Geometry A/B

Course Description:
This course provides students with a rigorous and in-depth introduction to Geometry, laying the foundation for upper-level coursework that relies on these concepts while also giving students the skis to describe and measure their world. The course emphasizes the development of analytical thinking skills and the ability to provide proof and justification in logical progression. Students develop and use geometric theorems and formulas for figures on the coordinate plane as well as two- and three-dimensional figures. Students also learn construction skills in order to solidify the conceptual knowledge and have ample opportunities to model real-world examples using the concepts learned throughout the course.

Assignments and Assessments:
Guided Learning Unit – During the spring semester, students will be assigned a Guided Learning Unit that is divided into 4 parts. Each part will be due on specific dates throughout the semester and will be worth 25 points. The project will be worth a total of 100 point and will count as one test grade.

All other units will be completed following this process:

1. Students will attend live and interactive classes or view recorded (At My Pace - AMP) instruction video and participate by answering questions in the live setting or by pausing the AMP instruction video to solve a given problem. Students will have immediate feedback on their current level of comprehension, thus reinforcing learning and providing the opportunity to improve their skills within each lesson.
2. Students will complete one homework assignment before attending or viewing the next instruction session. Students are provided with answers to homework assignments and are expected to self-check their answers. Classes begin with time for students to ask the instructor about homework questions they were not able to complete correctly. Students using AMP recorded instruction can set up time with an instructor, up to 5 hours per course, for individual tutoring.
3. After approximately every two assignments, students complete a quiz (using paper and pencil) that is proctored by an adult and returned to the instructor for grading and feedback. Instructors look at both work and answers to ensure that students are using sound mathematical processes to demonstrate mastery. After each unit, students complete a test in the same manner. The instructor creates an online personal grading notebook for each student where the student's work, the instructor's feedback, and the grade can be viewed. Access to the notebook is granted to the student and parents, as well as any education advisors.
4. At the end of each semester, students complete a cumulative final exam.
5. Course grades are assigned based on a weighted average of 40% quiz / 60% test. The final exam is weighted the same as the other tests.

Unit 1: Statistics and Probability (Guided Learning Unit – spring semester)

Description: Unit 1 will focus on statistical principles such as conditional probability and the rules of probability. Students will understand independence and conditional probability and how to use them to interpret data including describing events as subsets or a sample space (unions, intersections, complements). Differences between independent probability and conditional probability will be explored. Rules of probability will be used to compute probabilities of compound events and be able to interpret the answer in terms of the given data. Finally, students will use probability to evaluate outcomes of decisions, determine fairness and analyze decisions and strategies.

Skills to be demonstrated:

- Understand the independence of two events and how to compute the probability of the two events occurring together as the product of their probabilities.
- Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections or complements of other events.
- Understand when to apply conditional probability and be able to interpret independence of two events.
- Construct two-way frequency tables of data and use the tale as a sample space to decide if events are independent and approximate conditional probabilities.
- Interpret two-way frequency tables of data when two categories are associated with each object being classified.
- Explain the concepts of conditional probability and independence using real-world context.
- Use rules of probability (Addition Rule, Multiplication Rule) to compute probabilities of compound events and interpret the answer in terms of the model provided.
- Use permutations and combinations to compute probabilities of compound events and apply these to real-world scenarios.
- Use probabilities to make fair decisions.
- Using probability concepts, analyze decisions and strategies.

Unit 2: Foundations for Geometry

Description: Unit 2 will focus on building the foundations for the course, learning the definitions and properties that will be used throughout the course as well as transformation. It includes an introduction to construction and transformations of geometric figures. Students will be introduced to the fact that geometry is a mathematical way of processing the same skills learned in Algebra I o the way mathematics is applied to geometric shapes and figures

Skills to be demonstrated:

- Identify the difference between Euclidean and Non-Euclidean Geometry.
- Define points, line segments, planes, angles, and know their properties.
- Construct segments, angles, segment bisectors, angle bisectors.
- Use the definition of congruence to determine lines, angles, and segments to be congruent.
- Use the midpoint formula to locate the coordinates of a midpoint or a missing endpoint and the distance formula to calculate the distance between two points.
- Find the point on a line segment that divides the segment into a given ratio.
- Represent transformations in a plane using reflections, rotations, and translations.
- Describe transformations using words.
- Use the geometric descriptions of transformations to predict the effect on a figure.
- Use translation rules (checking each point in a figure) to decide if two figures are congruent and identify a sequence of transformations that will originate with one figure and result in the transformed figure.
- Describe the rotations and reflections that carry a figure onto itself or another figure.
- Define rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and segments of lines (corresponding angles remain congruent, and parallel and perpendicular lines maintain their relationships from pre-image to image.)

Unit 3: Geometric Reasoning

Description: Unit 3 focuses on both inductive and deductive reasoning, introducing the skill of writing proofs to demonstrate a logical and analytical thinking process that leads to a conclusion. Students will use logical reasoning to communicate and analyze conjectures and statements using a variety of means.

Skills to be demonstrated:

- Use inductive reasoning to identify patterns and make conjectures.
- Find counterexamples to disprove a conjecture.
- Demonstrate logical reasoning using the Law of Detachment and the Law of Syllogism.
- Write inverse, converse, and contrapositive of a conditional statement.
- Write and analyze biconditional statements.
- Begin proofs by identifying the given information and use geometry definitions and properties to prove the given statement.
- Use deductive reasoning to prove geometric theorems using two column, paragraphs and flow charts.

Unit 4: Parallel and Perpendicular Lines

Description: Unit 4 focuses on the relationships between the angles formed between parallel lines cut by a transversal, relationships between angle pairs, constructions, and applying knowledge learned in Algebra to figures and algebraic knowledge to geometric figures to solve for given values of angles.

Skills to be demonstrated:

- Identify parallel, perpendicular, and skew lines.
- Identify angle pairs and their relationships when two parallel lines are cut by a transversal.
- Use angles formed by a transversal to prove that two lines are parallel.
- Prove and use theorems regarding angle pairs to calculate angle measures formed by two parallel lines cut by a transversal, including problems that require using a system of equations.
- Prove lines to be parallel using theorem converses and varying proof formats.
- Prove and apply theorems about perpendicular lines.
- Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.
- Construct parallel line and perpendicular bisectors.

Unit 5: Triangle Congruence

Description: Unit 5 focuses on learning triangle definitions and theorems of congruency. Students will accurately use theorems along with analytical reasoning skills to prove congruency in triangles.

Skills to be demonstrated:

- Classify triangles by their angle measures and side lengths and use classification to find angle measures and side lengths.
- Use appropriate theorems to find the measures of interior and exterior angles of a triangle.
- Prove the Triangle Sum Theorem and apply it to find angle measures.
- Use the definition of congruence to determine triangles to be congruent
- Use the definition of congruence to prove triangles congruent by explaining that corresponding sides and angles are congruent.
- Prove triangle congruence using SSS, SAS, ASA, AAS, HL, and CPCTC postulates.
- Use the properties of isosceles and equilateral triangles in solving missing triangle measure and in completing proofs.

Unit 6: Properties and Attributes of Triangles

Description: Unit 6 focuses on learning properties of triangles of both general form and special forms, constructions, and real-world problmes that can be modeled using these concepts. Students will apply skills of proving theorems and construction to more deeply understand triangle measurements.

Skills to be demonstrated:

- Prove and apply theorems about perpendicular bisectors and angle bisectors including those within a triangle.
- Construct incenters and circumcenters, circles inscribed in a triangle and circumscribed about a triangle.
- Identify and find bisectors, medians, altitudes, and midsegments of triangles, and explain how they relate to the orthocenter, incenter, circumcenter, centroid of a triangle.
- Know that the length of sides and measures of angles are related and the Triangle Inequality Theorem, applying these to solve real-world problems.
- Apply the Pythagorean Theorem to find missing triangle side measures.
- Use Pythagorean inequalities to classify triangles.
- Justify and apply properties of 30-60-90 and 45-45-90 special right triangles.

Unit 7: Polygons and Quadrilaterals

Description: Unit 7 focuses on identifying the properties of polygons and quadrilaterals and the theorems that govern them. Students will both construct polygons and use the properties to calculate measurements and to use modeling to solve real world problems.

Skills to be demonstrated:

- Identify, classify, and describe relationships within the family of quadrilaterals.
- Construct regular polygons that are both equilateral and equiangular by inscribing them in circles.
- Apply the properties of various quadrilaterals to calculate angle measures and side lengths.
- Identify and apply theorems regarding the properties of parallelograms, including rectangles, rhombi, and squares, and use them in problem solving.
- Apply parallelogram theorems to calculate angle measures and segment lengths and to solve proofs.

Unit 8: Similarity
Description: Unit 8 focuses on learning triangle theorems of similarity. Students will accurately use theorems along with analytical reasoning skills to prove similarity in triangles.

Skills to be demonstrated:

- Apply properties and use proportions to solve problems with similar polygons.
- Use AA, SSS, and SAS similarity postulates and theorems to solve for angle measures and side lengths of similar triangles.
- Identify the relationships between side lengths, perimeters, and areas of similar figures, and use similarity, perimeter, and area ratios for similar triangles to calculate perimeters and areas.
- Understand the definition of proportional geometry with respect to dilations and manipulating a figure using scale factor.
- Decide whether two geometric figures are similar, and for triangles, explain the meaning of triangle similarity based on congruent corresponding angles and proportional corresponding side relationships.

Unit 9: Right Triangles and Trigonometry
Description: Unit 9 focuses on developing a more rigorous understanding of right triangles including trigonometric concepts. Students will learn and apply the trigonometric ratios to derive the laws for oblique triangle measurements. Students will model and solve real-world problems using trigonometric properties.

Skills to be demonstrated:

- Recognize similarity in right triangles.
- Use trigonometric ratios and their inverses to solve for missing side lengths or angle measures of right triangles.
- Convert measures of triangles between radians and degrees.
- Evaluate the six trigonometric functions for angles.
- Recognize the relationship between the sine and cosine of complementary angles.
- Model and solve real world problems using trigonometric functions to find unknown measurements such as angles of elevation and depression.
- Derive the Law of Cosines and Law of Sines.
- Derive the formula for the area of an oblique triangle using sine.

Unit 10: Extending Perimeter, Circumference, and Area, and Geometric Probability
Description: Unit 10 focuses on finding the area and perimeter of a polygons and circles, including composite figures. Students will develop and apply the formulas, explore the changes in area and perimeter when dimensions change, and solve real world problems involving geometric probability.

Skills to be demonstrated:

- Prove the Pythagorean Theorem.
- Develop and apply the formulas for the areas of triangles, special quadrilaterals, circles, and regular polygons.
- Use the Area Addition Postulate to find the areas of composite figures.
- Use coordinates to compute perimeter of polygons and area of triangles and rectangles using the distance formula.
- Describe the effect on perimeter and area when one or more dimensions of a figure are changed.
- Use geometric probabilities to predict results in real world situations.

Unit 11: Spatial Reasoning
Description: Unit 11 focuses on learning how to visualize the cross section of three-dimensional figures and the results of rotating two-dimensional figures. Area and volume are calculated and the relationships between the formulas are explored. Students will be challenged to learn and apply formulas by understanding their relationships with other formulas so that comprehension is elevated. Real world applications help students to correlate the shapes described with objects in the physical world.

Skills to be demonstrated:

- Identify the shapes of two-dimensional cross-sections of three-dimensional objects and identify three-dimensional objects generated by rotations of two-dimensional objects.
- Classify three-dimensional figures according to their properties.
- Calculate the surface area and volume of prisms, cylinders, pyramids, cones, and spheres.
- Discover the relationship between the surface area and volume of similar figures and identify their scale factors.
- Solve real world problems based on area and volume models and applying the concept of density including pounds per square inch and people per square mile.

Unit 12: Circles

Description: Unit 12 focuses on the deepening the understanding of the relationships between circles, lines, and angles. Students will derive formulas and apply them for solving real world problems

Skills to demonstrate:

- Identify relationships between arcs and angles formed by secants, tangents, and chords, and use those relationships and theorems for solving angle and arc measures and arc length.
- Prove properties of angles for a quadrilateral inscribed in a circle.
- Use the relationship among inscribed angles, radii, and chords for problem solving.
- Prove that all circles are similar.
- Derive the formulas for and find the arc lengths and areas of sectors of circles.
- Identify the center and radius given the equation of a circle in standard form, and then graph it.
- Determine the equation of a circle in standard form given specific information about a circle.
- Given an equation of a circle that is not in standard form, find the circle's center and radius by using completing the square.