

**Mathematics Standards**

**Geometry**

**Course Overview:** In this course students will apply their current mathematical knowledge to solve problems. This course will involve many geometric applications and the relationships between points, lines, angles, and figures. Students will see how geometry connects to other areas of mathematics and in the real world.

**Bold standards are essential standards that all students will learn as they complete the course.**

**Unit 1 Shapes and Transformations (13 Days)**

**Description:** In this unit students will become familiar with basic geometric shapes and learn how to describe each one using its attributes such as parallel sides or rotation symmetry. Students will also investigate three basic rigid transformations: reflections, rotations, and translations. There will also be an introduction to probability and learn how to use probability to make predictions.

**Standards**

1. The students can build symmetrical designs using the same basic shapes.
2. The students can generate question to investigate, make predictions, and test their predictions as they work with Mobius strips and related constructions.
3. The students can use their understanding of area and perimeter. Students will investigate how the perimeter and area of a shape change as the shape enlarges proportionally.
4. The students can begin to develop a convincing argument and critique the reasoning of others.
5. The students can build an angle and understand what an angle is and how it is measured. The students can use complicated shapes composed of triangles and will begin to use attributes of sides and angle to compare and describe those shapes. (G-CO.1)
6. The students will use their spatial visualization skills to investigate reflection. (G-CO.2, G-CO.4, G-CO.5, G-CO.6)
7. The students will understand the three rigid transformations and will learn some connections between them. Students are also introduced to notation for corresponding parts. (G-CO.2, G-CO.4, G-CO.5, G-CO.6)
8. The students will discover that objects and their images are equidistant from the line of reflection, and that the line segment connecting a point with its reflected image is perpendicular to the line of reflection. In the process, students will recognize that the slopes of perpendicular lines are opposite reciprocals. (G-CO.1, G-CO.2, G-CO.4, G-CO.5, G-CO.6, G-GPE.5)
9. The students will begin to develop an understanding of reflection symmetry as they investigate reflections. The students also will learn how to translate a geometric figure on a coordinate grid. Finally, the students will learn that reflection and reflection symmetry can help them discover relationships within a shape, namely an isosceles triangle. (G-CO.1, G-CO.2, G-CO.3, G-CO.4, G-CO.5, G-CO.6, G-CO.10)
10. The students will use what they know about transformations to make other shapes including: rhombus, square, parallelogram, isosceles triangle, right triangle, kite, and dart. (G-CO.2, G-CO.4, G-CO.5, G-CO.6)
11. The students will learn about reflection, rotation, and translation symmetry and will identify which common shapes have each type of symmetry. (G-CO.2, G-CO.3, G-CO.4, G-CO.5, G-CO.6)
12. The students will learn how to classify shapes by their attributes using Venn diagrams. They will also review geometric vocabulary and concepts.
13. The students will continue to study the attributes of shapes as they begin to formalize their vocabulary: both names of shapes and attributes of shapes. Students will also become familiar with how to mark diagrams to help communicate attributes such as equal length and right angle.

**Unit 2 Angles and Measurement (11 Days)**

**Description:** In this unit students will learn the relationships between pairs of angles formed by transversal and the angles in a triangles. Students will also find the area and perimeter of triangles, parallelograms, and trapezoids. The relationships among the three side lengths of a right triangle will be investigated along with how to estimate the value of a square root. Students will be able to determine when the lengths of three segments can and cannot form a triangle.

**Standards**

1. The students will be introduced to a problem about mirror reflections. Students will learn how to name angles, and will learn the three main relationships for angle measures, namely, supplementary, complementary, and same. Students will also discover that vertical angles have the same measure. (G-CO.9)
2. The students will use their understanding of translation to determine that when a transversal intersects parallel lines, corresponding angles have equal measure. They will also continue to practice using angle relationships to solve for unknown angles. (G-CO.9)
3. The students will continue to apply their knowledge of corresponding angles, and will develop theorems about alternate interior and same-side interior angles. Students will also learn that when a light beam reflects off a mirror, the angle of the light hitting the mirror equals the angle of the light leaving the mirror. (G-CO.9)
4. The students will discover that the angles in a triangle add up to 180°. They will also practice finding angles in complex diagrams that use multiple relationships. (G-CO.9, G-CO.10)
5. The students will learn the converses of some of their angle theorems, and see arguments for them. Students will also apply their knowledge of angle relationships to analyze the hinged mirror trick. (G-CO.9, G-CO.10)
6. The students will gain a geometric sense of length and area by investigating various unit measures of each concept. The students will also learn that the measurement of an object depends on the units being used.
7. The students will learn how to find the area of a triangle and will develop multiple methods to find the area of composite shapes formed by rectangles and triangles.
8. The students will use rectangles and triangles to develop algorithms to find the area of new shapes, including parallelograms and trapezoids.
9. The students will explore how to find the height of a triangle given that one side has been specified as the base. Additionally, students will find the areas of composite shapes using what they have learned about the areas of triangles, parallelograms, and trapezoids.
10. The students will develop a strategy to find the length of the hypotenuse of a right triangle when the lengths of the legs are known in preparation for the Pythagorean Theorem. The students will also learn how to determine whether or not three given lengths can make a triangle. They will also understand how to find the maximum and minimum lengths of a third side given the lengths of the two other sides.
11. The students will develop and prove the Pythagorean Theorem. (G-SRT.8)

**Unit 3 Justification and Similarity (10 Days)**

**Description:** In this unit the students will learn how to support a mathematical statement using flowcharts and conditional statements. The students will also learn about the special relationships between shapes that are similar or congruent. Lastly the students will determine if triangles are similar or congruent.

**Standards**

1. The students will learn about the concept of dilation and will investigate the characteristics that figures share if they have the same shape. Students will determine that dilations have equal angles and proportional corresponding side lengths. (G-CO.2, G-CO.12, G-SRT.1a, G-SRT.1b, G-C.1)
2. The students will learn that figures that can be related through a sequence of transformations that include a dilation are similar and will determine that multiplying lengths of figures by a common number produces a similar figure. Students will use the equivalent ratios to find missing lengths in similar figures and will learn that congruent figures are similar and have a side ratio of 1. (G-CO.2, G-SRT.1a, G-SRT.1b, G-SRT.2)
3. The students will continue to become familiar with similarity, they will examine the ratio of the perimeters of similar figures and will practice setting up and solving equations to solve proportional problems. (G-CO.2, G-SRT.1b, G-SRT.2)
4. The students will apply proportional reasoning and will learn how to write similarity statements. (G-SRT.2, G-SRT.4, G-SRT.5)
5. The students will learn the SAS similarity and AA similarity conditions for determining triangle similarity. (G-SRT.2, G-SRT.3, G-SRT.5)
6. The students will learn how to use flowcharts to organize their arguments for triangle similarity and will continue to practice applying the AA similarity and SAS similarity conditions. (G-SRT.5)
7. The students will practice making and using flowcharts in more challenging reasoning contexts. Students also further investigate the fact that if two triangles are similar and the common ratio between the lengths of their corresponding sides is 1, then the triangles must be congruent. (G-SRT.4, G-SRT.5)
8. The students will complete their list of triangle similarity conditions involving sides and angles, learning about the SSS ~ condition in the process. (G-SRT.2, G-SRT.5)
9. The students will practice using the three triangle similarity conditions and organizing their reasoning in a flowchart. Students will also use a flowchart to diagram a multi-step argument. (G-SRT.5)
10. The students will apply their knowledge of similar triangles to multiple contexts. (G-CO.3, G-SRT.4)

**Unit 4 Trigonometry and Probability (11 Days)**

**Description:** In this unit the student will learn how the tangent ratio is connected to the slope of a line and they will become comfortable with the trigonometric ratio of tangent. The student will apply trig ratios to find missing measurements in right triangles. The student will learn how to model real world situations with right triangles and probability situations such as tree diagrams and area models. The student will learn several ways to model probability situations and how to formalize methods for computing probabilities of unions, intersections, and complements of events. Lastly, the student will learn how to find expected value in games of chance.

**Standards**

1. The students will recognize that all the slope triangles on a given line are similar to each other and will begin to connect a specific slope to a specific angle measurement and ratio. (G-SRT.6)
2. The students will connect specific slope ratios to their related angles and use this information to find missing sides or angles of right triangles with 11°, 22°, 18°, or 45° angles. (G-SRT.6)
3. The students will use technology to generate slope ratios for new angles in order to solve for missing side lengths on triangles. (G-SRT.6)
4. The students will practice using slope ratios to find the length of a leg of a right triangle and will learn that this ratio is called tangent. Students will also practice re-orienting a triangle and will learn new ways to identify which leg is Δx and which is Δy. Additionally, students will learn how to find the slope ratio using a scientific calculator. (G-SRT.6, G-SRT.8)
5. The students will apply their knowledge of tangent ratios to find measurements about the classroom or school site. (G-SRT.8)
6. The students will learn how to use a probability area model to represent a situation of chance. (S-CP.1)
7. The students will develop more complex tree diagrams to model probabilities for events that are not equally likely. They will further consider the difference between theoretical and experimental probability. (S-CP.1)
8. The students will use tree diagrams and area models as ways to represent and solve probability problems. They will revisit the concept of a “fair” game and calculate some expected values. (S-CP.1, S-CP.7)
9. The students will learn mathematical language for calculating probabilities of unions, intersections, and complements of events. (S-CP.1)
10. The students will learn how to find the expected value of a game of chance. (S-MT.6(+))

**Unit 5 Completing the Triangle Toolkit (12 Days)**

**Description:** In this unit the student will learn how to recognize and use special right triangles, sine, and cosine as well as the inverses of these functions. The student will apply the trig ratios to find missing measurements in right triangles. The student will also learn a new triangle tools called the law of sines and the law of cosines. Lastly, the student will learn how to recognize when the information provided is not enough to determine a unique triangle.

**Standards**

1. The students will learn about the sine and cosine ratios and will start a Triangle Toolkit. (G-SRT.6, G-SRT.8)
2. The students will develop strategies to recognize which trigonometric ratio to use based on the relative position of the reference angle and the given sides involved. (G-SRT.6, G-SRT.7, G-SRT.8)
3. **The students will understand how to use trigonometric ratios to find the unknown angle measures of a right triangle and will be introduced to the concept of “inverse.”** (G-SRT.6, G-SRT.8)
4. The students will use sine, cosine, and tangent ratios to solve application problems. (G-SRT.8)
5. The students will recognize the similarity ratios in 30°- 60°- 90° and 45°- 45°- 90° triangles and begin to apply those ratios as a shortcut to finding missing side lengths. (G-CO.10, G-CO.12, G-SRT.8)
6. The students will learn to recognize 3:4:5 and 5:12:13 triangles and find other examples of Pythagorean Triples. In addition, students will practice recognizing and applying all three of their new triangle shortcuts. (G-SRT.8)
7. The students will review their tools for finding missing sides and angles of triangles and will develop a method to solve for missing sides and angles for a non-right triangles. (G-SRT.8)
8. The students will recognize the relationship between a side and the angle opposite that side in a triangle. Students will also develop the Law of Sines and use it to find missing side lengths and angles of non-right triangles. (G-SRT.9(+), G-SRT.10(+))
9. The students will complete their Triangle Toolkits by developing the Law of Cosines. (G-SRT.10(+))
10. The students will learn that multiple triangles are sometimes possible when two side lengths and an angle not between them are given (SSA). (G-SRT.10(+))
11. The students will apply their current triangle tools to solve multiple problems and applications (G-SRT.8, G-SRT.11(+))

**Unit 6 Congruent Triangles (10 Days)**

**Description:** In this unit students will learn what information is needed in order to conclude that two triangles are congruent. They will also learn what a converse of a conditional statement is and how to recognize whether or not the converse is true. Finally students will learn how to organize a flowchart that conclude that two triangles are congruent.

**Standards**

1. The students will practice identifying congruent triangles by first determining that the triangles are similar and that the ratio of corresponding sides is 1. (G-CO.6, G-CO.7, G-CO.8, G-SRT.2, G-SRT.5)
2. The students will use their understanding of similarity and congruence to develop conditions that guarantee that triangles are congruent. (G-CO.6, G-CO.7, G-CO.8, G-SRT.5)
3. The students will show that the triangle congruence conditions are true using rigid transformations. (G-CO.2, G-CO.6, G-CO.7, G-CO.8, G-SRT.5)
4. **The students will extend their use of flowcharts to document triangle congruence facts. They will practice identifying pairs of congruent triangles and will contrast congruence arguments with similarity arguments**. (G-CO.10, G-SRT.5)
5. The students will recognize the converse relationship between conditional statements, and will then investigate the relationship between the truth of a statement and the truth of its converse. (G-CO.9, G-CO.10, G-SRT.5)
6. The students will review angle relationships, trigonometry, and similar triangles. (G-MG.1, G-MG.3)
7. The students will review area and perimeter of a triangle, trigonometry, Pythagorean Theorem, and the Triangle Angle Sum Theorem. (G-GPE.7)
8. The students will review building models, similarity, and inverse trigonometric ratios. (G-MG.1, G-MG.3)
9. The students will analyze the probability of winning and losing a game from the television show *Let’s Make a Deal*. Students will collect experimental data and construct a probability model to represent the game. (S-MD.7(+))
10. The students will review transformations and symmetry. (G-CO.2, G-CO.5, G-CO.6, G-CO.12)

**Unit 7 Proof and Quadrilaterals (14 Days)**

**Description:** In this unit students will learn the relationships of the sides, angles, and diagonals of special quadrilaterals. They will also learn how to write a convincing proof in a variety of formats such as flowcharts and two-column proofs. Finding the midpoint of a line segment will also be one of the focuses. Finally they will use algebraic tools to explore quadrilaterals on a coordinate axes.

**Standards**

1. The students will explore the special properties of a circle and will explore Reuleaux curves and square wheels. (G-CO.1, G-CO.12)
2. The students will review shapes and their properties as they fold a circle to create a tetrahedron. Students also begin to understand how the area of a shape changes as it is enlarged proportionally. (G-CO.1, G-CO.12)
3. The students will analyze and solve several “shortest distance” problems and will reinforce their understanding of reflection and similarity. At the same time, students will lay the foundation for understanding the surface of a three-dimensional object. (G-MG.3)
4. The students will review how to create regular polygons with a hinged mirror and will use their understanding of reflection and congruence to learn more about the central angles of these shapes. At the same time, students will learn more about the diagonals of rhombi. (G-CO.12)
5. The students will be introduced to proof and will learn more properties of parallelograms and kites. (G-CO.11, G-CO.12)
6. The students will use their understanding of congruent triangles to prove properties of rhombi and will practice using a flowchart structure to organize a proof. (G-CO.11, G-CO.12)
7. The students will continue developing flowchart proofs as a way to communicate a logical argument and will prove that all rectangles are also parallelograms. (G-CO.11)
8. The students will write flowchart proofs to demonstrate additional properties of quadrilaterals and isosceles triangles. (G-CO.11)
9. The students will continue to learn how to build a convincing argument, they will be introduced to the format of a two-column proof. (G-CO.11)
10. The students will continue to develop their skills of writing proofs as they prove new properties of triangles and quadrilaterals. Students will be exposed to proofs based on similar triangles and those requiring auxiliary lines to be added to a diagram. (G-CO.10, G-CO.11, G-SRT.5)
11. The students will investigate quadrilaterals for special properties, such as parallel sides or a right angle. Students will also review several algebraic tools and will apply these skills to analyze shapes on a coordinate grid. (G-GPE.4, G-GPE,5, G-GPE.7)
12. The students will develop methods for finding the midpoint of a segment on a coordinate grid as they continue their study of coordinate geometry. (G-GPE.4, G-GPE.7)
13. The students will analyze quadrilaterals on a coordinate grid and identify them by type. (G-GPE.4, G-GPE.6, G-GPE.7)

**Unit 8 Polygons and Circles (12 Days)**

**Description:** In this unit students will learn about special types of polygons, such as regular and non-convex polygons. They will also learn how the measure of the interior and exterior angles of a regular polygon are related to the number of sides of the polygon. How the area of similar figures are related will also be taught in this unit. It will conclude with how to find the area and circumference of a circle and the parts of circles and use this ability to solve problems in various contexts.

**Standards**

1. The students will learn that regular polygons can be built using congruent isosceles triangles with certain angle measures. Students will also learn that the central angle of a regular *n*‑gon or pinwheel with *n* sides is always 360° ÷*n* and will learn how to determine if a shape is convex. (G-CO.12)
2. The students will learn how to find the sum of the interior angles of a polygon and will be able to apply this skill to solve problems. (G-GMD.1)
3. The students will learn how to determine the measure of an interior and exterior angle of a regular polygon. (G-GMD.1)
4. The students will develop multiple strategies to find the measures of interior and exterior angles of a regular polygon as well as the sum of the interior angles of polygons in general. (G-GMD.1)
5. The students will develop an algorithm to find the area of any regular polygon. (G-GMD.1)
6. The students will learn that the ratio of the areas of similar figures is the square of the ratio of similarity. (G-SRT.5)
7. The students will continue to develop their understanding for how the area and perimeter of a shape change as the shape is enlarged or reduced proportionally. (G-SRT.5)
8. The students will discover the area and circumference formulas for a circle with radius 1. (G-GMD.1)
9. The students will use their understanding of the ratios of areas of similar figures to develop a method of finding the area and circumference of a circle with any sized radius. Students will also develop methods to find the area of sectors and the length of arcs. (G-GMD.1, G-C.5)
10. The students will use problem-solving strategies to find areas of circular and polygonal regions in context. (G-MG.1, G-MG.3)

**Unit 9 Solids and Constructions (9 Days)**

**Description:** In this unit students will learn how to find the surface area and volume of three-dimensional solids, such as prisms and cylinders and how to represent them with a mat plan, net, and side and top views. They will also learn how the volume changes when a three-dimensional solid is enlarged proportionally. Then conclude the unit with constructing familiar geometric shapes using construction tools such as tracing paper, a compass and straightedge.

**Standards**

1. The students will learn how to represent three-dimensional solids using side views and a mat plan. Students will also be introduced to volume as a form of measurement. (G-GMD.1)
2. The students will understand how to represent a solid with a net and will be introduced to prisms. Students will also learn how to find the surface area of a solid. (G-GMD.1)
3. The students will practice finding the surface area and volume of non-rectangular prisms and cylinders. Students will understand that the volume of a cylinder or prism remains constant if the solid is slanted. Finally, students will learn how to sketch prisms and cylinders on their paper. (G-GMD.1,G-GMD.2, G-GMD.3, G-MG.1)
4. The students will understand that the ratio of the volumes of similar figures is the cube of the linear scale factor and they will use this relationship in applications. (G-GMD.3, G-MG.1)
5. The students will apply their understanding of the ratios of similarity. (G-GMD.3, G-MG.1)
6. The students will become acquainted with basic construction techniques such as copying an angle or a line segment using a compass and a straightedge. Students will also learn how to construct the incenter of a triangle, a circle inscribed within a triangle, a regular hexagon, and an equilateral triangle. (G-CO.9, G-CO.12, G-CO.13, G-C.3, G-MG.2)
7. The students will understand how to construct a perpendicular bisector and an angle bisector and will understand how the properties of the diagonals of a rhombus help create each construction. (G-CO.12)
8. The students will learn how to construct a line parallel to a given line through a given point not on the line and how to construct a square. Students will also learn how to copy triangles. (G-CO.12, G-CO.13)
9. The students will further explore geometric constructions with a compass and a straightedge. Students will learn about the medians and centroid of a triangle and will understand how to construct them. (G-CO.10, G-CO.12, G-CO.13, G-C.3)

**Unit 10- Circles and Conditional Probability (16 Days)**

**Description:** In this unit students will explore the relationships between angles, arcs, and chords in a circle. They will also analyze probabilities, develop an understanding of conditional probability and more formal mathematical definitions of independence. Students will determine if two categorical variables are associated with each other. Lastly, students will add the additional tool of two-way tables to their existing tools of area models and tree diagrams to calculate and display probabilities.

**Standards**

1. The students will learn that the perpendicular bisector of a chord passes through the center of the circle and will learn new circle-related vocabulary, such as major and minor arcs. (G-CO.12, G-MG.1, G-C.2)
2. The students will learn about the relationships between inscribed angles and the arcs that they intercept. Students will also learn the difference between arc measure and arc length. (G-CO.12, G-C.2, G-C.5)
3. The students will learn that an angle inscribed in a semicircle measures 90°. Students will also prove that opposite angles in an inscribed quadrilateral are supplementary. Students will develop different methods to find the length of a chord and will use the idea of similar triangles to find the relationships between the lengths created by two intersecting chords. (G-CO.12, G-C.2, G-C.3)
4. The students will learn that a line tangent to a circle is perpendicular to the radius of the circle drawn to the point of tangency. Students will apply their knowledge of tangents, chords, angles, and arcs to solve problems involving circles. (C-CO.12, G-C.2, G-C.3)
5. **The students will consolidate their understanding of the relationships that exist between angles, arcs, chords, and tangents of a circle as they solve application problems.** Students will also learn how to find a circle that circumscribes a triangle. (G-CO.12, G-C.2, G-C.3, G-C.5)
6. The students will begin to develop the concept of conditional probability. They will connect their intuitive understanding of independence with the mathematical definition. Students will compare independent events with mutually exclusive events. Then they will connect independence to the association of two variables. (S-CP.3, S-CP.5, S-CP.6)
7. The students will calculate conditional probabilities from data arranged in relative frequency two-way tables. They will determine if two categorical variables, presented on a two-way table, are associated. (S-CP.3, S-CP.4, S-CP.5, S-CP.6)
8. The students will compare area models to two-way tables as methods for displaying probabilities. In the process, students will learn the Multiplication Rule and an alternate definition for independence in probability situations. Students will apply their knowledge of independence to various situations. (S-CP.2, S-CP.3, S-CP.4, S-CP.5, S-CP.6, S-CP.7)
9. The students will use the Fundamental Principle of Counting to count permutations and other outcomes when there are too many to list. (S-CP.7, S-CP.9(+), S-MD.6(+))
10. The students will identify permutations and will develop two formulas for calculating the number of permutations. (S-CP.9(+), S-MD.6(+))
11. The students will describe the difference between permutations and combinations, learn how counting permutations can be a first step in counting combinations, and develop a method for counting combinations. (S-CP.7, S-CP.9(+))
12. The students will determine counting methods for situations that involve order and repetition, order and no repetition, no order with repetition, and no order without repetition. (S-CP.9(+))
13. The students will solve challenging, multifaceted probability problems using the tools and techniques developed in this chapter. (S-CP.9(+), S-MD.6(+), S-MD.7(+))

**Unit 11 Solids and Circles (12 Days)**

**Description:** In this unit, students will learn how to find the volume and surface area of a pyramid, cone, and sphere. They will also learn about the properties of special polyhedra, called Platonic Solids. Students will find the cross-section of a solid. Finally students will find the measures of angles and arcs that are formed by tangents and secants as well as the relationships between the lengths of segments created when tangents or secants intersect outside a circle.

**Standards**

1. The students will build the five Platonic Solids and will understand why these are the only solids with faces that are congruent, regular polygons. Students will also learn how to describe polyhedra using the number of faces and will learn about dual polyhedra. (G-CO.12)
2. The students will learn how a pyramid is defined and how to name it according to the shape of its base. Students will learn about slant height and finding the total surface area of a pyramid. (G-CO.12, G-GMD.1, G-MG.1)
3. The students will discover that the volume of a pyramid is one-third of the volume of a prism with the same base and height. (G-CO.12, G-GMD.1, G-GMD.3, G-GMD.4, G-MG.1)
4. The students will practice calculating the volume of a pyramid and will learn how to find the volume and surface area of a cone. Students will solve two application problems involving cones. (G-GMD.1, G-GMD.3, G-MG.1)
5. The students will learn how to find the surface area and volume of a sphere. (G-GMD.1, G-GMD.3, G-MG.1)
6. The students will learn what a great circle is and will learn about a spherical coordinate system. They will also learn how to calculate the distance between two locations on the Earth using the measure of the arc between them. (G-MG.1, G-C.5)
7. The students will study the relationships between the measures of the arcs and angles formed when two lines that are tangent to the same circle intersect. (G-MG.1, G-C.2, G-C.4(+))
8. The students will complete their study of circles in this course by finding the relationships between the measures of the angles and arcs intercepted by two intersecting secants or a secant and a tangent that intersect. (G-C.2

**Unit 12 Conics and Closure (10 Days)**

**Description:** In this unit, students will extend their geometric understanding of circles to write algebraic equations for circles. They will also look at the cross-sections of a cone and learn about the geometric properties of parabolas. They will apply their geometric tools in new ways and find new connections between familiar geometric ideas and learn more special properties of familiar shapes.

**Standards**

1. The students will learn how to find the equation of a circle graphed on coordinate axes. (G-GPE.1)
2. The students will complete the square to rewrite the equation of a circle from general form to graphing form. (G-GPE.1)
3. The students will identify the following cross-sections of a cone: point, line, absolute value, parabola, circle, ellipse, and hyperbola. Students will learn the geometric definition of a parabola, and will investigate how the position of the focus and directrix affects the shape and direction of the parabola. (G-GMD.4)
4. The students will use the geometric definition of a parabola to graph various parabolas on focus-directrix paper. Students will derive the equation of a parabola using the geometric definition. Students will also be introduced to the geometric definition of an ellipse. (G-GPE.2, G-CPE.3, G-GMD.4)
5. The students will learn that the quadrilateral formed by joining consecutive midpoints of any quadrilateral is a parallelogram. (G-GPE.4)
6. The students will review their understanding of polyhedra as they conjecture about the relationship of the number of faces, vertices, and edges of a basic polyhedron. (G-MG.3)
7. The students will be introduced to phi (ϕ), the golden ratio, and will study several different contexts where phi arises. During this investigation, students will review similarity, writing and solving quadratic equations, the angles of regular polygons, and the definitions of regular polyhedra. Students will also get a preview of infinite series, which will be a subject for a later math course. (G-MG.3)
8. The students will find the areas of complex regions and will use probability to solve a challenging problem. (G-MG.3, S-MD.7(+))