (CCSS: G-CO)
  - GLE 2: Concepts of similarity are foundational to geometry and its applications
    - EO a: Understand similarity in terms of similarity transformations. (CCSS: G-SRT)
    - EO a.i: Verify experimentally the properties of dilations given by a center and a scale factor. (CCSS: G-SRT.1)
    - EO a.i.1: Show that 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. (CCSS: G-SRT.1a)
    - EO a.i.2: Show that the dilation of a line segment is longer or shorter in the ratio given by the scale factor. (CCSS: G-SRT.1b)
    - EO a.ii: Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar. (CCSS: G-SRT.2)
    - EO a.iii: 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. (CCSS: G-SRT.2)
    - EO a.iv: Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. (CCSS: G-SRT.3)
    - EO b: Prove theorems involving similarity. (CCSS: G-SRT)
    - EO b.i: Prove theorems about triangles. (CCSS: G-SRT.4)
    - EO b.ii: Prove that all circles are similar. (CCSS: G-C.1)
    - EO b.iii: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. (CCSS: G-SRT.5)
    - EO c: Define trigonometric ratios and solve problems involving right triangles. (CCSS: G-SRT)
    - EO c.i: Explain 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. (CCSS: G-SRT.6)
    - EO c.ii: Explain and use the relationship between the sine and cosine of complementary angles. (CCSS: G-SRT.7)
    - EO c.iii: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.* (CCSS: G-SRT.8)
    - EO d.iii: Apply trigonometry to general triangles.
  - GLE 3: Objects in the plane can be described and analyzed algebraically
    - EO a.ii.1: Use coordinates to prove simple geometric theorems algebraically. (CCSS: G-GPE)
  - GLE 4: Right triangles are central to geometry and its applications
  - GLE 5: Objects in the real world can be modeled using geometric concepts
    - EO a.iii: Apply geometric methods to solve design problems. * (CCSS: G-MG.3)
- Standard 4: Shape, Dimension, and Geometric Relationships
  - GLE 1: Objects in the plane can be transformed, and those transformations can be described and analyzed mathematically
    - EO a: Experiment with transformations in the plane. (CCSS: G-CO)
  - GLE 2: Concepts of similarity are foundational to geometry and its applications
    - EO a: Understand similarity in terms of similarity transformations. (CCSS: G-SRT)
    - EO a.i: Verify experimentally the properties of dilations given by a center and a scale factor. (CCSS: G-SRT.1)
    - EO a.i.1: Show that 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. (CCSS: G-SRT.1a)
    - EO a.i.2: Show that the dilation of a line segment is longer or shorter in the ratio given by the scale factor. (CCSS: G-SRT.1b)
    - EO a.ii: Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar. (CCSS: G-SRT.2)
    - EO a.iii: 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. (CCSS: G-SRT.2)
    - EO a.iv: Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. (CCSS: G-SRT.3)
    - EO b: Prove theorems involving similarity. (CCSS: G-SRT)
    - EO b.i: Prove theorems about triangles. (CCSS: G-SRT.4)
    - EO b.ii: Prove that all circles are similar. (CCSS: G-C.1)
    - EO b.iii: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. (CCSS: G-SRT.5)
    - EO c: Define trigonometric ratios and solve problems involving right triangles. (CCSS: G-SRT)
    - EO c.i: Explain 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. (CCSS: G-SRT.6)
    - EO c.ii: Explain and use the relationship between the sine and cosine of complementary angles. (CCSS: G-SRT.7)
    - EO c.iii: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.* (CCSS: G-SRT.8)
    - EO d.iii: Apply trigonometry to general triangles.
  - GLE 3: Objects in the plane can be described and analyzed algebraically
    - EO a.ii.1: Use coordinates to prove simple geometric theorems algebraically. (CCSS: G-GPE)
  - GLE 4: Right triangles are central to geometry and its applications
  - GLE 5: Objects in the real world can be modeled using geometric concepts
    - EO a.iii: Apply geometric methods to solve design problems. * (CCSS: G-MG.3)
- Standard MP: Mathematical Practices
  - GLE 1: Developing mathematical practices are processes and proficiencies necessary to flexibly use skills and concepts in multiple contexts.
    - EO 5: Use appropriate tools strategically

District Unit of Study Updates:	
Date	**Comments**

Desired Results

Big Ideas:

- Reasoning/Proof, Relationships,

Overarching Understandings:

- Mathematics makes sense; mathematical ideas interconnect and build on one another to produce a coherent body of knowledge.
- Relationships can be described and generalizations made for mathematical situations that have numbers, shapes, symbols, and data that repeat in predictable ways.

Overarching Essential Questions:

- How can I use what I already know to learn something new?
- How can we make connections and use them to solve problems?
- How can you describe a pattern?

Organizing Concepts

Right Triangles and Trigonometry

Students will understand that...

- Right triangles are used in multiple settings to find measures indirectly.
- Trigonometric ratios are used in physics, architecture, surveying and engineering.
- Problem solvers look for and express regularity in repeated reasoning.

Students will know...

- The Pythagorean Theorem and its converse.
- The distance formula is based on the Pythagorean Theorem.
- Ways to simplify with radical numbers and expressions.
- 30-60-90 and 45-45-90 right triangle conjectures.
- Sine, Cosine, and Tangent ratios.
- Angles of depression and elevation.
- Key vocabulary: Sine, cosine, tangent, Pythagorean Theorem, hypotenuse, proportion, similar, angle of depression, angle of elevation, dilations
- Geometric mean.
- Law of Sines and Law of Cosines.

Essential Questions

- How do I know when to use the Pythagorean Theorem? Trigonometric ratios?
- In what ways are right triangles applied in real life situations?
- Which trigonometric ratio should I use in problem solving?

Students will be able to...

- Explain 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.
- Define trigonometric ratios and solve problems involving right triangles.
- Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- Explain and use the relationship between the sine and cosine of complementary angles.

Similarity

Students will understand that...

- If similarity exists, then conjectures can be made about angles measures and side lengths of geometric figures.
- There are Geometric conjectures that can be proven to verify similarity between figures.

Students will know...

- A similarity transformation is a rigid motion (a transformation that preserves length, angle measure, area) together with rescaling.
- AA, SSS, and SAS triangle similarity conjectures.
- Dilations are with respect to a fixed point or center.
- Key vocabulary: similarity, enlargement, reduction, similarity transformation (a rigid motion followed by a dilation).
- Properties of dilations: 1. Dilation for line segments longer or shorter in the ratio given by the scale factor and 2. Line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

Essential Questions

- How are similar triangles used in the real world?
- How can I enlarge a picture?
- How can I use technology to show geometric properties?
- How do I know two figures are similar?

Students will be able to...

- 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.
- Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar.
- Prove theorems involving similarity of triangles (Includes a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity).
- Show that 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.
- Show that the dilation of a line segment is longer or shorter in the ratio given by the scale factor.
- Understand similarity in terms of similarity transformations.
- Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
- Verify experimentally the properties of dilations given by a center and a scale factor.
- Verify experimentally the properties of dilations given by a center and a scale factor..

Grade 10 - Mathematics (Geometry)
Quadrilaterals and Polygons (2017-18) (15 - 20 Days)
Jan - Feb

Last Updated: 6/12/2017

Overview

How does the understanding of quadrilaterals help us create structures?
Students will use coordinates to verify the properties of a given quadrilateral or polygon.

In this unit students will be able to apply their understanding of parallel and perpendicular lines, as well as distance relationship to the properties of quadrilaterals. Relationships within a quadrilateral and polygons, are a visual tool to help with algebraic manipulation. Both inductive and deductive reasoning will be used to to prove the attributes of a quadrilateral.

Standards:

- Standard 2: Patterns, Functions, and Algebraic Structures
  - GLE 4: Solutions to equations, inequalities and systems of equations are found using a variety of tools
    - EO a.ii: Create equations in two or more variables to represent relationships between quantities and graph equations on coordinate axes with labels and scales. (CCSS: A-CED.2)
    - EO b.i: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. (CCSS: A-REI.1)
    - EO c: Solve equations and inequalities in one variable. (CCSS: A-REI)
    - EO d: Solve systems of equations. (CCSS: A-REI)
    - EO e: Represent and solve equations and inequalities graphically. (CCSS: A-REI)
- Standard 4: Shape, Dimension, and Geometric Relationships
  - GLE 1: Objects in the plane can be transformed, and those transformations can be described and analyzed mathematically
    - EO a: Experiment with transformations in the plane. (CCSS: G-CO)
    - EO c: Prove geometric theorems. (CCSS: G-CO)
    - EO c.iii: Prove theorems about parallelograms. (CCSS: G-CO.11)
  - GLE 2: Concepts of similarity are foundational to geometry and its applications
    - EO b.iii: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. (CCSS: G-SRT.5)
  - GLE 3: Objects in the plane can be described and analyzed algebraically
    - EO a: Express Geometric Properties with Equations. (CCSS: G-GPE)
    - EO a.ii: Use coordinates to prove simple geometric theorems algebraically. (CCSS: G-GPE.4)
    - EO a.ii.2: Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. (CCSS: G-GPE.5)
  - GLE 5: Objects in the real world can be modeled using geometric concepts
    - EO a.iii: Apply geometric methods to solve design problems. * (CCSS: G-MG.3)
- Standard MP: Mathematical Practices
  - GLE 1: Developing mathematical practices are processes and proficiencies necessary to flexibly use skills and concepts in multiple contexts.

District Unit of Study Updates:

Date	Comments
6/9/2017 7:00:00 PM	Added Unit Overview

Desired Results

Big Ideas:

- Reasoning/Proof, Relationships,

Overarching Understandings:

- Effective mathematical reasoning and proof involves making claims about relationships and justifying those claims by relying on the properties that are the structure of mathematics.
- Mathematics makes sense; mathematical ideas interconnect and build on one another to produce a coherent body of knowledge.
- Relationships can be described and generalizations made for mathematical situations that have numbers, shapes, symbols, and data that repeat in predictable ways.

Overarching Essential Questions:

- Is your claim always true?
- How can I use what I already know to learn something new?
- How can we make connections and use them to solve problems?
- How can patterns within and between figures help create generalizations?
- How can you describe a pattern?

Organizing Concepts

Congruence: Proof

Students will understand that...

- Angles and side measures are used to distinctly classify shapes.
- Congruence is proven using properties of shapes.
- Proof allows us to communicate in a precise and efficient manner.

Students will know...

- Appropriate markings on diagrams to show angle congruence, segment congruence, parallel lines, and right angles.
- Geometric properties such as parallel lines with a transversal, triangle congruence and properties, angle and line relationships, and properties of equality.
- Method to justify the geometric properties.
- Rigid transformations (rotations, reflections, rotations).
- The properties of specific quadrilaterals (parallelogram, rectangle, square, rhombus, kite, trapezoid).

Essential Questions

- How can the idea of congruency be used outside of mathematics?
- How do you justify geometric patterns?
- What makes a good definition?
- What strategies can we use to draw conclusions in geometry?

Students will be able to...

- Justify theorems about parallelograms (includes opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals).
- Make formal arguments to justify reasoning.

Expressing Geometric Properties with Equations

Students will understand that...

- Algebraic properties and modeling are connected to geometric properties.
- Problem solvers model with mathematics by describing geometric shapes with algebraic equations.
- The coordinate plane is used to identify and verify properties of Geometric figures.
- The coordinate plane is useful to greatly simplify models of objects and structures.

Students will know...

- Graphing parallel and perpendicular lines using technology.
- Equations of lines.
- Finding distance on a coordinate grid.
- Methods for using coordinates to verify congruence
- Midpoint Formula
- Polygon sum theorem and polygon exterior angle theorem.
- Slope formula, slope of parallel lines, slope of perpendicular lines

Essential Questions

- How can you write an equation to represent geometric properties?
- How can you use coordinates to classify shapes? Prove relationships within quadrilaterals?
- How can an equation help find the solution to a problem?
- What is the connection between linear functions and quadrilaterals?
- Why do different types of equations require different types of solution processes?

Students will be able to...

- Use coordinates to prove simple geometric theorems algebraically (for example, prove that a figure in a plane is a square, rectangle, or other quadrilateral).
- Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric properities.
- Solve systems of equations to determine the points of intersection of sides of quadrilaterals.
- Create and solve algebraic equations based on congruence between angles, segments and theorems in quadrilaterals and polygons.
- Create equations in two variables to represent relationships between quantities and graph equations on coordinate axes with labels and scales.
- Solve systems of equations graphically and algebraically.
- Use geometric properties of quadrilaterals to create and solve algebraic equations.

Grade 10 - Mathematics (Geometry)
Probability and Statistics (2017-18) (16 - 20 Days)
Feb - Mar

Last Updated: 6/12/2017

Overview

How does probability help us to model random situations?
Students will understand compound events and conditional probability.

Students will use probability rules to compute probabilities of compound events. They will be able to discern between mutually exclusive and overlapping events. In addition, students will be able to find the conditional probability of multiple events occurring. In order to do this, students will be able to identify independent and dependent events.

Standards:

- Standard 3: Data Analysis, Statistics, and Probability
  - GLE 3: Probability models outcomes for situations in which there is inherent randomness
    - EO a: Understand independence and conditional probability and use them to interpret data. (CCSS: S-CP)
    - EO a.i: 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. (CCSS: S-CP.1)
    - EO a.ii: Explain 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. (CCSS: S-CP.2)
    - EO a.iii: Using the conditional probability of A given B as P(A and B)/P(B), interpret the 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. (CCSS: S-CP.3)
    - EO a.iv: 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. (CCSS CP.4)
    - EO a.v: Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. (CCSS: S-CP.5)
    - EO b: Use the rules of probability to compute probabilities of compound events in a uniform probability model. (CCSS: S-CP.6)
    - EO b.i: 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. (CCSS: S-CP.6)
    - EO b.ii: Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. (CCSS: S-CP.7)
    - EO b.iii: (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.
    - EO d: Calculate expected values and use them to solve problems
    - EO e: Use probability to evaluate outcomes of decisions
    - EO e.i.1: Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fastfood restaurant.
    - EO e.i.2: Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using vairous, but reasonable, chances of having a minor or a major accident.

District Unit of Study Updates:

Date	Comments
6/9/2017 7:00:32 PM	Added Unit Overview

Desired Results

Big Ideas:

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Overarching Understandings:

Overarching Essential Questions:

Organizing Concepts

Conditional Probability and the Rules of Probabiltiy

Students will understand that...

- By extending patterns we can make accurate and successful predictions about future trends.
- Probability helps us to make inferences and predict the outcome of an event in order to make informed decisions.
- Problem solvers explore randomness and chance through probability.
- The relationship among events affects probability.
- Understand conditional probability and compound events.

Students will know...

- Conditional probability - P(B given A)=P(Aand B) / P(A)
- Dependent events – the occurrence of one event affects the occurrence of the other event; P(Aand B) = P(A) P(B given A).
- Experimental and theoretical probability.
- Independent events – the occurrence of one event has no effect on the occurrence of the other event; P(Aand B) = P(A) P(B) .
- Key Vocabulary - compound events, mutually exclusive events, conditional probability, independent and dependent events.
- Ways to represent probability (rational numbers or percents)

Essential Questions

- Can probability model all uncertain situations?
- How can understanding probability help us make decisions?
- How does conditional probability help us interpret situations?
- When is probability an appropriate method of analysis?

Students will be able to...

- Apply the Addition Rule to compound events, P(Aor B) = P(A) + P(B) – P(Aand B), and interpret the answer in terms of the model.
- Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use a two-way table as a sample space to decide if events are independent or dependent and to approximate probabilities.
- Explain why two events are independent. For example use P(Aand B) = P(A) P(B) or P(Agiven B) = P(B given A).
- Find the conditional probability of Agiven B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.
- Find the probability of two dependent events or two independent events
- Find the probability of two independent events.
- Recognize, find, and explain conditional probability and independence in everyday situations.(e.g., Compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer)
- Use a two-way table as a sample space to decide if events are independent or dependent and to approximate probabilities.
- Use independence and conditional probability to interpret data.

Grade 10 - Mathematics (Geometry)
Circles (2017-18) (24 - 28 Days)
Mar - Apr

Last Updated: 6/12/2017

Overview

What affect do circles and curvature have on technology?
Students will be able to algebraically model the geometric relationship of angles and lines of a circle.

Students will identify and describe the geometric and algebraic relationships of basic theorems of a circle to solve a problem. Such as tangent line is perpendicular to a radius, central angles, inscribed angles, chords, secants, and tangent lines dealing with segment lengths. Relationships among segments on chords, secants and tangents as an application of similarity. Students use the distance formula to write the equation of a circle when given the radius and coordinates of the center and vice versa.

Standards:

- Standard 2: Patterns, Functions, and Algebraic Structures
  - GLE 4: Solutions to equations, inequalities and systems of equations are found using a variety of tools
    - EO a: Create equations that describe numbers or relationships. (CCSS: A-CED)
- Standard 4: Shape, Dimension, and Geometric Relationships
  - GLE 1: Objects in the plane can be transformed, and those transformations can be described and analyzed mathematically
    - EO a.i: State 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. (CCSS: G-CO.1)
    - EO c: Prove geometric theorems. (CCSS: G-CO)
    - EO d.ii: Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. (CCSS: G-CO.13)
  - GLE 2: Concepts of similarity are foundational to geometry and its applications
    - EO b.ii: Prove that all circles are similar. (CCSS: G-C.1)
    - EO e: Understand and apply theorems about circles. (CCSS: G-C)
    - EO e.i: Identify and describe relationships among inscribed angles, radii, and chords. (CCSS: G-C.2)
    - EO e.ii: Construct the inscribed and circumscribed circles of a triangle. (CCSS: G-C.3)
    - EO e.iii: Prove properties of angles for a quadrilateral inscribed in a circle. (CCSS: G-C.3)
    - EO f: Find arc lengths and areas of sectors of circles. (CCSS: G-C)
    - EO f.i: 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. (CCSS: G-C.5)
    - EO f.ii: Derive the formula for the area of a sector. (CCSS: G-C.5)
  - GLE 3: Objects in the plane can be described and analyzed algebraically
    - EO a: Express Geometric Properties with Equations. (CCSS: G-GPE)
    - EO a.i: Translate between the geometric description and the equation for a conic section. (CCSS: G-GPE)
    - EO a.i.1: Derive the equation of a circle of given center and radius using the Pythagorean Theorem. (CCSS: G-GPE.1)
    - EO a.i.2: Complete the square to find the center and radius of a circle given by an equation. (CCSS: G-GPE.1)
- Standard MP: Mathematical Practices
  - GLE 1: Developing mathematical practices are processes and proficiencies necessary to flexibly use skills and concepts in multiple contexts.
    - EO 1: Make sense of problems and persevere in solving them.
    - EO 3: Construct viable arguments and critique the reasoning of others.
    - EO 6: Attend to precision
    - EO 7: Look for and make use of structure

District Unit of Study Updates:

Date	Comments
6/9/2017 7:00:59 PM	Added Unit Overview

Desired Results

Big Ideas:

- Modeling, Problem Solving, Relationships, Spatial Reasoning,

Overarching Understandings:

- Geometric relationships, expressed through words, pictures, graphs and numeric and algebraic expressions are used to explain and model the physical world and phenomena.
- Real world objects have attributes of space, shape and structure which can be measured, classified and analyzed.

Overarching Essential Questions:

- How do geometric relationships help us describe the world around us?
- Which attributes should I use?
- Why do we describe the world mathematically?

Organizing Concepts

Circles: Proof and Construction

Students will understand that...

- Relationships exist among angles, segments, lengths, circumference, and area of circles.
- Problems involving circles can be solved using properties and theorems of segments, angles, and arcs.
- Studying properties and relationships of geometric objects provides insights in to physical world that otherwise would be hidden.
- Problem solvers look for and make use of structure.

Students will know...

- Precise definition of a circle based on the undefined notions of point and distance around a circular arc.
- Theorems about chords, tangents, and secants.
- Key vocabulary: circle, center, radius, diameter, chord, chord segments, secant, tangent, common tangent, congruent circles, tangent circles, concentric circles, interior of a circle, exterior of a circle, point of tangency, circumscribed, and inscribed.

Essential Questions

- Do perfect circles naturally occur in the physical world?
- How does the use of circles impact modern society? How have circles changed history?
- What properties of circles make them useful in modeling situations?

Students will be able to...

- Identify and describe relationships among inscribed angles, radii, and chords (Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.).
- Understand and apply theorems about circles (e.g. perpendicular bisector of a chord).
- Create algebraic equations based on properties and theorems for circles and use them to solve problems.
- Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
- Construct the inscribed and circumscribed circles of a triangle.
- Prove properties of angles for a quadrilateral inscribed in a circle.

Circles: Similarity and Proportionality

Students will understand that...

- Circles model real world situations that involve proportional reasoning and direct variation.
- Definition of a sector.
- Definition of arc length.
- Formula for the area of a sector.

Students will know...

- The definition and how to label the following: central angle, minor arc, major arc, semicircle, intercepted arc, and congruent arcs..
- Definition of a sector..
- Definition of arc length
- Constant of proportionality
- Formulas for area and circumference of circles
- Formula for the area of a sector

Essential Questions

- How are angles and intercepted arcs of circles related and applied?
- How are arc lengths applied in the real-world?
- How are sector areas used in the real-world?
- How does similarity affect how circles are used?

Students will be able to...

- Find arc lengths and areas of sectors of circles.
- Derive the formula for the area of a sector.
- 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.
- Prove that all circles are similar.

Congruence: Proof

Students will understand that...

- Deriving and analyzing geometric relationships develops reasoning and justification skills.

Students will know...

Essential Questions

Students will be able to...

Expressing Geometric Properties with Equations

Students will understand that...

- The coordinate plane is used to identify and verify properties of Geometric figures.
- Acircle can be modeled with a graph, equation, table, or description.
- Problem solvers attend to precision.

Students will know...

- Standard equation of a circle.
- Methods to complete the square.
- Methods for graphing circles.
- Derive means to arrive a conclusion from facts and deductive reasoning.

Essential Questions

- How can we model a situation using the equation of a circle? Agraph of a circle?
- How can you create and solve algebraic equations based on geometric relationships.
- How does the transformation of a circle affect its equation?
- How is the equation of a circle related to the Pythagorean Theorem?

Students will be able to...

- Graph circles using the equation.
- Complete the square to find the center and radius of a circle given by an equation.
- Derive the equation of a circle of given center and radius using the Pythagorean Theorem.

Grade 10 - Mathematics (Geometry)
Geometric Measurement and Dimension (2017-18) (15 - 20 Days)
May - May

Last Updated: 6/12/2017

Overview

How do the dimensions affect the geometric measurement?
Students will find area of polygons and circle sectors, volume and literal equations.

Students will continue to build on their knowledge of circles to write equations to find arc length and area of sectors. Triangle area, quadrilateral area, special right triangles, and trigonometric ratio may be applied when finding the area of kites, rhombus, and regular polygons. Students will be able to use their knowledge of area and volume formulas to rewrite equations for different dimensions (literal equations), solve for a dimension, find shaded region and composite figures. In addition, describing the relationship of a two-dimensional cross-section rotating about a line to create a three-dimensional shape.

Standards:

- Standard 1: Number Sense, Properties, and Operations
  - GLE 2: Quantitative reasoning is used to make sense of quantities and their relationships in problem situations
    - EO a: Reason quantitatively and use units to solve problems (CCSS: N-Q)
    - EO a.i: Use units as a way to understand problems and to guide the solution of multi-step problems. (CCSS: N-Q.1)
    - EO a.i.1: Choose and interpret units consistently in formulas. (CCSS: N-Q.1)
    - EO a.ii: Define appropriate quantities for the purpose of descriptive modeling. (CCSS: N-Q.2)
    - EO a.iii: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (CCSS: N-Q.3)
- Standard 2: Patterns, Functions, and Algebraic Structures
  - GLE 3: Expressions can be represented in multiple, equivalent forms
    - EO b: Write expressions in equivalent forms to solve problems. (CCSS: A-SSE)
    - EO b.i: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.* (CCSS: A-SSE.3)
  - GLE 4: Solutions to equations, inequalities and systems of equations are found using a variety of tools
    - EO a.i: Create equations and inequalities in one variable and use them to solve problems. (CCSS: A-CED.1)
    - EO a.iv: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (CCSS: A-CED.4)
    - EO b: Understand solving equations as a process of reasoning and explain the reasoning. (CCSS: A-REI)
    - EO b.i: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. (CCSS: A-REI.1)
    - EO c: Solve equations and inequalities in one variable. (CCSS: A-REI)
- Standard 4: Shape, Dimension, and Geometric Relationships
  - GLE 4: Attributes of two- and three-dimensional objects are measurable and can be quantified
    - EO a: Explain volume formulas and use them to solve problems. (CCSS: G-GMD)
    - EO a.i: Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. (CCSS: G-GMD.1)
    - EO a.ii: Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.* (CCSS: G-GMD.3)
    - EO b: Visualize relationships between two-dimensional and three-dimensional objects. (CCSS: G-GMD)
    - EO b.i: Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. (CCSS: G-GMD.4)
  - GLE 5: Objects in the real world can be modeled using geometric concepts
    - EO a: Apply geometric concepts in modeling situations. (CCSS: G-MG)
    - EO a.i: Use geometric shapes, their measures, and their properties to describe objects. * (CCSS: G-MG.1)
    - EO a.ii: Apply concepts of density based on area and volume in modeling situations. * (CCSS: G-MG.2)
    - EO a.iii: Apply geometric methods to solve design problems. * (CCSS: G-MG.3)
- Standard MP: Mathematical Practices
  - GLE 1: Developing mathematical practices are processes and proficiencies necessary to flexibly use skills and concepts in multiple contexts.
    - EO 1: Make sense of problems and persevere in solving them.
    - EO 2: Reason abstractly and quantitatively.
    - EO 5: Use appropriate tools strategically
    - EO 6: Attend to precision

District Unit of Study Updates:

Date	Comments
6/9/2017 7:01:28 PM	Added Unit Overview

Desired Results

Big Ideas:

- Reasoning/Proof, Modeling, Problem Solving, Spatial Reasoning,

Overarching Understandings:

- Geometric relationships, expressed through words, pictures, graphs and numeric and algebraic expressions are used to explain and model the physical world and phenomena.
- Real world objects have attributes of space, shape and structure which can be measured, classified and analyzed.

Overarching Essential Questions:

- How do geometric relationships help us describe the world around us?
- How do you use dimensions to model the world?
- Which attributes should I use?
- Why do we describe the world mathematically?

Organizing Concepts

Expressing Geometric Properties with Equations

Students will understand that...

- Algebraic properties and modeling are connected to Geometric properties and formulas.
- Problem solvers reason abstractly and quantitatively.

Students will know...

- Substitution of variables in context.
- Methods for simplifying polynomial expressions.
- Methods for solving literal equations.

Essential Questions

- How can you represent a value for area with polynomials?
- How can you represent a value for volume with polynomials?
- What properties can help isolate a variable in a formula?

Students will be able to...

- Apply geometric concepts in modeling situations
- Create equations, based on areas and volumes, and use them to solve problems.
- Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
- Write polynomial expressions to represent area and volume in equivalent forms to solve problems.

Geometric Measurement and Dimension

Students will understand that...

- Volume of irregular figures can be found using volume of common figures.
- Problem situations can be modeled geometrically using properties of geometric figures.
- Problem solvers attend to precision.

Students will know...

- Area formulas developed in earlier grades for triangles, parallelograms, rectangles, squares, trapezoid, and circle.
- Formulas and methods for area of regular polygons.
- Area formulas for kites, sectors, and annulus (washer)
- Methods for finding area of shaded regions and compound shapes.
- Strategies for finding surface area of 3-D figures.
- Formula for finding the volume and surface area of spheres.
- Volume formulas for prisms and cylinders (Bh) and pyramids and cones (1/3 Bh)
- Methods for finding the volume of compound 3-D figures (to include figures with missing portions such as a tire).
- Appropriate use of units.

Essential Questions

- How can two-dimensions help us describe three-dimensional shapes?
- How does what we measure affect how we measure? When is using one unit better than another to measure?
- Where do volume formulas come from?
- How is the volume of irregular 3D figure measured?

Students will be able to...

- Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone (informal can be dissection arguments, Cavalieri's Principle, or informal limit arguments).

Modeling with Geometry

Students will understand that...

- Problem situations can be modeled geometrically using properties of geometric figures.
- There is often more than one correct model for any given situation.

Students will know...

- Units to represent area and volume in contexts.
- Methods for measuring density in multiple contexts.
- Applications of area and volume such as density of a material, packaging, GIS, and creating a floor plan.
- Technology programs that model two- and three-dimensional space.

Essential Questions

- How are mathematical objects different from the physical objects they model?
- How can surface area be minimized while maximizing volume?
- What makes a good geometric model of a physical object or situation?

Students will be able to...

- Use geometric shapes, their measures, and their properties to describe objects (e.g. modeling a tree trunk or a human torso as a cylinder).
- 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).
- Apply concepts of density based on area and volume in modeling situations (e.g. persons per square mile, BTUs per cubic foot).