Geometry Unit 1: Reasoning in Geometry

Lesson	Learning Targets
1.1 Creating Definitions	• Understand the process of writing a good definition requires classifying, differentiating and testing the definition by looking for counterexamples. • Define basic geometric terms by looking at examples and nonexamples.
1.2 Inductive Reasoning	• Define inductive reasoning as the process of making conjectures based on patterns and examples. • Apply inductive reasoning to find a general rule for a given pattern or sequence.
1.3 Conditional Statements	• Identify the condition and conclusion of a conditional statement. • Write the converse of a conditional statement and determine if it is true.
1.4 What is Deductive Reasoning?	• Justify a claim using informal arguments. • Define deductive reasoning as the process of proving a claim with a sequence of logical statements.
1.5 Using Deductive Reasoning	• Disprove a claim using counterexamples. • Understand the difference between supporting a claim with examples and proving a claim.
1.6 Visual Reasoning	• Use visuals to justify algebraic, numeric, and geometric results.

Geometry Unit 2: Building Blocks of Geometry

Lesson	Learning Targets
2.1 Points, Lines, Segments, and Rays	• Use precise terminology and notation to refer to points, segments, lines, and rays. • Define congruent segments as segments with equal lengths and solve for missing segment lengths. • Draw and mark geometric figures.
2.2 Coordinate Connection: Midpoint	• Understand that a midpoint divides a segment into two congruent parts and is equidistant from both endpoints. • Given two endpoints, find the coordinates of the midpoint and given an endpoint and a midpoint, find the coordinates of the other endpoint.
2.3 Naming and Classifying Angles	• Define, name, and measure angles accurately and precisely. • Determine angle measurements by attending to congruence markings, angle addition, and angle bisectors.
2.4 Vertical Angles and Linear Pairs	• Discover and apply vertical angle and linear pair relationships.
2.5 Angles on Parallel Lines	• Identify corresponding, same side interior, alternate interior, and alternate exterior angles on a transversal. • Discover and apply the properties of the angles formed by a transversal cutting parallel lines. • Use congruent angles on a transversal to write informal proofs about parallel lines.
2.6 Coordinate Connection: Parallel vs. Perpendicular	• Graph equations of lines. • Write equations of lines in slope-intercept form. • Use the coordinate grid to reason about parallel and perpendicular slopes.

Geometry Unit 3: Congruence Transformations

Lesson	Learning Targets
3.1 Introduction to Transformations	• Identify the motions made by translations, reflections, and rotations. • Visualize the sequence of "moves" required to take a preimage to its image. • Informally describe the set of transformations that take a preimage to its image and understand that this sequence is not unique.
3.2 Translations	• Understand that translations are rigid motions that move each point some fixed horizontal and vertical distance. • Write a translation rule. • Give the ordered pairs of the image after a translation.
3.3 Reflections	• Identify patterns in ordered pairs when a figure is reflected across the x-axis, y-axis, or the line y=x. • Perform reflections using patty paper and ordered pair rules. • Recognize that a point and its image after a reflection are equidistant from the line of reflection.
3.4 Rotations	• Identify patterns in ordered pairs when a figure is rotated 90˚, 180˚, or 270˚ counterclockwise. • Perform and describe rotations in the coordinate plane.
3.5 Compositions of Transformations	• Perform 2 or more transformations in sequence on the coordinate plane. • Determine the sequence of transformations that takes a preimage to its image. • Explore the outcomes of changing the sequence in which transformations are performed.
3.6 Definition of Congruence	• Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. • Identify corresponding sides and angles in congruent figures and write congruence statements. • Distinguish between transformations that are isometries and those that aren't.

3.7 Coordinate Connection: Transformations of Equations	• Understand that rigid transformations can be applied to algebraic equations and their graphs, which represent a particular set of ordered pairs. • Connect graphical and algebraic representations of reflections and translations. • Given an equation, determine the transformation that occurred.

Geometry Unit 4: Triangles and Proof

Lesson	Learning Targets
4.1 What Makes a Triangle?	• Determine when three side lengths will form a triangle. • Classify triangles by angles and sides.
4.2 Triangle Properties	• Explain why the sum of the angles in a triangle is always 180°. • Notice a relationship between the exterior angle of a triangle and the sum of the non-adjacent interior angles. • Solve for missing angles in triangles.
4.3 Proving the Exterior Angle Conjecture	• Generalize an argument for the exterior angle conjecture. • Introduce the structure of a flow-chart proof.
4.4 Angle Side Relationships in Triangles	• Determine the relationship between the location of the largest sides and largest angles in a triangle. • Discover properties of isosceles and equilateral triangles.
4.5 Right Triangles & Pythagorean Theorem	• Understand that the Pythagorean Theorem gives the relationship between the areas of the squares made from the sides of a right triangle. • Solve for missing sides in a right triangle. • Determine if a triangle is right, acute, or obtuse based on its side lengths.
4.6 Coordinate Connection: Distance	• Connect distance in the coordinate plane with finding the length of the hypotenuse of a right triangle.
4.7 Establishing Congruent Parts in Triangles	• Know that two triangles are congruent if they have exactly the same three sides and exactly the same three angles. • Given two congruent triangles, find missing sides and angles in either triangle using CPCTC. • Apply triangle properties and definitions to establish congruent parts (e.g. bisector, midpoint, Pythagorean theorem, triangle angle sum, vertical angles, etc.).

4.8 Triangle Congruence Shortcuts	• Understand that when given three sides of a triangle or two sides and an included angle, only one unique triangle can be made, thus establishing congruence. • Determine if two triangles are congruent using the SSS and SAS criteria. • Notice that triangle congruence proofs require identifying, organizing, and justifying the congruent parts of two triangles.
4.9 More Triangle Congruence Shortcuts	• Understand that triangles with the same angles have the same shape and that similar triangles with a scale factor of 1 are congruent. • Determine if two triangles are congruent using the ASA and AAS criteria. • Notice that triangle congruence proofs require identifying, organizing, and justifying the congruent parts of two triangles.
4.10 Triangle Congruence Proofs	• Understand the sequence of a proof as starting with the givens and concluding with the proof statement. • Identify the statements and reasons needed to complete a logical argument. • Use the flowchart structure to write proofs.

Geometry Unit 5: Quadrilaterals and Other Polygons

Lesson	Learning Targets
5.1 Quadrilateral Hierarchy	• Explain how quadrilaterals can belong to one or more subgroups based on their attributes. • Review definitions of quadrilaterals, parallelograms, rectangles, squares, rhombi, kites, and trapezoids. • Distinguish between convex and concave polygons.
5.2 Proving Parallelogram Properties	• Use congruent triangles and angles on a transversal to prove properties about parallelograms.
5.3 Properties of Special Parallelograms	• Use congruent triangles to prove properties about the diagonals of rectangles, rhombi, and squares.
5.4 Coordinate Connection: Quadrilaterals on the Plane	• Use slope and distance on the coordinate plane to classify quadrilaterals given by ordered pairs.
5.5 Areas of Quadrilaterals	• Use the properties of special quadrilaterals to decompose shapes into rectangles and find their area. • Connect the dimensions of the original shape to the base and height of a rectangle to generate an area formula for parallelograms, trapezoids, and rhombi.
5.6 Polygon Interior and Exterior Angle Sums	• Generalize a formula for finding the interior angle sum of any polygon by decomposing the shape into triangles. • Given the number of sides of a polygon, determine the angle sum and solve for missing angles; given the angle sum, solve for the number of sides of a polygon. • Explain why the exterior angle sum of any polygon is always 360°.
5.7 Regular Polygons and their Areas	• Solve for side lengths and apothems using properties of regular polygons. • Decompose regular polygons into congruent triangles in order to find their areas.

Geometry Unit 6: Similarity

Lesson	Learning Targets
6.1 Dilations, Scale Factor, and Similarity	• Understand that dilations produce similar figures where ratios of sides within and between figures are preserved. • Use proportional reasoning to solve for missing sides of similar figures; given similar figures, determine the scale factor.
6.2 Coordinate Connection: Dilations on the Plane	• Understand that dilations produce similar figures where the ratio of corresponding parts is given by the scale factor. • Explore the properties of dilations given by a center and a scale factor and use them to explain why similar figures have proportional sides and congruent corresponding angles.
6.3 Proving Similar Figures	• Determine if two figures are similar by describing the sequence of similarity transformations that carry the first figure to the second. • Determine if two triangles are similar by verifying that all corresponding angles are congruent and all corresponding sides are proportional.
6.4 Triangle Similarity Shortcuts	• Establish AA, SSS, and SAS similarity criteria. • Use similarity criteria to solve problems and prove relationships in geometric figures.
6.5 Proportional Segments between Parallel Lines	• Use similar triangles to identify and solve for proportional segments between parallel lines.
6.6 Area and Perimeter of Similar Figures	• Explain why sides and perimeter of similar figures grow by the scale factor and area grows by the square of the scale factor. • Use relationships between perimeter and area of similar figures to solve for missing sides and areas.

Geometry Unit 7: Special Right Triangles & Trigonometry

Lesson	Learning Targets
7.1 45°, 45°, 90° Triangles	• Discover a relationship between the legs and hypotenuse of a 45°, 45°, 90° triangle and use this to solve for missing sides. • Simplify radicals.
7.2 30°, 60°, 90° Triangles	• Discover the relationship between the legs and hypotenuse of a 30°, 60°, 90° triangle and use this to solve for missing sides.
7.3 Trigonometric Ratios	• Understand that the sine, cosine, and tangent give specific ratios of sides in a right triangle in reference to one of the acute angles. • Interpret values of the sine, cosine, and tangent. • Write sine, cosine, and tangent ratios for both acute angles in a right triangle.
7.4 Using Trig Ratios to Solve for Missing Sides	• Use a calculator to find sine, cosine, and tangent ratios for a given right triangle and interpret these ratios. • Given an angle and side in a right triangle, choose a trig ratio and use proportional reasoning to solve for a missing side.
7.5 Inverse Trig Ratios	• Understand that the ratios of sides in a right triangle determine the angles. • Solve for missing angles in a right triangle using inverse trig ratios.
7.6 Applications of Trigonometry	• Use trig ratios and the Pythagorean Theorem to solve right triangles in applied problems. • Interpret statements about heights, distances, and angles of elevation and depression.

Geometry Unit 8: Circles

Lesson	Learning Targets
8.1 Coordinate Connection: Equation of a Circle	• Understand a circle as the set of all points that are exactly one radius away from a given center. • Use the Pythagorean Theorem to write the equation of a circle given the center and radius; identify the center and radius of a circle given the equation • Determine if an ordered pair is inside, on, or outside a circle.
8.2 Circle Vocabulary	• Define the terms major arc, minor arc, chord, tangent line, radius, and diameter. • Identify the measure of an arc as the measure of its corresponding central angle.
8.3 Tangents to Circles	• Identify that a tangent line to a circle is perpendicular to the radius at the point of tangency and explore related properties. • Solve problems involving tangents to circles.
8.4 Chords and Arcs	• Understand that congruent chords are equidistant from the center and imply congruent intercepted arcs and congruent central angles. • Solve problems using chord and arc properties.
8.5 Perpendicular Bisectors of Chords	• Explore why the perpendicular bisector of a chord must pass through the center of the circle, and why a diameter perpendicular to the chord must bisect the chord. • Solve problems using perpendicular bisectors of chords.
8.6 Inscribed Angles and Quadrilaterals	• Describe and apply the relationship between an inscribed angle and the arc it intercepts. • Explain why the angle inscribed in a diameter is a right angle. • Prove using inscribed angles why opposite angles in an inscribed quadrilateral are supplementary.

8.7 Area and Circumference of a Circle	• Generate formulas for the circumference and area of a circle. • Given the radius, diameter, circumference, or area of a circle, solve for a different measurement of the circle.
8.8 Area of a Sector	• Define sectors as slices of circles that contain a fraction of the total area. • Understand that the area of a sector is proportional to the central angle and use this to calculate area.
8.9 Arc Length	• Define arc length as distance around a circle that makes up a fraction of the circumference. • Understand that arc length is proportional to the central angle and use this to calculate arc length.

Geometry Unit 9: Surface Area and Volume

Lesson	Learning Targets
9.1 Introducing Volume with Prisms and Cylinders	• Make sense of nontraditional and traditional units of volume for describing the space inside a container. • Understand the volume formulas of prisms and cylinders as representing stacked layers of the base shape. • Solve problems related to the volumes of prisms and cylinders.
9.2 Surface Area and Volume of Prisms and Cylinders	• Explore how changing the dimensions of cylinders and prisms affects their volumes. • Connect the dimensions of a cylinder and prism to the measurements on a net of the solid and use this to calculate surface area.
9.3 Volume of Pyramids and Cones	• Explain the relationship between the volume of a cone and cylinder, and pyramid and prism and use this to solve volume problems.
9.4 Surface Area of Pyramids and Cones	• Connect the dimensions of a cone and pyramid to the measurements on a net of the solid. • Find the lateral and surface area of cones and pyramids.
9.5 Volume of Spheres	• Consider how changes in the radius of a sphere affect its volume. • Use the volume formula of a sphere to solve problems.
9.6 Surface Area of Spheres	• Understand the relationship between the formulas for area, surface area, and volume in relation to spheres. • Use the surface area formula of a sphere to solve problems.
9.7 Problem Solving with Volume	• Use mathematical tools to solve a problem related to surface area and volume for which there is no immediately obvious strategy. • Understand that problem solving requires making and evaluating assumptions, choosing and justifying a strategy, and assessing the reasonableness of an answer.
9.8 Volume of Similar Solids	• Understand how scaling the side lengths of a solid affect the surface area and volume. • Determine dimensions and volumes of similar solids.

Geometry Unit 10: Statistics

Lesson	Learning Targets
10.1 Categorical Data and Displays	• Identify categorical and quantitative variables. • Organize data in frequency and relative frequency tables. • Interpret bar charts and pie charts.
10.2 Measures of Center for Quantitative Data	• Calculate a mean and median from a set of values and from a graph of a distribution. • Understand the effects of outliers on a mean or median.
10.3 Measures of Spread for Quantitative Data	• Calculate and interpret range and standard deviation from a data set. • Use the graph of a set of data to make conclusions about standard deviation. • Understand the effect of outliers on range and standard deviation.
10.4 Scatterplots and Line of Best Fit	• Identify explanatory and response variables. • Create and describe a scatterplot for two-variable data. • Interpret the slope and y-intercept of a line of best fit.
10.5 Predictions and Residuals	• Use a line of best fit to make predictions. • Calculate and interpret a residual using linear models.
10.6 Models for Nonlinear Data	• Describe non-linear models. • Calculate and interpret a residual using non-linear models.
10.7 Probability Models and Rules	• Understand that probabilities describe the results of a long run. • Use proper notation to describe the probability of an event. • Learn and apply basic rules of probability.
10.8 Probability using Two-Way Tables	• Decide if two events are mutually exclusive. • Apply the general addition rule for any two events: P(A or B) = P(A) + P(B) – P(A and B). • Use two-way tables to find probabilities, including conditional probabilities.

10.9 Probability using Tree Diagrams	• Decide if two events are independent. • Apply the general multiplication rule for any two events: P(A or B) = P(A) × P(B|A). • Use tree diagrams to find the probability of more than one event occurring.
10.10 Random Sampling	• Understand the difference between a population and a sample. • Understand that estimates based on random samples will display sampling variability. • Describe the population to which results can be generalized based on the sampling method utilized.
10.11 Margin of Error	• Understand and interpret, but do not calculate, margin of error. • Construct a confidence interval when given an estimate and a margin of error. • Understand that a larger sample size leads to a smaller margin of error.
10.12 Observational Studies and Experiments	• Understand the difference between an observational study and an experiment. • Understand how random assignment accounts for confounding variables, so we can find evidence for a causal relationship. • Understand the difference between correlation and causation.
10.13 Random Sample and Random Assignment	• Understand that a random sample allows the results of a study to be generalized to a larger population. • Understand that random assignment in an experiment is needed to show causation.