## GEOMETRY

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| **Curriculum/Content Area:** Mathematics | **Course Length: 2 terms** |
| **Course Title: Geometry and Honors Geometry(highlighted extensions)** | **Date last reviewed:** 2014/15 Link Previous UbD |
| **Prerequisites: NA** | **Board approval date:** 8/2020 |
| **Primary Resource:** REVEAL Geometry | |

## Desired Results

**Course description and purpose:**
This course develops geometric concepts, including the study of formal proofs (including coordinate and indirect methods), the use of postulates and theorems as well as algebraic applications. Geometry development includes measurements, identification and application of polygons, circles and polyhedrons. Algebra is used extensively for areas, volumes, lengths, angle measures, and graphing.

Honors Geometry is a rigorous and fast paced course that increases the depth of study related to concepts in Geometry.

| **Enduring Understandings**: | **Essential Questions**: |
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| Mathematicians make sense of problems and persevere in solving them. | a. How do we as mathematicians analyze the problem in order to choose the best strategy(ies) or resource to make sense of the problem?<br>b. How do we as mathematicians persevere in solving problems? |
| Mathematicians attend to precision. | How do we as mathematicians know if we fully & accurately answered the problem and does the results make sense in the context of the problem? |
| Mathematicians reason abstractly and quantitatively. | How do we as mathematicians make sense of quantities and situations symbolically? |
| Mathematicians construct viable arguments and critique the reasoning of others. | a. How can we as mathematicians justify our answer(s)?<br>b. How can we as mathematicians evaluate and question whether a mathematical argument is accurate? |
| Mathematicians model with mathematics. | a. What model(s) can we as mathematicians use to solve a problem?<br>b. How can we as mathematicians determine an effective model to use to solve a problem? |
| Mathematicians use appropriate tools strategically. | What tools are available and efficient for us as mathematicians to use while solving a problem? |
| Mathematicians look for and make use of structure | How can we as mathematicians use and apply patterns and structures to solve problems? |
| Mathematicians look for and express regularity in repeated reasoning. | How can we as mathematicians create and apply generalizations from repeated reasoning? |

| Mathematical Practice Standards |
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| The Standards for Mathematical Practice are central to the teaching and learning of mathematics. These practices describe the behaviors and habits of mind that are exhibited by students who are mathematically proficient. Mathematical understanding is the intersection of these practices and mathematics content. It is critical that the Standards for Mathematical Practice are embedded in daily mathematics instruction. |

| Mathematical Practice Standards | | Grade Level/Course |
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| **Habits of Mind** | MP.1 Make sense of problems and persevere in solving them | Understand the meaning of a problem and look for entry points to its conclusion.<br>Analyze information (givens, constraints, relationships, goals.<br>Make conjectures and plan a solution pathway.<br>Monitor and evaluate the progress and change course as necessary<br>Check answers to problems and ask, “Does this make sense?” |
| | MP.6 Attend to precision. | Communicate precisely using clear definitions.<br>State the meaning of symbols, carefully specifying units of measure, and providing accurate labels.<br>State the meaning of symbols, carefully specifying units of measure, and providing accurate labels.<br>Calculate accurately and efficiently, expressing.<br>numerical answers with a degree of precision.<br>Provide carefully formulated explanations.<br>Label accurately when measuring and graphing. |
| **Reasoning & Explaining** | MP.2 Reason abstractly and quantitatively. | Make sense of quantities and relationships in problem situations.<br>Represent abstract situations symbolically and understand the meaning of quantities.<br>Create a coherent representation of the problem at hand.<br>Consider the units involved.<br>Flexibility uses properties of operations. |
| | MP.3 Construct viable arguments and critique the reasoning of others. | Use definitions and previously established causes/effects (results) in constructing arguments.<br>Make conjectures and use counterexamples to build a logical progression of statements to explore and support ideas.<br>Communicate and defend mathematical reasoning using objects, drawings, diagrams, and/or actions.<br>Listen to or read the arguments of others.<br>Decide if the arguments of others make sense and ask probing questions to clarify or improve the |

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| | | arguments. |
| **Modeling & Using Tools** | MP.4 Model with mathematics. | Apply prior knowledge to solve real world problems.<br>Identify important quantities and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and/or formulas.Use assumptions and approximations to make a problem simpler.<br>Check to see if an answer makes sense within the context of a situation and change a model when necessary. |
| | MP.5 Use appropriate tools strategically. | Make sound decisions about the use of specific tools (examples might include: calculator, concrete models, digital, technologies, pencil/paper, ruler, compass, protractor)<br>Use technology tools to visualize the results of assumptions, explore consequences, and compare predictions with data.<br>Identify relevant external math resources (digital content on a website) and use them to pose or solve problems.<br>Use technological tools to explore and deepen understanding of concepts. |
| **Seeing Structure & Generalizing** | MP.7 Look for and make use of structure. | Look for patterns or structure, recognizing that quantities can be represented in different ways.<br>Recognize the significance in concepts and models and use the patterns or structure for solving related problems.<br>View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems. |
| | MP.8 Look for and express regularity in repeated reasoning. | Notice repeated calculations and look for general methods and shortcuts.<br>Continually evaluate the reasonableness of intermediate results (comparing estimates), while attending to details, and make generalizations based on findings. |

| **Priority Standard Clusters** |
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| **G-COA Experiment with transformations in the plane.**<br>● *(G-COA1)*: 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. The main mathematical practice relevant for this task is MP6, "Attend to Precision."<br>● *(G-COA2)*: 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). MP1, Make Sense of Problems and Persevere in Solving Them

- *(G-COA3)*: Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. This task provides a good opportunity for students to engage in MP3, Construct Viable Arguments and Critique the Reasoning of Others. Students can also use MP7, Look for and Make Use of Structure.
- *(G-COA4)*: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. Work on this task exemplifies MP6, "Attend to Precision."
- *(G-COA5)*: 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. This task provides an ideal setting to engage in MP2, Reason Abstractly and Quantitatively. The task also encourages development of MP5, Use Appropriate Tools Strategically.

**G-COC Prove Geometric Theorems**

- *(G-COC9)*: Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.
- *(G-COC10)*: Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point. MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.
- *(G-COC11)*: Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals. MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.

**G-SRTB Prove theorems involving similarity.**

- *(G-SRTB4)*: Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.
- *(G-SRTB5)*: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.

**G-SRTC Define trigonometric ratios and solve problems involving right triangles.**

- *(G-SRTC6)*: 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. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.
- *(G-SRTC7)*: Explain and use the relationship between the sine and cosine of complementary angles. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.
- *(G-SRTC8)*: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.

**Supporting Standard Clusters**

**G-COB Understand congruence in terms of rigid motions.**

- *(G-COB6)*: 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.
- *(G-COB7)*: 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.
- *(G-COB8)*: Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

**G-COD Make geometric constructions.**

- *(G-COD12)*: Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle, constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
- *(G-COD13)*: Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

**G-SRTA Understand similarity in terms of similarity transformations.**

- *(G-SRTA1)*: 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.
- *(G-SRTA2)*: 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.
- *(G-SRTA3)*: Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

**G-SRTD Apply trigonometry to general triangles.**

- *(G-SRTD9)*: (+) Derive the formula A = 1/2 ab sin(c) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
- *(G-SRTD10)*: (+) Prove the Laws of Sines and Cosines and use them to solve problems.
- *(G-SRTD11)*: (+) 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).

**G-CA Understand and apply theorems about circles.**

- *(G-CA1)*: Prove that all circles are similar.
- *(G-CA2)*: 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.
- *(G-CA3)*: Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
- *(G-CA4)*: (+) Construct a tangent line from a point outside a given circle to the circle.

**G-CB Find arc lengths and areas of sectors of circles.**

- *(G-CB5)*: 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.

**G-GPEA Translate between the geometric description and the equation for a conic section.**

- *(G-GPEA1)*: Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
- *(G-GPEA2)*: Derive the equation of a parabola given a focus and directrix.

**G-GPEB Use coordinates to prove simple geometric theorems algebraically.**

- *(G-GPE4)*: Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1,V3) lies on the circle centered at the origin and containing the point (0,2).
- *(G-GPE5)*: 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).
- *(G-GPE6)*: Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
- *(G-CPE7)*: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

**G-GMDA Explain volume formulas and use them to solve problems.**

- *(G-GMD1)*: Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.
- *(G-GMD3)*: Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

**G-GMDB Visualize relationships between two-dimensional and three-dimensional objects.**

- *(G-GMD4)*: Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify

three-dimensional objects generated by rotations of two-dimensional objects.

**G-MGA Apply geometric concepts in modeling situations.**

- *(G-MG1)*: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- *(G-MG2)*: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
- *(G-MG3)*: 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).

**S-CPA Understand independence and conditional probability and use them to interpret data.**

- *(S-CPA1)*: 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").
- *(S-CPA2)*: Understand that two events A and B are independent if the probability of A and B occuring together is the product of their probabilities, and use this characterization to determine if they are independent.
- *(S-CPA3)*: Understand the conditional probability of A given B as P(A 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.
- *(S-CPA4)*: 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. For example, collect data from a random sample of students in your school on their favorite subject among math, science and english. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.
- *(S-CPA5)*: Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

**S-CPB Use the rules of probability to compute probabilities of compound events in a uniform probability model.**

- *(S-CPB6)*: 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.
- *(S-CPB7)*: 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.
- *(S-CPB8)*: (+) 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.
- *(S-CPB9)*: (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

**S-MDB Use probability to evaluate outcomes of decisions.**

- *(S-MDB6)*: (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
- *(S-MDB7)*: (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

## Unit 1 - Tools of Geometry

**Essential Questions:**

1. a. How do we as mathematicians analyze the problem in order to choose the best strategy(ies) or resource to make sense of the problem?
   b. How do we as mathematicians persevere in solving problems?(MP1)
2. How do we as mathematicians know if we fully & accurately answered the problem and does the results make sense in the context of the problem?(MP6)
3. How are points, lines, and segments used to model the real world?

**Unit Standards**

**Priority Standards**

**G-COA Experiment with transformations in the plane.**

- *(G-COA1)*: 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. The main mathematical practice relevant for this task is MP6, "Attend to Precision."

**Supporting Standards**

**G-COD Make geometric constructions.**

- *(G-COD12)*: Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). ***Copying a segment***; copying an angle; ***bisecting a segment;*** bisecting an angle, constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

**G-GPEB Use coordinates to prove simple geometric theorems algebraically.**

- *(G-GPE6)*: Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

**G-MGA Apply geometric concepts in modeling situations.**

- *(G-MG1)*: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can analyze figures to identify points, lines, planes, and intersections of lines and planes.
  - I can describe and distinguish between the unique characteristics of the undefined terms in geometry (points, lines, and planes) (G-COA1)
  - I can use geometric shapes to model real world situations. (G-MG1)
  - Use properties of those shapes to draw conclusions about the real world situation. (G-MG1)
- I can apply the distance formula to find the lengths of line segments.
  - I can use the undefined terms to define, identify and build angles, circles, parallel and perpendicular lines, rays and ***line segments***. (G-COA1)
- I can find midpoints and bisect line segments.
  - I can use dilations(fractional distance) to find the coordinates of a point that divides a directed segment in a given ratio. (G-GPE6)
  - I can devise potential methods for constructing various objects. (G-COD12)
  - I can prove that the constructions work. (G-COD12)

**Assessment Evidence**

**Performance Assessment Options & Rubrics**
*May include, but are not limited to the following:*

- Geometry Feedback & Scoring Rubric based on Priority Standards
- Geometry Feedback & Scoring Rubric based on Math Practice Standards

**Other assessment options**
*May include, but are not limited to the following:*

- Quick Writes
- KWL Chart - (What I Know, Want to know, Learned)
- Marking Text
- Learning Log Reflection - Daily/Weekly
- I-Chart - Gather/Organize Information on a topic

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| • Module Pre-Test<br>• End of Unit Assessment (3 versions)<br>• End of Unit Assessment (2 versions - differentiation)<br>• Mid-unit checks/quizzes | • Focused Note Taking<br>• CSG - Collaborative Study Groups<br>• Socratic Seminar<br>• Philosophical Chairs<br>• Think/Pair/Share |

**Digital Tools & Supplementary Resources**

- ALEKS
- Web Sketch Pad (DESMOS and etools)
- Spiral Review (Reveal)
- Take Another Look
- Dynamic Practice

**Unit 2 - Angles and Geometric Figures**

**Essential Questions:**

1. a. What model(s) can we as mathematicians use to solve a problem?
   b. How can we as mathematicians determine an effective model to use to solve a problem?(MP4)
2. How do we as mathematicians know if we fully & accurately answered the problem and does the results make sense in the context of the problem?(MP6)
3. How are angles and two-dimensional figures used to model the real world?

**Priority Standards**

**G-COA Experiment with transformations in the plane.**

- *(G-COA1)*: 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. The main mathematical practice relevant for this task is MP6, "Attend to Precision."
- *(G-COA2)*: 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). MP1, Make Sense of Problems and Persevere in Solving Them

**Supporting Standards**

**G-COD Make geometric constructions.**

- *(G-COD12)*: Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; ***copying an angle***; bisecting a segment; bisecting an angle, constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

**G-MGA Apply geometric concepts in modeling situations.**

- *(G-MG1)*: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

**G-GMDA Explain volume formulas and use them to solve problems.**

- *(G-GMD3)*: Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

**G-GPEB Use coordinates to prove simple geometric theorems algebraically.**

- *(G-CPE7)*: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using

the distance formula.

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can use and identify different kinds of angles.
  - I can use the undefined terms to define, identify and build **angles**, circles, parallel and perpendicular lines, rays and line segments. (G-COA1)
  - I can devise potential methods for constructing various objects(angles). (G-COD12)
  - I can prove that the constructions work. (G-COD12)
- I can find measures of angles using complementary and supplementary angles.
- I can find measures of 2-dimensional figures.
  - I can use the distance formula to find relevant lengths and apply formulas for finding perimeter and area of polygons whose vertices are given using coordinates.(G-CPE7)
  - Decompose more complex figures whose vertices are given using coordinates into familiar shapes that are easier to work with..(G-CPE7)
- I can identify transformations and represent reflections, translations, and rotations.
  - I can describe and distinguish between a reflection, translation and rotation by associating a meaning of the rigid motions that are occuring (flipping vs. sliding vs. turning) (G-COA2)
  - I can determine which transformations preserve properties of the preimage to the image (isometries) and justify your reasoning (G-COA2)
  - I can create and represent transformations of a given geometric figure using graph paper, transparencies, and/or software (G-COA2)
  - I can choose the appropriate tool (graph paper, software, etc) to explore the relationship between coordinates of an image and preimage (G-COA2)
  - Create a rule to determine the coordinates for the image of a figure when a specific transformation is applied to the preimage (G-COA2)
- I can find measures of 3-dimensional figures.
  - Use geometric shapes to model real world situations(G-MGA1)
  - Use properties of those shapes to draw conclusions about the real world situation.(G-MGA1)
  - I can apply volume formulas to suggest solutions to real-world problems involving geometric solids. (G-GMD 3)
- I can model 3-dimensional figures with 2-dimensional representations.(REVEAL)
- I can apply definitions of precision, accuracy, and error to measurements and computed values(REVEAL)
- I can use significant figures in measurement (REVEAL)

**Assessment Evidence**

| **Performance Assessment Options & Rubrics**<br>*May include, but are not limited to the following:*<br>• Geometry Feedback & Scoring Rubric based on Priority Standards<br>• Geometry Feedback & Scoring Rubric based on Math Practice Standards<br>• Module Pre-Test | **Other assessment options**<br>*May include, but are not limited to the following:*<br>• Learnsmart<br>• REVEAL performance tasks<br>• LEARN Checks<br>• Extension<br>• Dynamic Practice |
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| • End of Unit Assessment (3 versions)<br>• End of Unit Assessment (2 versions - differentiation)<br>• Mid-unit checks/quizzes | WICOR strategies:<br>• Quick Writes<br>• KWL Chart - (What I Know, Want to know, Learned)<br>• Marking Text<br>• Learning Log Reflection - Daily/Weekly<br>• I-Chart - Gather/Organize Information on a topic<br>• Focused Note Taking<br>• CSG - Collaborative Study Groups<br>• Socratic Seminar<br>• Philosophical Chairs<br>• Think/Pair/Share |

**Digital Tools & Supplementary Resources**

- ALEKS
- Web Sketch Pad (DESMOS and etools)
- Spiral Review (Reveal)
- Take Another Look
- Dynamic Practice

**Unit 3 - Logical Arguments and Line Relationships**

**Essential Questions:**

1 .a. How can we as mathematicians justify our answer(s)?

b. How can we as mathematicians evaluate and question whether a mathematical argument is accurate?(MP3)

2.How do we as mathematicians know if we fully & accurately answered the problem and does the results make sense in the context of the problem?(MP6)

3. What makes a logical argument, and how are logical arguments used in geometry.

**Priority Standards**

**G-COA Experiment with transformations in the plane.**

- *(G-COA1)*: 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. The main mathematical practice relevant for this task is MP6, "Attend to Precision."

- *(G-COC9)*: Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.

**Supporting Standards**

**G-COD Make geometric constructions.**

- *(G-COD12)*: Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle, constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

**G-MGA Apply geometric concepts in modeling situations.**

- *(G-MG3)*: Apply geometric methods to solve design problems

**G-GPEB Use coordinates to prove simple geometric theorems algebraically.**

- *(G-GPE5)*: 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).

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can write and analyze conjectures using Inductive Reasoning
- I can write and analyze compound statements by using logic.
- I can apply the Laws of Detachment and Syllogism in Deductive reasoning.
- I can analyze and construct viable arguments.
- I can prove theorems about line segments and angles by writing 2-column proofs.
    - I can make and prove conjectures about situations that lead to theorems involving lines and angles (Vertical Angle Theorems, special angle pair theorems between parallel lines, and the perpendicular bisector theorem) (G-COC9)
    - I can examine and critique proofs produced by other students, re-examining my own proofs in light of what other students have done (G-COC9)
- I can identify and use relationships between parallel lines and transversals.
    - Use the undefined terms to define, identify and build angles, circles, parallel and perpendicular lines, rays and line segments. (G-COA1)
    - I can devise potential methods for constructing various objects(Parallel line through point not on line). (G-COD12)
    - I can prove that the constructions work. (G-COD12)
- I can classify lines as parallel and perpendicular using the slope criteria.
    - Recognize that the slopes of parallel lines are equal, since they are related by a translation.(G-GPE5)
    - Recognize that the slopes of perpendicular lines are negative reciprocals since they are related by 90 degree rotation(G-GPE5).
    - Apply of parallel and perpendicular lines to solve problems.(G-GPE5)
- I can identify and use parallel lines by the use of angle relationships.
    - I can use precise academic vocabulary and specific theorems to justify my reasoning accurately and concisely (including transformational property language) (G-COC9)
- I can use perpendicular lines to find distances.
    - I can devise potential methods for constructing various objects(). (G-COD12)
    - I can prove that the constructions work. (G-COD12)
    - I can use geometry to model real world situations in order to design solutions to real world problems (shortest distance between point and line).(G-MG3)

**Assessment Evidence**

| **Performance Assessment Options & Rubrics**<br>*May include, but are not limited to the following:* | **Other assessment options**<br>*May include, but are not limited to the following:* |
|---|---|
| • Geometry Feedback & Scoring Rubric based on Priority Standards | • Quick Writes<br>• KWL Chart - (What I Know, Want to know, Learned) |

| | |
|---|---|
| • Geometry Feedback & Scoring Rubric based on Math Practice Standards<br>• Module Pre-Test<br>• End of Unit Assessment (3 versions)<br>• End of Unit Assessment (2 versions - differentiation)<br>• Mid-unit checks/quizzes | • Marking Text<br>• Learning Log Reflection - Daily/Weekly<br>• I-Chart - Gather/Organize Information on a topic<br>• Focused Note Taking<br>• CSG - Collaborative Study Groups<br>• Socratic Seminar<br>• Philosophical Chairs<br>• Think/Pair/Share |

**Digital Tools & Supplementary Resources**

- ALEKS
- Web Sketch Pad (DESMOS and etools)
- Spiral Review (Reveal)
- Take Another Look
- Dynamic Practice

**Unit 4 - Transformations and Symmetry**

**Essential Questions:**

1. What tools are available and efficient for us as mathematicians to use while solving a problem?(MP5)
2. How can we as mathematicians use and apply patterns and structures to solve problems?(MP7)
3. How are rigid transformations used to show geometric relationships

**Priority Standards**

**G-COA Experiment with transformations in the plane.**

- *(G-COA3)*: Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. This task provides a good opportunity for students to engage in MP3, Construct Viable Arguments and Critique the Reasoning of Others. Students can also use MP7, Look for and Make Use of Structure.
- *(G-COA4)*: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. Work on this task exemplifies MP6, "Attend to Precision."
- *(G-COA5)*: 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. This task provides an ideal setting to engage in MP2, Reason Abstractly and Quantitatively. The task also encourages development of MP5, Use Appropriate Tools Strategically.

**Supporting Standards**

**G-COB Understand Congruence in terms of rigid motion**

- *(G-COB6)*: 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.

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can use rigid motions to reflect figures on the coordinate plane.
  - I can accurately find images of figures using rigid motions(G-COB6)
- I can use rigid motions to translate figures on the coordinate plane.
  - I can accurately find images of figures using rigid motions(G-COB6)
- I can use rigid motions to rotate figures about points on the coordinate plane.
  - I can accurately find images of figures using rigid motions(G-COB6)
- I can use two or more rigid motions to transform figures on the coordinate plane.
  - I can look for patterns in what happens when carrying out sequences of rigid motions (G-COA5)
- I can use symmetry to describe the transformations that carry a figure onto itself.
  - I can understand symmetry in terms of transformations (G-COA3)
  - I can explore which shapes are symmetric and what symmetries they will have (G-COA3)
  - I can use properties of symmetry to categorize shapes and develop generalizations held by these shapes (how a shape maps onto itself, # of lines of symmetry, degree of rotational symmetry) (G-COA3)
  - I can explore properties of transformations using common geometric relationships (G-COA4)
- I can define a transformation based on what geometric relationships are preserved from a preimage to its image (G-COA4)

**Assessment Evidence**

**Performance Assessment Options & Rubrics**
*May include, but are not limited to the following:*

- Geometry Feedback & Scoring Rubric based on Priority Standards
- Geometry Feedback & Scoring Rubric based on Math Practice Standards
- Module Pre-Test
- End of Unit Assessment (3 versions)
- End of Unit Assessment (2 versions - differentiation)
- Mid-unit checks/quizzes

**Other assessment options**
*May include, but are not limited to the following:*

- Quick Writes
- KWL Chart - (What I Know, Want to know, Learned)
- Marking Text
- Learning Log Reflection - Daily/Weekly
- I-Chart - Gather/Organize Information on a topic
- Focused Note Taking
- CSG - Collaborative Study Groups
- Socratic Seminar
- Philosophical Chairs
- Think/Pair/Share

**Digital Tools & Supplementary Resources**

- ALEKS
- Web Sketch Pad (DESMOS and etools)
- Spiral Review (Reveal)
- Take Another Look
- Dynamic Practice

- **Unit 5 - Angles of Triangles**

**Essential Questions:**

1. a. How can we as mathematicians justify our answer(s)?
   b. How can we as mathematicians evaluate and question whether a mathematical argument is accurate?(MP3)
2. How can we as mathematicians create and apply generalizations from repeated reasoning?(MP8)
3. How can you prove congruence and use congruent figures in real world situations

**Priority Standards**

**G-COC Prove Geometric Theorems**

- *(G-COC10)*: Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point. MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.

**G-SRTB Prove theorems involving similarity**

- *(G-SRTB5)*: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.

**Supporting Standards**

**G-COB Understand Congruence in terms of rigid motion**

- *(G-COB7)*: 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.
- *(G-COB8)*: Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

**G-GPEB Use coordinates to prove simple geometric theorems algebraically.**

- *(G-GPE4)*: Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1,V3) lies on the circle centered at the origin and containing the point (0,2)

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can solve problems using the triangle angle sum and exterior angle theorems.
  - I can make and prove conjectures about situations that lead to the theorems of triangles (Triangle Angle Sum Theorem, Isosceles Triangle Theorem, Midsegment Theorem)(G-COC10)
  - I can use precise academic vocabulary and specific theorems to justify your reasoning accurately and concisely (including transformational property language) (G-COC10)
- I can prove triangles congruent and use congruence statements.
  - I can explain using rigid motions, why in congruent triangles corresponding parts must be congruent.(G-COB7)
  - I can explain that if two triangles have congruent corresponding parts, then the triangles must be congruent.(G-COB7)
- I can prove triangles congruent using SSS, SAS, AAS,ASA theorems.
  - I can examine and critique proofs produced by other students, re-examining their own proofs in light of what other students have done (G-COC10)
- I can use triangle congruence criteria to prove right triangles congruent.

- I can solve problems involving isosceles and equilateral triangles using triangle congruence.
- I can use coordinate geometry to prove triangles congruent.

**Assessment Evidence**

**Performance Assessment Options & Rubrics**
*May include, but are not limited to the following:*

- Geometry Feedback & Scoring Rubric based on Priority Standards
- Geometry Feedback & Scoring Rubric based on Math Practice Standards
- Module Pre-Test
- End of Unit Assessment (3 versions)
- End of Unit Assessment (2 versions - differentiation)
- Mid-unit checks/quizzes

**Other assessment options**
*May include, but are not limited to the following:*

- Quick Writes
- KWL Chart - (What I Know, Want to know, Learned)
- Marking Text
- Learning Log Reflection - Daily/Weekly
- I-Chart - Gather/Organize Information on a topic
- Focused Note Taking
- CSG - Collaborative Study Groups
- Socratic Seminar
- Philosophical Chairs
- Think/Pair/Share

**Digital Tools & Supplementary Resources**

- ALEKS
- Web Sketch Pad (DESMOS and etools)
- Spiral Review (Reveal)
- Take Another Look
- Dynamic Practice

- **Unit 6 -Relationships in Triangles**

**Essential Questions:**

1. What tools are available and efficient for us as mathematicians to use while solving a problem?(MP5)
2. How can we as mathematicians use and apply patterns and structures to solve problems? (MP7)
3. How can relationships in triangles be used in real-world situations?

**Priority Standards**
**G-COC Prove Geometric Theorems**

- *(G-COC9)*: Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.
- *(G-COC10)*: Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point. MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.

**Supporting Standards**

**G-COD Make geometric constructions.**

- *(G-COD12)*: Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle, constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

**G-CA Understand and apply theorems about circles.**

- *(G-CA3)*: Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can solve problems using perpendicular bisectors in triangles.
  - Make and prove conjectures about situations that lead to theorems involving lines and angles (Vertical Angle Theorems, special angle pair theorems between parallel lines, and the **perpendicular bisector theorem**) (G-COC9)
  - Identify how to find the incenter and circumcenter of a triangle(G-CA3)
  - Use the incenter and circumcenter to construct the incircle and circumcircle of a triangle(G-CA3)
- I can solve problems using angle bisectors in triangles.
  - Identify how to find the incenter and circumcenter of a triangle(G-CA3)
  - Use the incenter and circumcenter to construct the incircle and circumcircle of a triangle(G-CA3)
- I can solve problems using medians and altitudes in triangles.
  - Make and prove conjectures about situations that lead to the theorems of triangles (Triangle Angle Sum Theorem, Isosceles Triangle Theorem, Midsegment Theorem)(G-COC10)
  - Use precise academic vocabulary and specific theorems to justify your reasoning accurately and concisely (including transformational property language) (G-COC10)
  - Divise potential methods for constructing various objects.(G-COD12)
  - Prove that the constructions work.(G-COD12)
- I can solve problems using inequalities in the angles and sides of a triangle.
- I can prove theorems about triangles using indirect proof.
- I can prove and apply the Triangle Inequality Theorem.

**Assessment Evidence**

**Performance Assessment Options & Rubrics**
*May include, but are not limited to the following:*

- Geometry Feedback & Scoring Rubric based on Priority Standards
- Geometry Feedback & Scoring Rubric based on Math Practice Standards
- Module Pre-Test
- End of Unit Assessment (3 versions)

**Other assessment options**
*May include, but are not limited to the following:*

- Quick Writes
- KWL Chart - (What I Know, Want to know, Learned)
- Marking Text
- Learning Log Reflection - Daily/Weekly
- I-Chart - Gather/Organize Information on a topic
- Focused Note Taking
- CSG - Collaborative Study Groups
- Socratic Seminar

| | |
|---|---|
| • End of Unit Assessment<br>(2 versions - differentiation)<br>• Mid-unit checks/quizzes | • Philosophical Chairs<br>• Think/Pair/Share |

**Digital Tools & Supplementary Resources**

- ALEKS
- Web Sketch Pad (DESMOS and etools)
- Spiral Review (Reveal)
- Take Another Look
- Dynamic Practice

**Module 7: Quadrilaterals**

**Essential Questions:**

1.a. How can we as mathematicians justify our answer(s)?

b. How can we as mathematicians evaluate and question whether a mathematical argument is accurate?(MP3)

2.How do we as mathematicians know if we fully & accurately answered the problem and does the results make sense in the context of the problem?(MP6)

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

**Priority Standards**

**G-COC Prove Geometric Theorems**

- *(G-COC11)*: Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals. MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.

**Supporting Standards**

**G-GPEB Use coordinates to prove simple geometric theorems algebraically.**

- *(G-GPE4)*: Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1,V3) lies on the circle centered at the origin and containing the point (0,2).

**G-MGA Apply geometric concepts in modeling situations.**

- *(G-MG1)*: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can prove theorems about the interior and exterior angles of polygons and use the theorems to solve problems.
    - Use geometric shapes to model real world situations.(G-MG1)

- Use properties of those shapes to draw conclusions about the real world situation.(G-MG1)
- I can prove theorems about properties of parallelograms and use the properties of parallelograms to solve problems.
- I can prove and use the tests for parallelograms to determine whether quadrilaterals are parallelograms.
  - Make and prove conjectures about situations that lead to the theorems of a parallelogram (teacher reference: opposite sides and angles congruent, diagonals bisect each other, rectangle are parallelograms with congruent diagonals) (G-COC11)
  - Use precise academic vocabulary and specific theorems to justify your reasoning accurately and concisely (including transformational property language) (G-COC11)
  - Examine and critique proofs produced by other students, re-examining their own proofs in light of what other students have done (G-COC11)
- I can recognize and apply properties of rectangles and use them to determine whether a parallelogram is a rectangle.
  - Identify properties and how they can be expressed using coordinates.(G-GPE4)
  - Demonstrate why a property holds using algebra to show the relationships among the coordinates.(G-GPE4)
- I can recognize and apply the properties of rhombi and squares.
- I can solve problems using the properties of trapezoids and kites.

**Assessment Evidence**

**Performance Assessment Options & Rubrics**
*May include, but are not limited to the following:*

- Geometry Feedback & Scoring Rubric based on Priority Standards
- Geometry Feedback & Scoring Rubric based on Math Practice Standards
- Module Pre-Test
- End of Unit Assessment (3 versions)
- End of Unit Assessment (2 versions - differentiation)
- Mid-unit checks/quizzes

**Other assessment options**
*May include, but are not limited to the following:*

- Quick Writes
- KWL Chart - (What I Know, Want to know, Learned)
- Marking Text
- Learning Log Reflection - Daily/Weekly
- I-Chart - Gather/Organize Information on a topic
- Focused Note Taking
- CSG - Collaborative Study Groups
- Socratic Seminar
- Philosophical Chairs
- Think/Pair/Share

**Digital Tools & Supplementary Resources**

- ALEKS
- Web Sketch Pad (DESMOS and etools)
- Spiral Review (Reveal)
- Take Another Look
- Dynamic Practice

**Module 8: Similarity**

**Essential Questions:**

1.a. How can we as mathematicians justify our answer(s)?
b. How can we as mathematicians evaluate and question whether a mathematical argument is accurate?(MP3)
2.What tools are available and efficient for us as mathematicians to use while solving a problem?(MP5)
3.What does it mean for objects to be similar, and how is similarity useful for modeling in the real world?

**Priority Standards**

**G-COC Prove Geometric Theorems**

- *(G-COC10)*: Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point. MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.

**G-SRTB Prove theorems involving similarity.**

- *(G-SRTB4)*: Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.
- *(G-SRTB5)*: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.

**G-COA Experiment with Transformations in the plane**

- *(G-COA2)*: 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). MP1, Make Sense of Problems and Persevere in Solving Them

**Supporting Standards**

**G-COD Make geometric constructions.**

- *(G-COD12)*: Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle, constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

**G-SRTA Understand similarity in terms of similarity transformations.**

- *(G-SRTA1)*: 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.
- *(G-SRTA2)*: 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.
- *(G-SRTA3)*: Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can draw and analyze dilated figures using tools or functions.
    - I can create and represent transformations of a given geometric figure using graph paper, transparencies, and/or software (G-COA2)

- I can choose the appropriate tool (graph paper, software, etc) to explore the relationship between coordinates of an image and preimage (G-COA2)
- I can create a rule to determine the coordinates for the image of a figure when a specific transformation is applied to the preimage (G-COA2)
- I can develop accurate methods for carrying out dilations using different tools.(G-SRTA1)
- I can recognize the impact of different centers and scale factors on the image of a factor.(G-SRTA1)
- I can accurately interpret the scale factor of a given dilation and recognize it's relationship to ratios of corresponding sides of the image and preimage.(G-SRTA1)
- I can recognize that corresponding sides of the preimage and image in a dilation will be parallel.(G-SRTA1)

- I can solve problems using the definition of similar polygons.
  - I can look for patterns in carrying out sequences of dilations and rigid motions.(G-SRTA2)
  - I can recognize that a sequence of a dilation and one or more rigid motions results in an image that is similar to the preimage (teacher reference: sequences are called similarity transformations or similarity motions)(G-SRTA2)
  - I can find transformations relating given figures to determine whether they're similar.(G-SRTA2)
  - I can recognize that similar figures have congruent pairs of corresponding angles and all pairs of corresponding sides are proportional in length.(G-SRTA2)
- I can apply the AA Similarity criterion to solve problems and prove triangles similar.
  - I can recognize the AA similarity criterion for triangles.(G-SRTA3)
  - I can use similarity transformations to show that the AA similarity criterion works for triangles.(G-SRTA3)
- I can apply the SSS and SAS Similarity criteria to solve problems and prove triangles similar.
  - I can choose from a variety of tools to explore triangle congruence and similarity in order to explain geometric relationships and apply reasoning to real world situations (teacher reference - include transformational property language) (G-SRTB.5)
  - I can examine and critique proofs produced by other students, re-examining their own proofs in light of what other students have done (G-SRT.B.5)
- I can use triangle proportionality to solve problems and prove theorems.
  - I can make and prove conjectures about situations that lead to the theorems of triangles (Triangle Angle Sum Theorem, Isosceles Triangle Theorem, **Midsegment Theorem**)(G-COC10)
  - I can use precise academic vocabulary and specific theorems to justify your reasoning accurately and concisely (including transformational property language) (G-COC10)
  - I can devise potential methods for constructing various objects (G-COC12)
  - I can prove that the constructions work. (G-COC12)
- I can solve problems and prove theorems about parts of similar triangles by using triangle similarity.
  - I can make and prove conjectures about situations that lead to the theorems of similar triangles (teacher reference: proportionality theorem, side splitter and its converse, 3rd angle theorem, triangle similarity theorem) (G-SRTB4)
  - I can use precise academic vocabulary and specific theorems to justify your reasoning accurately and concisely (including transformational property language) (G-SRTB4)
  - I can examine and critique proofs produced by other students, re-examining their own proofs in light of what other students have done (G-SRTB4)

| **Assessment Evidence** | |
|---|---|
| **Performance Assessment Options & Rubrics** | **Other assessment options** |

| *May include, but are not limited to the following:* | *May include, but are not limited to the following:* |
|---|---|
| • Geometry Feedback & Scoring Rubric based on Priority Standards<br>• Geometry Feedback & Scoring Rubric based on Math Practice Standards<br>• Module Pre-Test<br>• End of Unit Assessment (3 versions)<br>• End of Unit Assessment (2 versions - differentiation)<br>• Mid-unit checks/quizzes | • Quick Writes<br>• KWL Chart - (What I Know, Want to know, Learned)<br>• Marking Text<br>• Learning Log Reflection - Daily/Weekly<br>• I-Chart - Gather/Organize Information on a topic<br>• Focused Note Taking<br>• CSG - Collaborative Study Groups<br>• Socratic Seminar<br>• Philosophical Chairs<br>• Think/Pair/Share |

**Digital Tools & Supplementary Resources**

- ALEKS
- Web Sketch Pad (DESMOS and etools)
- Spiral Review (Reveal)
- Take Another Look
- Dynamic Practice

**Module 9: Right Triangles and Trigonometry**

**Essential Questions:**

1. How can we as mathematicians evaluate and question whether a mathematical argument is accurate?(MP3)
2. How can we as mathematicians determine an effective model to use to solve a problem? MP4)
3. How are right triangle relationships useful in solving real-world problems?

**Priority Standards**

**G-SRTB Prove theorems involving similarity.**

- *(G-SRTB4)*: Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.
- *(G-SRTB5)*: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.

**G-SRTC Define trigonometric ratios and solve problems involving right triangles.**

- *(G-SRTC6)*: 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. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.
- *(G-SRTC7)*: Explain and use the relationship between the sine and cosine of complementary angles. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.
- *(G-SRTC8)*: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.

**Supporting Standards**

**G-SRTD Apply trigonometry to general triangles.**

- *(G-SRTD9)*: (+) Derive the formula A = 1/2 ab sin(c) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
- *(G-SRTD10)*: (+) Prove the Laws of Sines and Cosines and use them to solve problems.
- *(G-SRTD11)*: (+) 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).

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can solve problems involving relationships between parts of a right triangle and the altitude to its hypotenuse using the geometric mean.
    - I can make and prove conjectures about situations that lead to the theorems of similar triangles (teacher reference: proportionality theorem, side splitter and its converse, 3rd angle theorem, triangle similarity theorem) (G-SRTB4)
    - I can use precise academic vocabulary and specific theorems to justify your reasoning accurately and concisely (including transformational property language) (G-SRTB4)
    - I can examine and critique proofs produced by other students, re-examining their own proofs in light of what other students have done (G-SRTB4)
    - I can choose from a variety of tools to explore triangle congruence and similarity in order to explain geometric relationships and apply reasoning to real world situations (teacher reference - include transformational property language) (G-SRTB.5)
    - I can examine and critique proofs produced by other students, re-examining their own proofs in light of what other students have done (G-SRT.B.5)
- I can solve problems using the Pythagorean Theorem and its converse.
    - I can represent applied problems using right triangles (G-SRT.C.8)
- I can graph points and find distances using the distance formula for three dimensions.
- I can solve problems by using the properties of 45°-45°-90° and 30°-60°-90° triangle
- I can solve problems using the trigonometric ratios and the inverse trigonometric ratios for acute angles.
    - I can discover the foundation of trigonometry in similarity using the AA similarity criterion (G-SRT.C.6)
    - I can apply the definitions of right triangle trig ratios in order to find missing side lengths and angle measures (reg geo uses right triangles only while honors geo may extend to law of sines and cosines) (G-SRT.B.6)
    - I can observe that the sine of an angle is equal to the cosine of its complementary angle and this relationship and why it holds true for all right triangles (G-SRT.C.7)
    - I can identify relevant trig ratios and applying them to solve problems (G-SRT.C.8)
- I can solve real-world problems using the trigonometric ratios and their inverses.
    - I can recognize that the height of the triangle can be determined using the sine ratio.(G-SRTD9)
    - I can use variables to represent the given sides and angle measure in order to derive the formula (A = 1/2absin(c)).(G-SRTD9)
    - I can calculate the area for a triangle given 2 sides and an included angle, or, work backwards from the area to find missing sides or angles.(G-SRTD9)
- I can solve problems using the Law of Sines.
- I can solve problems using the Law of Cosines.

- I can find methods for finding missing sides in general triangles and then use those methods to derive the law of sines and cosines.(G-SRTD10)
- I can use the law of sines and cosines to find missing measurements in right and non-right triangles.(G-SRTD10)
- I can be aware of ambiguous solutions for the Law of Sines.(G-SRTD10)
- I can consider how the law of sines and cosines can be used to solve problems involving triangles.(G-SRTD11)
-

**Assessment Evidence**

**Performance Assessment Options & Rubrics**
*May include, but are not limited to the following:*

- Geometry Feedback & Scoring Rubric based on Priority Standards
- Geometry Feedback & Scoring Rubric based on Math Practice Standards
- Module Pre-Test
- End of Unit Assessment (3 versions)
- End of Unit Assessment (2 versions - differentiation)
- Mid-unit checks/quizzes

**Other assessment options**
*May include, but are not limited to the following:*

- Quick Writes
- KWL Chart - (What I Know, Want to know, Learned)
- Marking Text
- Learning Log Reflection - Daily/Weekly
- I-Chart - Gather/Organize Information on a topic
- Focused Note Taking
- CSG - Collaborative Study Groups
- Socratic Seminar
- Philosophical Chairs
- Think/Pair/Share

**Digital Tools & Supplementary Resources**

- ALEKS
- Web Sketch Pad (DESMOS and etools)
- Spiral Review (Reveal)
- Take Another Look
- Dynamic Practice

**Module 10: Circles**

**Essential Questions:**
1. How can we as mathematicians create and apply generalizations from repeated reasoning?(MP8)
2. What tools are available and efficient for us as mathematicians to use while solving a problem? MP5)
3. How can circles and parts of circles be used to model situations in the real world?

**Priority Standards**
**G-COA Experiment with transformations in the plane.**

- *(G-COA1)*: 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. The main mathematical practice relevant for this task is MP6, "Attend to Precision."

**Supporting Standards**

**G-COA13??**

**G-CA Understand and apply theorems about circles.**

- *(G-CA1)*: Prove that all circles are similar.
- *(G-CA2)*: 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.
- *(G-CA3)*: Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
- *(G-CA4)*: (+) Construct a tangent line from a point outside a given circle to the circle.

**G-CB Find arc lengths and areas of sectors of circles.**

- *(G-CB5)*: 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.

**G-GPEA Translate between the geometric description and the equation for a conic section.**

- *(G-GPEA1)*: Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
- *(G-GPEA2)*: Derive the equation of a parabola given a focus and directrix.

**G-GPEB Use coordinates to prove simple geometric theorems algebraically.**

- *(G-GPE4)*: Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1,V3) lies on the circle centered at the origin and containing the point (0,2).

**G-GMDA Explain volume formulas and use them to solve problems.**

- *(G-GMD1)*: Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can find and apply the formulas for the circumference and area of a circle.(G-CA1)
  - I can recognize that any two circles are related by a dilation possibly along with a translation.(G-CA1)
  - I can write a formal argument explaining reasoning for why two circles must be similar.(G-CA1)
  - I can consider why the various formulas work, using drawings and models as needed.*(G-GMD1)*
  - I can use similarity to define PI and develop the formula for the circumference of a circle.*(G-GMD1)*
  - I can use a limit argument to develop the area of a circle.*(G-GMD1)*
- I can find measures of angles and arcs using the properties of circles.
  - I can explore various properties related to circles.(G-CA2)
  - I can form conjectures about the relationships we find.(G-CA2)
  - I can develop justifications for why their conjectures work(G-CA2)
- I can solve problems using the relationships between arcs, chords, and diameters.
  - I can relate arc length and area of sectors to the fraction of the circle cut off by the corresponding central angle(G-CB5)
  - I can develop and use general formulas for arc length and sector area(G-CB5)
- I can solve problems using inscribed angles.
  - I can recognize that the opposite angles of a quadrilateral inscribed in a circle are supplementary and

justify why (G-CA3)

- I can solve problems using relationships between circles and tangents.
    - I can apply the properties of circles to find the tangent line(G-CA4)
      I can write a clear description for how to construct a tangent line(G-CA4)
    - I can provide a justification for why the construction works using properties of circles(G-CA4)
    -
- I can solve problems using relationships between circles, tangents, and secants.
- I can write and graph the equations of circles.
    - I can use the Pythagorean Theorem or distance formula to find the equation of a circle with a given center and radius(G-GPEA1)
    - I can see the relationship between the distance formula and the Pythagorean Theorem(G-GPEA1)
    - I can develop the general formula for the equation of a circle(G-GPEA1)
    - Given the general form for a circle, I can complete the square to find the center and radius(G-GPEA1)
    - I can identify properties and how they can be expressed using coordinates (G-GPE4)
    - I can demonstrate why a property holds using algebra to show the relationships among the coordinates(G-GPE4)

- I can write and graph the equations of parabolas using techniques for solving quadratic equations.
    - Use geometric properties and the distance formula to find the equation of a parabola(G-GPEA2)
    - Generalize the process for finding the definition of a parabola(G-GPEA2)
    - Recognize that a parabola can be described as a quadratic function(G-GPEA2)

**Assessment Evidence**

**Performance Assessment Options & Rubrics**
*May include, but are not limited to the following:*

- Geometry Feedback & Scoring Rubric based on Priority Standards
- Geometry Feedback & Scoring Rubric based on Math Practice Standards
- Module Pre-Test
- End of Unit Assessment (3 versions)
- End of Unit Assessment (2 versions - differentiation)
- Mid-unit checks/quizzes

**Other assessment options**
*May include, but are not limited to the following:*

- Quick Writes
- KWL Chart - (What I Know, Want to know, Learned)
- Marking Text
- Learning Log Reflection - Daily/Weekly
- I-Chart - Gather/Organize Information on a topic
- Focused Note Taking
- CSG - Collaborative Study Groups
- Socratic Seminar
- Philosophical Chairs
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**Digital Tools & Supplementary Resources**

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- Dynamic Practice

**Module 11: Measurement**

**Essential Questions:**

1.a. How do we as mathematicians analyze the problem in order to choose the best strategy(ies) or resource to make sense of the problem? b. How do we as mathematicians persevere in solving problems?(MP1)

2.How can we as mathematicians determine an effective model to use to solve a problem?(MP5)

3. How are measurements of two- and three-dimensional figures useful for modeling situations in the real world?

**Priority Standards**

**G-GCB - Find arc lengths and areas of sectors of circles**

- (G-CB5): 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.

**G-GMDA - Explain volume formulas and use them to solve problems**

- (G-GMD1): Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.
- (G-GMD3): Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems

**G-GMDB - Visualize relationships between two-dimensional and three-dimensional objects**

- (G-GMD4): Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

**G-MGA - Apply geometric concepts in modeling situations**

- (G-MG1): Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- (G-MG2): Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
- *(G-MG3)*: 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)

**Supporting Standards**

**G-GMDA- - Explain volume formulas and use them to solve problems**

- (G-GMD2):Give an informal argument using *Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.*

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can find areas of quadrilaterals by using the formulas they derive.
- I can find areas of regular polygons by using the formulas they derive.
    - I can use geometry to model real world situations in order to design solutions to real world problems(G-MG3)
    - I can justify the decisions made to demonstrate that the resulting design addresses the context(G-MG3)
- I can find areas of circles and sectors by using the formulas they derive.
    - I can relate arc length and area of sectors to the fraction of the circle cut off by the corresponding central angle(G-CB5)
    - I can develop and use general formulas for arc length and sector area(G-CB5)

- I can find surface areas of prisms, cylinders, pyramids, cones, and spheres and composites of these shapes using the formulas they derive.
    - I can use geometry to model real world situations in order to design solutions to real world problems(G-MG3)
    - I can justify the decisions made to demonstrate that the resulting design addresses the context(G-MG3)
- I can identify the shapes of cross sections formed by cuts to a solid, the three-dimensional objects generated by rotations of two-dimensional objects, and the three-dimensional symmetries of solids.
    - I can describe possible cross sections for solids, using precise language to describe them(G-GMD4)
    - I can describe the solids formed by rotation a two dimensional figure in three dimensions(G-GMD4)
- I can find volumes of prisms, pyramids, cylinders, cones, and spheres by using the formulas they derive.
    - I can use geometry to model real world situations in order to design solutions to real world problems(G-MG3)
    - I can justify the decisions made to demonstrate that the resulting design addresses the context(G-MG3)
    - I can use Cavaliers principle to explain why the formulas for the volume of a cylinder, pyramid and cone work.*(G-GMD1)*
- I can find measures of similar figures and solids by using scale factors.
    - I can relate the volumes among various solids with the same dimension.*(G-GMD1)*
- I can solve real-world problems involving density by using area and volume.
    - I can use geometry to model real world situations involving density(G-MG2)
    - I can draw conclusions about real world situations involving density(G-MG2)

**Assessment Evidence**

**Performance Assessment Options & Rubrics**
*May include, but are not limited to the following:*

- Geometry Feedback & Scoring Rubric based on Priority Standards
- Geometry Feedback & Scoring Rubric based on Math Practice Standards
- Module Pre-Test
- End of Unit Assessment (3 versions)
- End of Unit Assessment (2 versions - differentiation)
- Mid-unit checks/quizzes

**Other assessment options**
*May include, but are not limited to the following:*

- Quick Writes
- KWL Chart - (What I Know, Want to know, Learned)
- Marking Text
- Learning Log Reflection - Daily/Weekly
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- Focused Note Taking
- CSG - Collaborative Study Groups
- Socratic Seminar
- Philosophical Chairs
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**Digital Tools & Supplementary Resources**

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- Take Another Look
- Dynamic Practice

## Module 12: Probability

**Essential Questions:**

1.How do we as mathematicians make sense of quantities and situations symbolically?(MP2)

2. a. How do we as mathematicians analyze the problem in order to choose the best strategy(ies) or resource to make sense of the problem?

b. How do we as mathematicians persevere in solving problems?(MP1)

3. How can you use measurements to find probabilities?

**Priority Standards**

**Supporting Standards**

**S-CPA Understand independence and conditional probability and use them to interpret data.**

- *(S-CPA1)*: 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").
- *(S-CPA2)*: 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.
- *(S-CPA3)*: Understand the conditional probability of A given B as P(A 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.
- *(S-CPA4)*: 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. For example, collect data from a random sample of students in your school on their favorite subject among math, science and english. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.
- *(S-CPA5)*: Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

**S-CPB Use the rules of probability to compute probabilities of compound events in a uniform probability model.**

- *(S-CPB6)*: 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.
- *(S-CPB7)*: 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.
- *(S-CPB8)*: (+) 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.
- *(S-CPB9)*: (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

**S-MD Use probability to evaluate outcomes of decisions**

- (S-MDB6): (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
- (S-MDB7): (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

**Extensions**

- **More advanced Algebra application.**

**Learning Targets**

- I can describe events using subsets.
- I can solve problems involving using the rule for the probability of complementary events.
    - Relate Venn Diagrams and Frequency Tables to set notation and probability models(S-CPA1)
    - Represent contextual situations by their compliment to solve problems(S-CPA1)
    - Use set notation to represent contextual situations(S-CPA1)
    - Relate the complement of one event to the intersection of union of others(S-CPA1)
- I can find the probability of an event by using lengths of segments and areas.
    - Use random generation to explain and make arguments for fair decisions(S-MD-B6)
    - Use simulation to make decisions of fairness in different contextual situations(S-MD-B6)
    - Analyze both costs and benefits in different contextual situations(S-MD-B7)
    - Justify and critique arguments based on probability(S-MD-B7)
    - Attend to precision in communication of ideas, both orally and in written form
- I can solve problems involving probabilities of compound events using permutations and combinations.
    - Connect ideas from the fundamental counting principle to deduce rules for permutations and combinations(S-CPB9)
    - Explain the difference between permutations and combinations(S-CPB9)
    - Explain why combinations require extra division in their algorithm in contextual situations(S-CPB9)
    - Explain their reasoning using organized lists, tree diagrams or other displays of sample spaces(S-CPB9)

- I can solve problems involving probability of independent and dependent events using the Multiplication Rule
    - State problems' independence and dependence contextually(S-CPA2)
    - Attend to precision in wording of relationships by emphasizing relationships as associated rather than caused(S-CPA2)
    - Test for independence by comparing the joint probability of an event with the product of two events occurring marginally(S-CPA2)
    - Challenge ideas of mathematical and statistical independence(S-CPA2)
    - Use tree diagrams to help in clarification and calculation of specific probabilities(S-CPB8)
    - Use two way relative frequency tables to clarify and solve problems(S-CPB8)
    - Use problem pathways to create the general multiplication rule for dependent events(S-CPB8)
    - Use counting techniques to discover the general multiplication rule(S-CPB8)
- I can solve problems involving events that are and are not mutually exclusive using the Addition Rule.
    - Discover and build understanding the relationship of the addition rule to Venn Diagrams and Frequency Tables(S-CPB7)
    - Use the intersection and union of events to describe the probability of different situations(S-CPB7)
    - Use the probability rule to solve problems directly and indirectly through formula and manipulation(S-CPB7)
    - Connect Venn Diagrams and frequency tables to the addition rule by justifying and critiquing the reasoning of themselves and their peers(S-CPB7)
- I can solve problems involving conditional probability using the Multiplication Rule.
    - Contextually interpret probability of different events bringing to light the implications of independence and conditional events(S-CPA3)
    - Use joint and marginal probabilities to justify reasoning for the rule of conditional probability(S-CPA3)
    - Symbolize events by assigning labels to their descriptions and using notation from probability to define their operations(S-CPA3)
    - Use conditional probability to make decisions and justify claims of relationships to contextual situations(S-CPA5)

- Translate and explain conditional probability notation contextually(S-CPA5)
- Solve word problems related to conditional probability and explain their solutions contextually(S-CPA5)
- Use marginal distributions in frequency tables to explain conditional probability(S-CPA5)

- I can decide if events are independent and approximate conditional probabilities using two-way frequency tables.
  - Use data to interpret the association of different events by comparing conditional probabilities or testing for mathematical independence(S-CPA4)
  - Use frequency tables to describe a sample space of a population(S-CPA4)
  - Use frequency tables to argue and validate arguments of association by relating marginal and joint events(S-CPA4)
  - Identify why the 2 probabilities P(A) and P(A\B) are not always equal(S-CPB6)
  - Connect the previous ideas using 2 way frequency tables. venn diagrams, and/or counting principles to solve problems(S-CPB6)
  - Explain conditional solutions in terms of outcomes that belong to an observed set of outcomes(S-CPB6)

**Assessment Evidence**

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