Geometry

Semester A Summary:

In this course, students will learn, practice, and apply skills and strategies that will help them grow into strong mathematical thinkers. The course presents math as a complete subject to be studied, not merely sets of rules and formulas to be followed. Arriving at solutions is important, as are precision and vocabulary, but instruction does not center on procedural math only. Instead, instruction encourages depth of understanding, connections within and outside courses, flexibility of approaches, and usage of various tools. Daily instruction supports student learning of core geometry concepts and development of procedural fluency, beginning with geometry basics: points, lines, and planes; segments, angles, parallel lines, and perpendicular lines; and sides of triangles. The course continues with coverage of constructing regular shapes; transformations; triangle congruence; formal proofs; coordinate geometry; and similarity. Each instructional learning object is aligned to and framed by one of eight Standards for Mathematical Practice. Students are encouraged to use visual representations of their thinking to bridge their understanding between the concrete and abstract, allowing patterns and geometric principles to come to life. In peer model videos throughout the course, the learner's peers demonstrate apply targeted mathematical skills, often using real-world examples. Instruction in 21st century skills further illustrates connections between mathematical concepts and real-world situations to support students' development of the abilities, knowledge, and expertise they need to thrive in today's world. Mathematical discussion prompts encourage students to revise misconceptions, uncover nuances in application, make connections to prior knowledge, identify patterns, and engage with vocabulary. Students are encouraged to share their thinking, justify their own solutions, read critically, and constructively critique the reasoning of others. The course is designed to support a growth mindset regarding math and encourages students to engage in productive struggle; instructional materials implicitly and explicitly remind students that mistakes are opportunities for learning and acquiring new skills. Together the course elements ensure the student grows as a mathematical thinker and develops the tools necessary for success at work and in life.

Semester A Outline

1. **Geometry A Course Overview**
    1. Geometry A Course Overview
2. **Geometry Basics**
    1. Geometry Basics Introduction
    2. Points, Lines, and Planes
        - In this section, you will learn the precise definitions, based on the undefined notions of point, line, distance along a line, and distance around a circular arc for the geometric concepts of angle, circle, perpendicular line, parallel line, and line segment.
        - In this section, you will distinguish among undefined terms, definitions, conjectures, postulates, and theorems.
    3. Constructing Segments

- In this section, you will construct a segment and a copy of a segment.
- In this section, you will construct a bisector of a line segment.

4. Constructing Angles
    - In this section, you will construct an angle and a copy of an angle.
    - In this section, you will construct a bisector of an angle.
5. Constructing Parallel and Perpendicular Lines
    - In this section, you will construct perpendicular lines and a perpendicular bisector.
    - In this section, you will construct parallel lines and a parallel line through a point not on the line.
6. Sides of a Triangle
    - In this section, you will determine if three side lengths will form a triangle.
    - In this section, you will determine the range of lengths of a third side that will make a triangle given the other two side lengths.
7. Ordering Parts of a Triangle
    - In this section, you will use the angle measures of a triangle to order its sides by length.
    - In this section, you will use the side lengths of a triangle to order its angle measures.
8. Regular Polygons
    - In this section, you will find the number of sides of a regular polygon.
    - In this section, you will find the sum of both the interior and exterior angles of a regular polygon.
    - In this section, you will find measures of interior and exterior angles of regular polygons.
9. Geometry Basics Apply
10. Geometry Basics Review
11. Geometry Basics Unit Test

3. **Constructing Regular Shapes Portfolio**
    1. Constructing Regular Shapes Day 1
        - In this lesson, you will construct a square inscribed in a circle.
    2. Constructing Regular Shapes Day 2
        - In this lesson, you will construct a regular hexagon inscribed in a circle.
        - In this lesson, you will construct an equilateral triangle inscribed in a circle.
4. **Transformations**
    1. Transformations Introduction
    2. Translations
        - In this section, you will apply geometric descriptions of rigid motions to translate figures.
        - In this section, you will draw a geometric figure that undergoes a translation in the coordinate plane.
    3. Translations as Functions
        - In this section, you will use a function to translate a figure on a coordinate plane.
        - In this section, you will create a function that describes a given translation on a coordinate plane.
    4. Reflections
        - In this section, you will apply geometric descriptions of rigid motions to reflect figures.
        - In this section, you will draw a geometric figure that undergoes a reflection in the coordinate plane.

5. Reflections as Functions
    - In this section, you will use a function to reflect a figure in the coordinate plane.
    - In this section, you will create a function that describes a given reflection in the coordinate plane.
6. Rotations
    - In this section, you will apply geometric descriptions of rigid motions to rotate figures.
    - In this section, you will draw a geometric figure that undergoes a rotation in the coordinate plane.
7. Rotations as Functions
    - In this section, you will use a function to rotate a figure in the coordinate plane.
    - In this section, you will create a function that describes a given rotation in the coordinate plane.
8. Symmetry
    - In this section, you will summarize the rotations that transform a rectangle, parallelogram, trapezoid, or regular polygon onto itself.
    - In this section, you will summarize the reflections that carry a rectangle, parallelogram, trapezoid, or regular polygon onto itself.
9. Symmetry of Figures
    - In this section, you will draw lines of symmetry for a given figure.
    - In this section, you will determine whether a figure has point symmetry, line symmetry, both, or neither.
10. Comparing Rigid Transformations
    - In this section, you will create definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
    - In this section, you will compare transformations that preserve distance and angle measure to those that do not.
11. Making Predictions with Transformations
    - In this section, you will apply geometric descriptions of rigid motions to predict the effect of a given rigid motion on a given figure.
12. Compositions of Transformations
    - In this section, you will use the definition of congruence as it applies to rigid motions to assess two figures and determine whether they are congruent.
    - In this section, you will identify a sequence of transformations that will carry a given figure onto another.
13. Composition of Transformations Discussion Day 1
14. Composition of Transformations Discussion Day 2
15. Transformations Apply
16. Transformations Review
17. Transformations Unit Test

5. **Triangle Congruence**
    1. Triangle Congruence Introduction
    2. Congruency of Triangles
        - In this section, you will show that two triangles are congruent if and only if their corresponding pairs of sides and corresponding pairs of angles are congruent.
    3. The SSS Congruence Theorem
        - In this section, you will show how rigid transformations can be used to justify

why the SSS criterion for triangle congruence works.
    - In this section, you will use the SSS Congruence Theorem to solve problems.
4. The SAS Congruence Theorem
    - In this section, you will show how rigid transformations can be used to justify why the SAS criterion for triangle congruence works.
    - In this section, you will use the SAS Congruence Theorem to solve problems.
5. The ASA Congruence Theorem
    - In this section, you will show how rigid transformations can be used to justify how the ASA criterion for triangle congruence works.
    - In this section, you will use the ASA Congruence Theorem to solve problems.
6. The AAS Congruence Theorem
    - In this section, you will show how rigid transformations along with the Triangle Angle Sum Theorem can be used to prove the AAS criterion for triangle congruence.
    - In this section, you will use the AAS Congruence Theorem to solve problems.
7. The HL Congruence Theorem
    - In this section, you will show how rigid transformations, along with the Pythagorean Theorem, can be used to justify the HL criterion for triangle congruence.
    - In this section, you will use the HL criterion for triangle congruence to solve problems.
8. Determining Congruence Using Algebra
    - In this section, you will use algebraic methods to prove two triangles are congruent.
9. Triangle Congruence Apply
10. Triangle Congruence Review
11. Triangle Congruence Unit Test

6. **Formal Proofs**
    1. Formal Proofs Introduction
    2. Conditional Statements Discussion Day 1
        - In this section, you will identify the converse, inverse, and contrapositive of a conditional statement.
        - In this section, you will determine the validity of the converse, inverse, and contrapositive of a conditional statement.
    3. Conditional Statements Discussion Day 2
    4. Parallel and Perpendicular Lines
        - In this section, you will derive the formula for the slope of a line in a coordinate plane.
        - In this section, you will prove the slope criteria for parallel lines.
        - In this section, you will prove the slope criteria for perpendicular lines.
    5. Proofs About Angles
        - In this section, you will justify angle pair relationships formed by two parallel lines and a transversal.
        - In this section, you will prove angle pair relationships formed by two parallel lines and a transversal.
        - In this section, you will prove that the points on a perpendicular bisector are equidistant from the endpoints of a segment.
    6. Using Proofs About Angles
        - In this section, you will use the relationships between pairs of angles formed by two parallel lines and a transversal to prove two or more lines are parallel when given angle measurements.

- In this section, you will use the relationships between pairs of angles formed by two parallel lines and a transversal to solve problems.

7. Triangle Proofs
    - In this section, you will prove that the interior angles of a triangle sum to 180°.
    - In this section, you will prove that the exterior angles of a triangle sum to 360°.
    - In this section, you will prove that the base angles of an isosceles triangle are congruent.
8. Parallelogram Proofs
    - In this section, you will prove that opposite sides and angles of a parallelogram are congruent.
    - In this section, you will prove that the diagonals of a parallelogram bisect each other.
9. Converse Parallelogram Proofs
    - In this section, you will prove that a quadrilateral is a parallelogram if its opposite sides and angles are congruent.
    - In this lesson, you will prove that a quadrilateral is a parallelogram if its diagonals bisect each other.
10. Medians of a Triangle
    - In this section, you will prove that the medians of a triangle meet at a point.
11. Rectangle Proofs
    - In this section, you will prove that the diagonals of a rectangle are congruent.
    - In this section, you will prove that a parallelogram is a rectangle if its diagonals are congruent.
12. Properties of Rhombi and Trapezoids
    - In this section, you will use properties of rhombi and trapezoids to solve problems.
13. Formal Proofs Apply
14. Formal Proofs Review
15. Formal Proofs Unit Test

7. **Coordinate Geometry**
    1. Coordinate Geometry Introduction
    2. Distance in the Coordinate Plane
        - In this section, you will use the Pythagorean Theorem to develop the formula for the distance between two points on the coordinate plane.
        - In this section, you will use coordinates to compute the perimeter of polygons.
    3. Area in the Coordinate Plane
        - In this section, you will use coordinates to compute areas of rectangles on a coordinate plane.
        - In this section, you will use coordinates to compute the areas of triangles in a coordinate plane.
    4. The Midpoint Formula
        - In this section, you will derive the formula for finding the midpoint of a line segment in a coordinate plane.
        - In this section, you will calculate the midpoint of a line segment in the coordinate plane.
    5. Coordinate Proofs
        - In this section, you will use coordinates in geometry proofs.

- In this section, you will solve geometric problems by calculating the slope of parallel and perpendicular lines.
- In this section, you will use coordinate methods to prove two triangles are congruent.

6. Coordinate Geometry Apply
7. Coordinate Geometry Review
8. Coordinate Geometry Unit Test

8. **Similarity**
    1. Similarity Introduction
    2. Dilations of Segments
        - In this lesson, you will prove experimentally that a dilation takes a line not passing through the center of the dilation to a parallel line and leaves a line passing through the center unchanged.
        - In this section, you will prove experimentally that the dilation of a line segment is longer or shorter in the ratio given by the scale factor.
    3. Partitioning a Segment
        - In this section, you will calculate the point on a directed line segment between two given points that partitions the segment in a given ratio.
    4. Dilating Figures
        - In this section, you will dilate a figure in the coordinate plane given a magnitude for which the center is the origin.
        - In this section, you will dilate a figure in the coordinate plane using a magnitude and any point as the center of dilation.
    5. Definition of Similar Figures
        - In this section, you will explain using similarity transformations, the meaning of similarity for triangles.
        - In this section, you will compare and contrast dilations with translations, reflections, and rotations.
    6. Similar Figures in the Coordinate Plane
        - In this section, you will assess two figures using the definition of similarity in terms of similarity transformations to decide if they are similar.
        - In this section, you will use coordinate methods to prove two triangles are similar.
        - In this section, you will prove the AA criterion for two triangles to be similar.
    7. Proving Similar Triangles
        - In this section, you will find the missing side lengths of triangles by using congruence and similarity criteria for triangles.
        - In this section, you will prove that a line connecting the midpoints of two sides of a triangle is both parallel to the third side and half its length.
        - In this section, you will calculate answers to problems in geometric figures by using congruence and similarity criteria for triangles.
    8. Triangle Segments Portfolio Day 1
        - In this section, you will prove that a line through two sides of a triangle that is parallel to the third side divides the other two sides proportionally.
    9. Triangle Segments Portfolio Day 2
        - In this section, you will prove that a line that divides two sides of a triangle proportionally is parallel to the third side.
    10. Similar Figures and Perimeter
        - In this section, you will calculate and compare the perimeter of similar two-dimensional shapes.
        - In this section, you will determine how dilating a two-dimensional figure

affects its perimeter.

11. Similar Figures and Area
    - In this section, you will calculate and compare the areas of similar two-dimensional figures.
    - In this section, you will determine the effect of dilation on the area of two-dimensional figures.
    - In this section, you will determine how changing the area of a figure affects one or more dimensions of the figure.
12. Similar Figures and Surface Area
    - In this section, you will calculate and compare surface areas of similar three-dimensional shapes.
    - In this section, you will determine how dilation affects the surface area of a three-dimensional figure.
13. Similar Figures and Volume
    - In this section, you will calculate and compare the volumes of three-dimensional shapes.
    - In this section, you will determine how dilation affects the volume of three-dimensional figures.
    - In this section, you will determine how changing the volume of a figure affects the dimensions of that figure.
14. Altitudes in Right Triangles
    - In this section, you will use similar triangles to prove the Pythagorean Theorem.
    - In this section, you will use the geometric mean to solve problems.
15. Similarity Apply
16. Similarity Review
17. Similarity Unit Test

9. **Geometry A Semester Review and Exam**
    1. Geometry A Semester Review
    2. Geometry A Semester Exam

Semester B Summary:

In this course, students will learn, practice, and apply skills and strategies that will help them grow into strong mathematical thinkers. The course presents math as a complete subject to be studied, not merely sets of rules and formulas to be followed. Arriving at solutions is important, as are precision and vocabulary, but instruction does not center on procedural math only. Instead, instruction encourages depth of understanding, connections within and outside courses, flexibility of approaches, and usage of various tools. Daily instruction supports student learning of core geometry concepts and development of procedural fluency regarding trigonometry, constructing ramps, inverse trigonometry, circles, constructing tangent lines, 2D and 3D shapes, modeling with geometry, and probability. Each instructional learning object is aligned to and framed by one of eight Standards for Mathematical Practice. Students are encouraged to use visual representations of their thinking to bridge their understanding between the concrete and abstract, allowing patterns and geometric principles to come to life. In peer model videos throughout the course, the learner's peers demonstrate apply targeted mathematical skills, often using real-world examples. Instruction in 21st century skills further illustrates connections between mathematical concepts and real-world situations to support students' development of the abilities, knowledge, and expertise they need to thrive in today's world. Mathematical discussion prompts encourage students to revise misconceptions, uncover nuances in

application, make connections to prior knowledge, identify patterns, and engage with vocabulary. Students are encouraged to share their thinking, justify their own solutions, read critically, and constructively critique the reasoning of others. The course is designed to support a growth mindset regarding math and encourages students to engage in productive struggle; instructional materials implicitly and explicitly remind students that mistakes are opportunities for learning and acquiring new skills. Together the course elements ensure the student grows as a mathematical thinker and develops the tools necessary for success at work and in life.

Semester B Outline

1. **Geometry B Course Overview**
    1. Geometry B Course Overview
2. **Trigonometry**
    1. Trigonometry Introduction
    2. Similar Right Triangles
        - In this section, you will use similarity to show that side ratios in right triangles are determined by the angle measures.
    3. The Sine and Cosine Ratios
        - In this section, you will use the sine ratio to solve right triangles in applied problems.
        - In this section, you will use the cosine ratio to solve right triangles in applied problems.
        - In this section, you will use the relationship between the sine and the cosine of complementary angles.
    4. The Tangent Ratio
        - In this section, you will solve for sides and angles of a right triangle by using the tangent ratio.
    5. Special Right Triangles
        - In this section, you will use the relationships in a 30-60-90 right triangle to solve problems.
        - In this section, you will use the relationships in a 45-45-90 right triangle to solve problems.
    6. Area of Triangles
        - In this section, you will derive the formula $A = \frac{1}{2}ab\ sin\ C$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
        - In this section, you will use the formula $A = \frac{1}{2}ab\ sin\ C$ to determine the area of a triangle.
    7. Trigonometry Apply
    8. Trigonometry Review
    9. Trigonometry Unit Test
3. **ADA Ramp Portfolio**
    1. ADA Ramp Portfolio Day 1
        - In this lesson, you will apply geometric and trigonometric principles to design a ramp that meets ADA guidelines.
    2. ADA Ramp Portfolio Day 2
        - In this lesson, you will create a side-view scale drawing of the ramp labeled with lengths and appropriate angle measures.
4. **Inverse Trigonometry**
    1. Inverse Trigonometry Introduction
    2. Pythagorean Triples

- In this section, you will identify Pythagorean triples.
- In this section, you will learn about Pythagorean triples and how to use them to solve problems.

3. Generating Triples Discussion Day 1
4. Generating Triples Discussion Day 2
5. Inverse Sine
    - In this section, you will learn how to use the inverse of the sine ratio to solve applied problems.
6. Inverse Cosine
    - In this section, you will use the inverse of the cosine ratio to solve problems.
7. Inverse Tangent
    - In this section, you will use the inverse of the tangent ratio to solve problems.
8. Solving Right Triangles
    - In this section, you will use trigonometric ratios to solve right triangles in applied situations.
    - In this section, you will use the Pythagorean Theorem to solve right triangles in applied problems.
9. The Law of Sines
    - In this section, you will use the Law of Sines to find unknown measurements in right triangles.
    - In this section, you will use the Law of Sines to find unknown measurements in non-right triangles.
10. The Law of Cosines
    - In this section, you will use the Law of Cosines to find unknown measurements in right triangles.
    - In this section, you will use the Law of Cosines to find unknown measurements in non-right triangles.
11. Inverse Trigonometry Apply
12. Inverse Trigonometry Review
13. Inverse Trigonometry Unit Test

5. **Circles**
    1. Circles Introduction
    2. Segments Inside a Circle
        - In this section, you will identify and use the lengths of radii, diameters, secants, and chords within circles to solve problems.
        - In this section, you will identify and use the relationship between the radius of a circle and a line tangent to that circle at the point where the radius intersects the circle.
    3. Angles Inside a Circle
        - In this section, you will identify and use central angles, inscribed angles, and circumscribed angles.
        - In this section, you will identify and use angle measures formed by intersecting chords, secants, and tangents to solve problems.
        - In this section, you will understand and use the fact that an inscribed angle on a diameter measures 90 degrees.
    4. Circles and Triangles
        - In this section, you will construct the inscribed circle of a triangle.
        - In this section, you will construct the circumscribed circle of a triangle.
    5. Circles and Quadrilaterals
        - In this section, you will prove and apply properties of opposite angles within

a quadrilateral inscribed in a circle.

6. Similar Circles
    - In this section, you will prove that all circles are similar.
7. Trigonometry and Circles
    - In this section, you will describe an informal argument for the formula for the circumference of a circle.
    - In this section, you will describe an informal argument for the formula for the area of a circle.
8. Radian Angle Measure
    - In this section, you will derive the fact that the length of the arc of a circle intercepted by an angle is proportional to the radius of the circle.
    - In this section, you will define the measure of an angle in radians as the ratio of the arc length created by the angle to the circle's radius.
9. Area of a Sector
    - In this section, you will derive the formula for calculating the area of a sector.
    - In this section, you will use a formula to calculate the area of a sector on a circle.
10. Circles Apply
11. Circles Review
12. Circles Unit Test

6. **Construct a Tangent Line Portfolio**
    1. Construct a Tangent Line Portfolio
        - In this lesson, you will construct a tangent line from a point outside a given circle to the circle.
7. **2D and 3D Shapes**
    1. 2D and 3D Shapes Introduction
    2. Equation of a Circle
        - In this section, you will derive the equation of a circle using the Pythagorean Theorem when given a center and a radius.
        - In this section, you will determine the equation of a circle given coordinates of the endpoints of a diameter.
    3. Using Equations of Circles
        - In this section, you will calculate the center and radius of a circle given by an equation by using the method of completing the square.
        - In this section, you will solve problems in the coordinate plane involving equations of circles.
    4. Equation of a Parabola
        - In this section, you will derive the equation of a parabola given a focus and directrix.
        - In this section, you will graph a parabola in the coordinate plane.
    5. Using Equations of Parabolas
        - In this section, you will solve and graph mathematical and real-world problems that are modeled with the equation of a parabola.
        - In this section, you will interpret key features of parabolas that model mathematical and real-world problems.
    6. 2D and 3D Objects
        - In this section, you will identify the shapes of two-dimensional cross sections of three-dimensional objects.
        - In this section, you will identify three-dimensional objects generated by rotations of two-dimensional objects.

7. Volume of a Cylinder
    - In this section, you will describe the formula for the volume of a cylinder.
    - In this section, you will calculate the solution to problems with the volume formula for cylinders.
8. Volume of a Cone
    - In this section, you will describe an informal argument for the formula giving the volume of a cone based on the formula for the volume of a cylinder.
    - In this section, you will calculate solutions to problems that require using the volume formula for a cone.
9. Volume of a Pyramid
    - In this section, you will describe an informal argument for the formula that gives the volume of a pyramid, based on the formula for the volume of a cube.
    - In this section, you will calculate the solution to problems involving the volume of pyramids.
10. Volume of a Sphere
    - In this section, you will calculate the solution to problems using the volume formula for spheres.
11. 2D and 3D Shapes Apply
12. 2D and 3D Shapes Review
13. 2D and 3D Shapes Unit Test

8. **Modeling with Geometry**
    1. Modeling with Geometry Introduction
    2. Area of a Model
        - In this section, you will calculate the area of objects that can be modeled by a shape, or that can be modeled by multiple copies of that shape.
        - In this section, you will calculate the area of objects that can be modeled by composite figures.
    3. Surface Area of a Model
        - In this section, you will calculate the surface area of objects that can be modeled by prisms or cylinders.
        - In this section, you will calculate the surface area of objects that can be modeled by pyramids or cones.
    4. Volume of a Model
        - In this section, you will use the various volume formulas to solve problems involving the volume of composite three-dimensional figures.
    5. Density in Two Dimensions
        - In this section, you will calculate the density of two-dimensional objects.
        - In this section, you will use the density calculations of two-dimensional objects to solve problems.
    6. Density in Three Dimensions
        - In this section, you will calculate the density of three-dimensional objects.
        - In this section, you will use the density calculations of three-dimensional objects to solve problems.
    7. Modeling with Geometry Apply
    8. Modeling with Geometry Review
    9. Modeling with Geometry Unit Test
9. **Geometry B Semester Review and Exam**
    1. Geometry B Semester Review
    2. Geometry B Semester Exam