

Course Description:

Semester B builds and extends the skills students gained in semester A. The course continues to emphasize deductive and indirect reasoning as students write proofs relating to quadrilaterals and conics. This work is scaffolded using interactive videos. Students also apply geometric thinking to real-world problems through geometric transformations, and the algebraic and graphical representation of those transformations. Students endeavor to deepen their understanding of measurement by calculating area, surface area, and volume for a wide range of two- and three-dimensional figures. The semester concludes with an introduction to probability and predicting outcomes. This semester includes six modules, each containing ten lessons.

Module	Lesson Title	Objectives
Module 7: Polygons	Lesson 1: Interior Sum Theorem	<ul style="list-style-type: none"> • Differentiate between convex and concave polygons. • Define interior and exterior angles of a polygon. • Derive the interior angle sum theorem. • Calculate missing angle measures in convex polygons using the interior angle sum theorem.
	Lesson 2: Exterior Sum Theorem	<ul style="list-style-type: none"> • Sketch the exterior angles of a convex polygon. • Derive the exterior angle sum theorem. • Explain the angle sum postulate. • Solve problems using the angle sum postulate and exterior angle sum theorem.
	Lesson 3: Quadrilaterals	<ul style="list-style-type: none"> • Name the properties of quadrilaterals. • Classify quadrilaterals. • Solve problems using the properties of quadrilaterals and angle theorems. • Recognize when quadrilaterals consist of two parallel lines cut by transversals and apply the angle relationships.
	Lesson 4: Rectangle Construction	<ul style="list-style-type: none"> • Establish the properties of a rectangle using the coordinate plane. • Construct a square. • Calculate lengths in a rectangle using the coordinate plane. • Show that a quadrilateral is a square.

Module	Lesson Title	Objectives
	Lesson 5: Rectangle Proofs	<ul style="list-style-type: none"> • Prove the formula for calculating the length of the diagonal of a rectangle. • Prove the diagonals of a rectangle are congruent. • Prove the diagonals of a rectangle bisect each other. • Calculate lengths and angle measures within rectangle using properties and theorems.
	Lesson 6: Parallelograms	<ul style="list-style-type: none"> • Name the properties of parallelograms. • Explain why squares, rectangles, and rhombuses are types of parallelograms. • Solve for missing side and angle measures using the relationships within a parallelogram. • Construct a parallelogram.
	Lesson 7: Parallelogram Proofs	<ul style="list-style-type: none"> • Prove the opposite interior angles in a parallelogram are congruent. • Prove that a parallelogram is a rectangle IFF its diagonals are congruent. • Prove the opposite sides of a parallelogram are congruent. • Prove the consecutive angles in a parallelogram are supplementary.
	Lesson 8: Parallelograms and Rhombuses	<ul style="list-style-type: none"> • Name the properties of a rhombus. • Prove that if a parallelogram has two consecutive sides congruent, it is a rhombus. • Prove that a parallelogram is a rhombus if and only if each diagonal bisects a pair of opposite angles. • Prove that a parallelogram is a rhombus if and only if the diagonals are perpendicular.
	Lesson 9: Trapezoids	<ul style="list-style-type: none"> • Define trapezoid and isosceles trapezoid. • Identify and name the properties of each kind of trapezoid. • Solve for missing side lengths and angle measures using the relationships within a trapezoid.
	Lesson 10: Trapezoid Proofs	<ul style="list-style-type: none"> • Prove the trapezoid midsegment theorem. • Prove that the base angles of an isosceles trapezoid are congruent. • Prove that the opposite angles in an isosceles trapezoid are supplementary. • Prove that the diagonals in an isosceles trapezoid are congruent.

Module	Lesson Title	Objectives
Module 8: Transformations	Lesson 1: Rigid Motion	<ul style="list-style-type: none"> Name the types of transformations. Identify transformations in real life. Examine the transformations that preserve angle measure and length.
	Lesson 2: Translations	<ul style="list-style-type: none"> Identify properties of translations. Translate figures in the coordinate plane. Write a vector to represent a translation.
	Lesson 3: Reflections	<ul style="list-style-type: none"> Name the properties of a reflection. Write the equation of the line of reflection. Reflect figures in the coordinate plane.
	Lesson 4: Rotations	<ul style="list-style-type: none"> Define a rotation. Name the point of rotation. Rotate figures in the coordinate plane.
	Lesson 5: Dilations Defined	<ul style="list-style-type: none"> Define dilation. Calculate the center of dilation. Explain the properties of dilation. Dilate a line segment in the coordinate plane.
	Lesson 6: Dilating Figures	<ul style="list-style-type: none"> Calculate the scale factor. Dilate a figure in the coordinate plane. Solve problems involving dilation.
	Lesson 7: Composition	<ul style="list-style-type: none"> Name the transformations needed to carry a preimage to its image. Sketch an image by applying a series of transformations to a preimage. Perform a glide reflection.
	Lesson 8: Transformations & Congruency	<ul style="list-style-type: none"> Connect transformation to congruency. Show that translations, reflections, and rotations, and their compositions, are isometries. Show that a dilation is not an isometry.
	Lesson 9: Tessellations	<ul style="list-style-type: none"> Name the properties of a tessellation. Connect tessellations to transformations. Prove congruency in tessellation shapes.

Module	Lesson Title	Objectives
		<ul style="list-style-type: none"> Calculate the missing lengths of shapes in a tessellation using properties.
	Lesson 10: Frieze Patterns	<ul style="list-style-type: none"> Name the properties of a frieze pattern. Identify the type of symmetry in a frieze pattern. Describe how to create a frieze pattern. Identify which symmetry operation was used to create a frieze pattern.
Module 9: Circles	Lesson 1: The Parts of a Circle	<ul style="list-style-type: none"> Name the properties of a frieze pattern. Identify the type of symmetry in a frieze pattern. Describe how to create a frieze pattern. Identify which symmetry operation was used to create a frieze pattern.
	Lesson 2: Circumference and Area	<ul style="list-style-type: none"> Explore the relationship between circumference and diameter of a circle. Derive the formula for the area of a circle. Extrapolate the formula for the circumference of a circle. Solve problems involving the circumference and area of a circle.
	Lesson 3: Arcs and Sectors	<ul style="list-style-type: none"> Define and identify arcs, major arcs, minor arcs, central angles, semi-circles, and sectors. Explain the relationship between an arc and a chord. Differentiate between minor sectors and major sectors. Solve problems using the arc addition postulate.
	Lesson 4: Arc Lengths	<ul style="list-style-type: none"> Derive, using similarity, that the length of the arc intercepted by an angle is proportional to the radius. Calculate circumference of a circle and length of a circular arc. Convert angle measurements between degree and radian measure. Explain how the radius of a circle is related to its radian measure.
	Lesson 5: Tangent Lines	<ul style="list-style-type: none"> Identify the tangent of a circle and the point of tangency. Construct a tangent line. Explain the properties and theorems of tangent lines. Solve problems using the properties and theorems of tangent lines.

Module	Lesson Title	Objectives
	Lesson 6: Inscribing	<ul style="list-style-type: none"> Construct an inscribed equilateral triangle, square, and a regular hexagon. Prove the inscribed quadrilateral theorem. Identify and describe properties of inscribed angles and figures. Solve problems involving angles and quadrilaterals inscribed in a circle.
	Lesson 7: Circumscribing	<ul style="list-style-type: none"> Define terms related to circumscribed figures and angles. Differentiate between inscribed and circumscribed figures. Construct a circle circumscribed by a triangle and a circle circumscribed by a square. Solve mathematical problems involving circumscribed angles and figures.
	Lesson 8: Parabolas and Circles	<ul style="list-style-type: none"> Identify the parts of a parabola. Connect the parabola to a circle. Derive the equation of a parabola. Identify pertinent information about a parabola from its conic equation.
	Lesson 9: The Equation of a Circle	<ul style="list-style-type: none"> Derive the equation of a circle using the Pythagorean theorem. Calculate the length of a radius in the coordinate plane using the distance formula. Identify the center and radius of a circle from its equation. Write the equation of a circle in standard form.
	Lesson 10: Graphing Circles	<ul style="list-style-type: none"> Sketch the graph of a circle on the coordinate plane using its equation. Determine the equation of a line that is tangent to a circle at a given point. Prove all circles are similar. Determine if a given point is on a circle.
Module 10: Area and Surface Area	Lesson 1: Perimeter of Polygons	<ul style="list-style-type: none"> Calculate the perimeter various polygons. Calculate missing side lengths of a shape when given the total perimeter. Calculate the perimeter of a polygon using its area.
	Lesson 2: Area of Polygons	<ul style="list-style-type: none"> Calculate the area of a polygon in the coordinate plane. Calculate the area of a regular polygon by decomposing it into triangles. Calculate the area of a regular polygon using the perimeter and apothem. Determine the viability of solutions.

Module	Lesson Title	Objectives
	Lesson 3: Sectors and Segments	<ul style="list-style-type: none"> • Write an equation to determine the area of a sector. • Calculate the area of a sector. • Define a segment of a circle. • Calculate the area of a segment.
	Lesson 4: Composite Figures	<ul style="list-style-type: none"> • Partition composite figures into their base shapes. • Estimate the area of a composite figure. • Calculate the area of a composite figure. • Calculate density using area.
	Lesson 5: Maximizing Area	<ul style="list-style-type: none"> • Determine the optimal side lengths of a polygon whose perimeter is fixed to maximize its area. • Calculate the maximum area of a polygon when the perimeter is fixed. • Connect perimeter, area, and the number of sides a polygon has.
	Lesson 6: Discovering Solids	<ul style="list-style-type: none"> • Define and classify solids. • Identify faces, vertices, and edges of solids. • Verify that Euler's geometry formula is true for a given solid. • Solve problems using Euler's theorem.
	Lesson 7: Cubes & Spheres	<ul style="list-style-type: none"> • Name the mathematical properties of a cube and a sphere. • Derive the formula for the surface area of a cube and a sphere. • Calculate the surface area of a cube and a sphere.
	Lesson 8: Pyramids & Cones	<ul style="list-style-type: none"> • Identify the properties of pyramids and cones. • Derive the formula for the surface area of a cone. • Determine the formula for the surface area of a pyramid. • Calculate the surface area of a pyramid and a cone.
	Lesson 9: Cylinders & Prisms	<ul style="list-style-type: none"> • Name the properties of right prisms and right cylinders. • Identify the types of prisms. • Derive the formula for the surface area of a right prism and a right cylinder. • Calculate the surface area of a cylinder and a prism.

Module	Lesson Title	Objectives
	Lesson 10: Measurement Relationships	<ul style="list-style-type: none"> Describe the effect on the area when one or more dimensions of a figure are changed proportionally or non-proportionally. Calculate the total surface area of a composite shape. Calculate lateral surface area.
Module 11: Volume	Lesson 1: Introduction to Volume	<ul style="list-style-type: none"> Describe the effect on the area when one or more dimensions of a figure are changed proportionally or non-proportionally. Calculate the total surface area of a composite shape. Calculate lateral surface area.
	Lesson 2: Volume of a Cube	<ul style="list-style-type: none"> Derive the volume of a cube formula. Calculate the volume of a cube using different strategies. Identify the cross-section of a cube.
	Lesson 3: Volume of Prisms	<ul style="list-style-type: none"> Identify different types of prisms. Determine the formula for the volume of a prism. Calculate the volume of a prism. Identify the cross-section of a prism.
	Lesson 4: Rectangular Prism Volume	<ul style="list-style-type: none"> Distinguish between right rectangular prisms and oblique rectangular prisms. Calculate the volume of a right rectangular prism and an oblique rectangular prism. Calculate the volume of a composite solid. Analyze real world scenarios by comparing the volume of rectangular prisms.
	Lesson 5: Volume of Cylinders	<ul style="list-style-type: none"> Derive the formula for the volume of a cylinder. Identify the cross-sections of a cylinder and how they are used. Calculate the volume of a right cylinder and an oblique cylinder. Explain how the volume of a right cylinder compares to the volume of an oblique cylinder.
	Lesson 6: Volume of Spheres	<ul style="list-style-type: none"> Derive the formula for the volume of a sphere. Define and identify spheres, hemispheres, and great circles. Calculate the volume of a sphere. Identify the cross-section of a sphere and the three-dimensional object created by rotating the cross-section.

Module	Lesson Title	Objectives
	Lesson 7: Volume of Cones	<ul style="list-style-type: none"> • Explain the formula for the volume of a cone. • Identify the cross-section of a cone and the three-dimensional object created by rotating the cross-section. • Calculate the volume of a cone and a conical frustum.
	Lesson 8: Volume of Pyramids	<ul style="list-style-type: none"> • Explore the formula for the volume of a pyramid. • Identify the cross-section of a pyramid and the three-dimensional object created by rotating the cross-section. • Calculate the volume of a right pyramid and a truncated pyramid.
	Lesson 9: Changing Dimensions	<ul style="list-style-type: none"> • Describe how proportional changes in dimension affect volume. • Describe how non-proportional changes in dimension affect volume. • Scale the dimensions of an object. • Calculate the volume of a scaled object.
	Lesson 10: Comparisons	<ul style="list-style-type: none"> • Calculate the volume of a composite figure. • Compare the volumes of different shapes to make decisions. • Compare goods using volume per unit.
Module 12: Probability	Lesson 1: Probability Concepts	<ul style="list-style-type: none"> • Calculate the volume of a composite figure. • Compare the volumes of different shapes to make decisions. • Compare goods using volume per unit.
	Lesson 2: Area Models	<ul style="list-style-type: none"> • Define biased events, area model, mutually exclusive events, "and" probability and "or" probability. • Calculate the probability of biased events. • Construct an area model. • Calculate outcomes using an area model.
	Lesson 3: Independent Events	<ul style="list-style-type: none"> • Differentiate between dependent and independent events. • Calculate the probability of independent events. • Show that events are independent using the multiplication rule for independent events.

Module	Lesson Title	Objectives
	Lesson 4: Add and Subtract Rules	<ul style="list-style-type: none"> Name the outcomes in an intersection, union, and complement. Create a Venn diagram to represent a scenario. Explain the addition and subtraction rules. Calculate probability using addition and subtraction rules, along with a Venn diagram.
	Lesson 5: Conditional Probability	<ul style="list-style-type: none"> Define and identify conditional probability scenarios. Apply the conditional probability formula. Calculate conditional probability of independent and dependent events and interpret the outcome.
	Lesson 6: Two-Way Tables	<ul style="list-style-type: none"> Construct a two-way relative frequency table. Interpret a two-way table, including classifying events as independent or dependent. Calculate probability using a two-way table.
	Lesson 7: Fundamental Counting Rule	<ul style="list-style-type: none"> Define the fundamental counting rule. Calculate the total number of outcomes using the fundamental counting rule. Explain how a sample size affects probability.
	Lesson 8: Permutations	<ul style="list-style-type: none"> Identify permutations in which repetition is allowed and where repetition is not allowed. Develop formulas for calculating the number of permutations. Calculate the number of permutations for a given scenario using the appropriate formula.
	Lesson 9: Combinations	<ul style="list-style-type: none"> Differentiate between permutations and combinations. Derive the formulas for combinations with and without repetition. Identify combinations where repetition is allowed and where it is not allowed. Calculate the number of combinations for a given scenario.
	Lesson 10: Decisions & Analysis	<ul style="list-style-type: none"> Make fair decisions using probability. Apply the rules of probability to make the best decision in a scenario. Analyze decision-making using probability.