

GEOMETRY, SEMESTER B

COURSE OVERVIEW AND GOALS

Geometry builds upon students' command of geometric relationships and formulating mathematical arguments. Students learn through discovery and application, developing the skills they need to break down complex challenges and demonstrate their knowledge in new situations.

Course topics include reasoning, proofs, and the creation of sound mathematical arguments; points, lines, and angles; triangles and trigonometry; quadrilaterals and other polygons; circles; congruence, similarity, transformations, and constructions; coordinate geometry; three-dimensional solids; and applications of probability.

This course supports all students as they develop computational fluency and deepen conceptual understanding. Students begin each lesson by discovering new concepts through guided instruction, and then confirm their understanding in an interactive, feedback-rich environment. Modeling activities equip students with tools for analyzing a variety of real-world scenarios and mathematical ideas. Journaling activities allow students to reason abstractly and quantitatively, construct arguments, critique reasoning, and communicate precisely. Performance tasks prepare students to synthesize their knowledge in novel, real-world scenarios and require that they make sense of multifaceted problems and persevere in solving them.

This course is built to state standards.

There are no required or optional materials.

By the end of this course, you will be able to do the following:

- ❖ Find distances between points, slopes of lines, and midpoints of line segments.
- ❖ Apply geometric concepts to solve real-world and mathematical problems.
- ❖ Derive the equation of a circle or parabola on the coordinate plane.
- ❖ Graph and interpret key features of circles and parabolas on a coordinate plane.
- ❖ Perform congruence and similarity transformations on and off the coordinate plane.
- ❖ Calculate and compare the surface area and volume of a three-dimensional solid.

- ❖ Calculate probabilities and apply probability concepts to establish independence and make decisions.

COURSE COMPONENTS AND GRADING RUBRIC

The table gives a breakdown of the weight for each component in the course. Weight represents the percentage of the total score coming from each activity.

Course Components	Count	Weight
Pretest. <i>A pretest is an optional assessment, typically designed for credit recovery. If a student shows mastery of a lesson objective, the student may be automatically exempted from the upcoming activities associated with the mastered objective. Each passing pretest grade is entered into the gradebook.</i>	5	0%
Practice. <i>A practice activity provides instruction similar to that found in a study so that students can practice or review skills necessary to complete their assignment with mastery.</i>	5	5%
Journal. <i>A journal is a short reflective writing exercise that encourages students to connect historical events and ideas to their own lives and circumstances.</i>	5	5%
Project. <i>A project is a hands-on investigation that extends over several weeks.</i>	1	5%
Mastery Test. <i>A mastery test is a computer-scored lesson-level summative assessment.</i>	33	45%
Posttest. <i>A posttest appears at the end of each unit.</i>	5	15%
End-Of-Semester Test. <i>An end-of-semester test (EOS) appears at the end of each course.</i>	1	10%
Teacher-Graded Posttest. <i>A posttest that prompts students for written responses appears at the end of each unit.</i>	5	15%
Total	60	100%

**Teachers may manually adjust these weights if desired, per district grading requirements.*

UNIT 1: COORDINATE GEOMETRY

In this unit, you will apply concepts related to coordinate geometry to solve problems on a coordinate plane.

Lesson and Duration	Activities	Objectives
Midpoint Formula 1 hour, 25 minutes	<i>Overview: Midpoint Formula</i> <i>Study: Midpoint Formula</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Midpoint Formula</i>	- Define the midpoint of a segment. - Find the midpoints of horizontal and vertical segments by taking the average of the segments' endpoints. - Derive the midpoint formula. - Apply the midpoint formula to diagonal segments.
The Distance Formula 1 hour, 55 minutes	<i>Overview: The Distance Formula</i> <i>Study: The Distance Formula</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: The Distance Formula</i> <i>Journal: The Distance Formula</i>	- Recognize the relationship between the distance formula and the Pythagorean theorem. - Calculate the distance between two points using the distance formula. - Apply the distance formula to solve real-world problems.
Patterns and Lines 1 hour, 25 minutes	<i>Overview: Patterns and Lines</i> <i>Study: Patterns and Lines</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Patterns and Lines</i>	- Plot data in an xy-plane, draw a line of best fit, and make predictions about a real-world problem. - Define <i>linear equation</i>. - Write the linear equation of a line when given two data points on the line. - Determine the properties of a line when given a positive or negative coefficient of x.

Lesson and Duration	Activities	Objectives
Slope 1 hour, 55 minutes	<i>Overview: Slope</i> <i>Study: Slope</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Slope</i> <i>Practice: Modeling: The Rescue Ship</i>	- Define <i>slope</i>, <i>rise</i>, and <i>run</i>. - Determine the steepness and direction of lines with positive, negative, zero, or undefined slopes. - Derive the slope formula. - Determine whether the slope of a line is positive, negative, zero, or undefined. - Determine the slope of a line when given the linear equation of the line.
Equations of Lines 1 hour, 25 minutes	<i>Overview: Equations of Lines</i> <i>Study: Equations of Lines</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Equations of Lines</i>	- Identify the correct graph of a line when given its equation in slope-intercept form or point-slope form. - Determine the slope or y-intercept of a line when given its equation in slope-intercept form. - Write the slope-intercept equation of a line when given the slope and the y-intercept. - Write the point-slope equation of a line when given the slope and one point (not the intercept) on the line. - Determine the slope of a line when given its equation in point-slope form.
Equations of Parallel and Perpendicular Lines and Proofs 1 hour, 25 minutes	<i>Overview: Equations of Parallel and Perpendicular Lines and Proofs</i> <i>Study: Equations of Parallel and Perpendicular Lines and Proofs</i>	- Identify the relationship between the slopes of parallel and perpendicular lines. - Determine that the product of the slopes of two perpendicular lines is always -1.

Lesson and Duration	Activities	Objectives
	<i>Checkup: Practice Problems</i> <i>Mastery Test: Equations of Parallel and Perpendicular Lines and Proofs</i>	- Prove the slope criteria for parallel and perpendicular lines. - Determine the slope of a line when given the slope of a line parallel or perpendicular to it. - Determine the slope of a line, using the equation of a line parallel or perpendicular to a given line that passes through a given point.
Coordinate Geometry with Polygons 1 hour, 25 minutes	<i>Overview: Coordinate Geometry with Polygons</i> <i>Study: Coordinate Geometry with Polygons</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Coordinate Geometry with Polygons</i>	- Determine the geometric relationships of polygons on a coordinate plane using slopes. - Apply congruence transformations to verify properties of polygons on a coordinate plane. - Predict the locations of congruent figures on a coordinate plane using transformation techniques.
Area of a Triangle with Coordinate Geometry 1 hour, 25 minutes	<i>Overview: Area of a Triangle with Coordinate Geometry</i> <i>Study: Area of a Triangle with Coordinate Geometry</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Area of a Triangle with Coordinate Geometry</i>	- Derive the area formula of a triangle from the area formula of a rectangle. - Calculate the areas of right, obtuse, and acute triangles. - Compute the areas of triangles using coordinates. - Derive the formula $A = \frac{1}{2}bh$ for the area of a triangle by drawing an auxiliary line from the vertex, perpendicular to the opposite side.
Area and Perimeter of Polygons with	<i>Overview: Area and Perimeter of Polygons with Coordinate Geometry</i>	- Find the perimeter of any polygon. - Define <i>apothem</i>.

Lesson and Duration	Activities	Objectives
Coordinate Geometry 1 hour, 25 minutes	<i>Study: Area and Perimeter of Polygons with Coordinate Geometry</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Area and Perimeter of Polygons with Coordinate Geometry</i> <i>Checkup: Coordinate Geometry</i>	- Derive and apply the formula for the area of a regular polygon. - Determine the area of an irregular polygon by breaking it into quadrilaterals and regular polygons. - Compute perimeters of polygons using coordinates. - Compute areas of rectangles using coordinates.
Wrap-Up: Coordinate Geometry 1 hour, 40 minutes	<i>Review: Coordinate Geometry</i> <i>Posttest: Coordinate Geometry</i> <i>Teacher-Graded Posttest: Coordinate Geometry</i>	- Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 2: CONIC SECTIONS

In this unit, you will analyze conic sections and determine the equation of a circle on a coordinate plane.

Lesson and Duration	Activities	Objectives
From Lines to Conic Sections 1 hour, 25 minutes	<i>Overview: From Lines to Conic Sections</i> <i>Study: From Lines to Conic Sections</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: From Lines to Conic Sections</i>	- Define the general form of the slope-intercept equation of a line. - Recognize how the graph of a line changes when the slope or y-intercept is changed. - Determine and compare the steepness of lines when given the slope-intercept equations of the lines. - Identify the vertex, nappes, and edge of a right circular cone.

Lesson and Duration	Activities	Objectives
		- Define conic section. - Identify and/or illustrate how a conic section is formed with the use of a scanner. - Identify the three shapes that are formed when the plane and cone intersect at the vertex.
Geometry of Conic Sections 1 hour, 25 minutes	<i>Overview: Geometry of Conic Sections</i> <i>Study: Geometry of Conic Sections</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Geometry of Conic Sections</i>	- Construct and define a circle — define and label its radius and center. - Construct and define an ellipse — define and label its foci and axes. - Determine the relationships among an ellipse's foci, axes, and points. - Define and label a hyperbola's foci, transverse axes, and asymptotes. - Determine the relationships among a hyperbola's foci, transverse axes, asymptotes, and points. - Define and label a parabola's focus and directrix. - Determine the relationships among a parabola's focus, vertex, directrix, and points. - Apply geometric known relationships to circles, ellipses, hyperbolas, and parabolas.

Lesson and Duration	Activities	Objectives
Circles with Coordinates and Proofs 1 hour, 55 minutes	<i>Overview: Circles with Coordinates and Proofs</i> <i>Study: Circles with Coordinates and Proofs</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Circles with Coordinates and Proofs</i> <i>Journal: Point on a Circle</i>	- Derive and apply the standard-form equation of a circle centered at the origin. - Determine the location of a circle's center when given its equation. - Write the equation of a circle not centered at the origin. - Manipulate circles in the xy-plane and understand how the equations are affected.
Parabolas 1 hour, 25 minutes	<i>Overview: Parabolas</i> <i>Study: Parabolas</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Parabolas</i>	- Solve problems based on the relationships between the coefficients of the x- and y-terms in the equation of a parabola and the direction that the parabola opens. - Identify the standard equations for parabolas that open up, down, right, or left and have their vertex anywhere in the xy-plane. - Convert parabolic equations from standard to simplified form and vice versa. - Determine an equation that could represent a parabola when given the direction that the parabola opens and the coordinates of its vertex. - Determine the coefficient of the squared expression in the equation of a parabola when given all necessary information about the parabola.

Lesson and Duration	Activities	Objectives
Locus of Points 1 hour, 30 minutes	<i>Overview: Locus of Points</i> <i>Study: Locus of Points</i> <i>Mastery Test: Locus of Points</i> <i>Practice: Modeling: Wildlife Sanctuary</i> <i>Checkup: Conic Sections</i>	- Define directrix and focus. - Define the circle, line, angle bisector, and parabola as a "locus of points."
Wrap-Up: Conic Sections 1 hour, 40 minutes	<i>Review: Conic Sections</i> <i>Posttest: Conic Sections</i> <i>Teacher-Graded Posttest: Conic Sections</i>	- Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 3: CONSTRUCTIONS AND TRANSFORMATIONS

In this unit, you will create and evaluate geometric constructions and their various transformations using a set of established tools.

Lesson and Duration	Activities	Objectives
Constructions 1 hour, 30 minutes	<i>Overview: Constructions</i> <i>Study: Constructions</i> <i>Mastery Test: Constructions</i> <i>Practice: Modeling: Constructing a Square</i>	- Identify the five basic postulates of Euclidean geometry. - Create an equilateral triangle using only a straightedge and a compass. - Construct a hexagon triangle using only a straightedge and a compass. - Bisect an angle using only a straightedge and a compass.

Lesson and Duration	Activities	Objectives
		Determine the properties of a perpendicular bisector and draw one using only a straightedge and a compass.
Paper Folding 1 hour	<i>Overview: Paper Folding</i> <i>Study: Paper Folding</i> <i>Mastery Test: Paper Folding</i>	- Apply the paper-folding technique to find the midpoint of a segment. - Find a perpendicular line segment using the paper-folding technique. - Bisect an angle using the paper-folding technique. - Apply the paper-folding technique to draw parallel lines through a given point. - List three techniques used in geometric constructions with paper folding.
Impossible Problems from Antiquity 1 hour	<i>Overview: Impossible Problems from Antiquity</i> <i>Study: Impossible Problems from Antiquity</i> <i>Mastery Test: Impossible Problems from Antiquity</i>	- Examine two constructions that the Greeks never accomplished with only a straightedge and a compass. - Identify the angles that can be trisected with only a compass and a straightedge. - Recognize how attempts to solve the impossible problems from antiquity led to new innovations in mathematics. - Identify the most famous impossible problem from Greek antiquity.
Transformations 1 hour, 30 minutes	<i>Overview: Transformations</i> <i>Study: Transformations</i>	Define <i>reflection</i>, <i>rotation</i>, and <i>translation</i> as rigid motions that preserve the congruence of an image and a preimage.

Lesson and Duration	Activities	Objectives
	<i>Mastery Test: Transformations</i> <i>Journal: Transformations</i>	- Specify a sequence of transformations that will map a given figure onto another. - Predict the results of applying a sequence of transformations to a figure. - Apply series of transformations to move figures onto themselves.
Symmetry 1 hour	<i>Overview: Symmetry</i> <i>Study: Symmetry</i> <i>Mastery Test: Symmetry</i>	- Define <i>reflectional symmetry</i> and the <i>line of symmetry</i>. - Identify the lines of symmetry of regular polygons. - Define <i>rotational symmetry</i> and <i>point of symmetry</i>. - Identify the symmetric properties of a polygon.
Tessellations 1 hour	<i>Overview: Tessellations</i> <i>Study: Tessellations</i> <i>Mastery Test: Tessellations</i> <i>Checkup: Constructions and Transformations</i>	- Examine tessellated mosaics from ancient buildings, fabric designs, and fine art. - Define tessellation, semi-regular tessellation, and regular tessellation. - Translate and rotate polygons to make regular and semi-regular tessellation patterns. - Identify the polygons that can make a regular tessellation.
Wrap-Up: Constructions and Transformations 1 hour, 40 minutes	<i>Review: Constructions and Transformations</i> <i>Posttest: Constructions and Transformations</i>	- Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment.

Lesson and Duration	Activities	Objectives
	<i>Teacher-Graded Posttest: Constructions and Transformations</i>	Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 4: THREE-DIMENSIONAL SOLIDS

In this unit, you will calculate the surface areas and volumes of three-dimensional solids. You will use ratios to compare similar solids.

Lesson and Duration	Activities	Objectives
Three Dimensions 1 hour	<i>Overview: Three Dimensions</i> <i>Study: Three Dimensions</i> <i>Mastery Test: Three Dimensions</i>	- Determine the number of dimensions that a given geometric object has. - Determine how lower-dimensional objects are used to build larger-dimensional objects. - Identify the measurements used when measuring one-, two-, and three-dimensional geometric objects. - Identify the axes in the Cartesian coordinate system used to describe three-dimensional space.
What Is a Polyhedron? 1 hour	<i>Overview: What Is a Polyhedron?</i> <i>Study: What Is a Polyhedron?</i> <i>Mastery Test: What Is a Polyhedron?</i>	- Define polyhedron and identify its parts. - Define pyramid and prism. - Classify polyhedrons by their bases. - Determine the number of faces or surfaces that a given three-dimensional object has. - Determine the shape and size of cross sections of a polyhedron.

Lesson and Duration	Activities	Objectives
		Define the altitude of a three-dimensional object.
Cylinders and Cones 1 hour	<i>Overview: Cylinders and Cones</i> <i>Study: Cylinders and Cones</i> <i>Mastery Test: Cylinders and Cones</i>	- Define cylinder and cone. - Classify non-polyhedral solids with circular bases as cylinders and cones. - Determine the shape and size of cross sections of a non-polyhedral solid.
Platonic Solids 1 hour, 30 minutes	<i>Overview: Platonic Solids</i> <i>Study: Platonic Solids</i> <i>Mastery Test: Platonic Solids</i> <i>Practice: Modeling: Solids</i>	- Identify the names and properties of the five Platonic solids. - Determine the three types of polygons that can be faces of a Platonic solid. - Identify each Platonic solid when given the number or shape of its faces.
Surface Area 1 hour, 25 minutes	<i>Overview: Surface Area</i> <i>Study: Surface Area</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Surface Area</i>	- Identify the properties of a regular pyramid, including the location of the vertex. - Define surface area, lateral area, and base area. - Define slant-height. - Derive and apply the general surface area formula for a right prism and a regular pyramid with a square base. - Derive and apply the general surface area formula for a right cone and a right cylinder.

Lesson and Duration	Activities	Objectives
Volume 1 hour, 55 minutes	<i>Overview: Volume</i> <i>Study: Volume</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Volume</i> <i>Journal: Volume</i>	- Define volume. - Derive and apply the general volume formula for a prism, a cylinder, a cone, and a pyramid. - Identify Cavalieri's principle.
Spheres 1 hour, 25 minutes	<i>Overview: Spheres</i> <i>Study: Spheres</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Spheres</i>	- Identify the general formulas for the surface area and volume of a sphere with radius r. - Calculate the surface area and volume of the sphere when given its radius of axis.
Similar Solids 1 hour, 25 minutes	<i>Overview: Similar Solids</i> <i>Study: Similar Solids</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Similar Solids</i>	- Define translate and dilate as they apply to solids. - Determine the relationship between similar solids. - Identify the ratio of similar solids' surface areas, given the ratio of their edge lengths. - Determine the ratio of similar solids' volumes, given the ratio of their edge lengths. - Create the ratio of two similar spheres' volumes, given the ratio of their radii.
Performance Task: Three-Dimensional Solids 2 hours, 40 minutes	<i>Overview: Performance Task: Three-Dimensional Solids</i> <i>Study: Geodesic Domes</i> <i>Project: Performance Task: The Subway Stop</i>	- Apply your knowledge, skills, and resources to make sense of problems. - Solve problems using perseverance. - Apply precise mathematical vocabulary to communicate your thinking and solutions.

Lesson and Duration	Activities	Objectives
	<i>Checkup: Three-Dimensional Solids</i>	
Wrap-Up: Three-Dimensional Solids <i>1 hour, 40 minutes</i>	<i>Review: Three-Dimensional Solids</i> <i>Posttest: Three-Dimensional Solids</i> <i>Teacher-Graded Posttest: Three-Dimensional Solids</i>	- Review key ideas presented in the unit. - Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment. - Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

UNIT 5: APPLICATIONS OF PROBABILITY

In this unit, you will calculate probabilities in a range of practical scenarios. You will also examine the use of permutations and combinations to identify the likelihood of a compound event.

Lesson and Duration	Activities	Objectives
Probability <i>1 hour, 25 minutes</i>	<i>Overview: Probability</i> <i>Study: Probability</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Probability</i>	- List the outcomes in a sample space and in an event. - List the outcomes in the union, intersection, or complement of events. - Calculate the probability of an event using the sample space. - Find the probabilities of complements, unions, and intersections of events. - Find geometric probabilities using area. - Determine whether a decision is fair based on probability.

Lesson and Duration	Activities	Objectives
Probability of Independent and Dependent Events 1 hour, 55 minutes	<i>Overview: Probability of Independent and Dependent Events</i> <i>Study: Probability of Independent and Dependent Events</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Probability of Independent and Dependent Events</i> <i>Journal: Probability of Independent and Dependent Events</i>	- Find the probability of the union of two events. - Define <i>mutually exclusive events</i>. - Interpret the probabilities of the union and intersection of two events in terms of the model. - Recognize independent and dependent events in everyday language. - Determine whether two events are independent using probabilities. - Determine $P(A \text{ and } B)$, given two events that are independent.
Conditional Probability 1 hour, 25 minutes	<i>Overview: Conditional Probability</i> <i>Study: Conditional Probability</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Conditional Probability</i>	- Identify a conditional probability stated in everyday language. - Recognize the meaning of a conditional probability. - Determine $P(A B)$, given a Venn diagram. - Interpret a conditional probability using a Venn diagram. - Apply the formula $P(A B) = P(A \text{ and } B) / P(B)$ to find a conditional probability. - Find $P(A B)$, given that A and B are independent events and given $P(A)$ and $P(B)$. - Determine whether two events are independent using conditional probability. - Find the probability of the intersection of two events using conditional probability.

Lesson and Duration	Activities	Objectives
Two-Way Frequency Tables 1 hour, 55 minutes	<i>Overview: Two-Way Frequency Tables</i> <i>Study: Two-Way Frequency Tables</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Two-Way Frequency Tables</i> <i>Practice: Two-Way Frequency Tables</i>	• Create and interpret a two-way frequency table given data. • Find the marginal frequencies for a two-way frequency table. • Find the probability of the intersection of two events using a two-way frequency table. • Determine whether events are independent using a two-way frequency table. • Approximate conditional probabilities using a two-way frequency table. • Apply probability to analyze decisions.
Permutations and Combinations 1 hour, 25 minutes	<i>Overview: Permutations and Combinations</i> <i>Study: Permutations and Combinations</i> <i>Checkup: Practice Problems</i> <i>Mastery Test: Permutations and Combinations</i> <i>Checkup: Applications of Probability</i>	• Simplify a factorial expression. • Recognize the multiplication rule. • Find the number of permutations in a given situation. • Find the number of combinations in a given situation. • Identify a situation as involving a combination or a permutation. • Find probabilities to solve problems involving permutations or combinations.
Wrap-Up: Applications of Probability 1 hour, 40 minutes	<i>Review: Applications of Probability</i> <i>Posttest: Applications of Probability</i> <i>Teacher-Graded Posttest: Applications of Probability</i>	• Review key ideas presented in the unit. • Demonstrate mastery of concepts and skills from the unit by completing a computer-scored assessment.

Lesson and Duration	Activities	Objectives
		Demonstrate mastery of concepts and skills from the unit by completing a teacher-scored assessment.

SEMESTER WRAP-UP

In this unit, you will review the concepts and skills presented in the course and take a semester exam.

Lesson and Duration	Activities	Objectives
Semester Wrap-Up 1 hour, 20 minutes	<i>Review: Semester Exam</i> <i>End-of-Semester Test: Semester Exam</i>	- Review key ideas presented in the semester. - Demonstrate mastery of concepts and skills from the semester by completing a computer-scored assessment