

## Foundations of Geometry Learning Targets

The following is what a student in Foundations of Geometry should know and be able to do by the end of each semester. It is broken up by unit of study and also includes what portion of the textbook, *Geometry (Prentice Hall)*, is used in each unit. Since mathematics is cumulative in nature, many learning targets are expected to be used not only in the unit where they are introduced, but throughout the course. This list is published as a courtesy to all interested learners, and is not intended for use outside of this specific course.

### **First Semester:**

#### **A. Tools of Geometry (Chapter 1)**

1. Recognize patterns and use inductive reasoning to make conjectures.
2. Represent three-dimensional figures with isometric and orthographic drawings.
3. Draw nets for three-dimensional figures and recognize three-dimensional figures from nets.
4. Understand basic terms and postulates about points, segments, rays, lines, and planes.
5. Name angles correctly so that they can be located without confusion.
6. Measure and classify angles.
7. Identify special angle pairs (complementary, supplementary, and vertical).
8. Compare segment lengths or angle measures to determine if congruent, to locate a segment midpoint, or to identify an angle bisector.
9. Use the segment or angle addition postulates to write and solve a linear equation (part plus part equals whole).
10. Use congruence of segments or angles to write and solve a linear equation (part equals part).
11. Draw conclusions from a diagram based on appearance, markings, or postulates.
12. Construct congruent segments and angles or bisect segments and angles using a compass and straightedge.
13. Calculate the distance between two points on the coordinate plane using the distance formula.
14. Find the midpoint of a segment on the coordinate plane using the midpoint formula.
15. Find the perimeters and areas of rectangles and squares, and the circumference and area of circles.

#### **B. Parallel and Perpendicular Lines (Section 2-5, Chapter 3)**

1. Prove and apply theorems about congruent angles (vertical angles, congruent complements, and congruent supplements).
2. Identify angles formed by two lines and a transversal.
3. Recognize and use congruent or supplementary angles formed by parallel lines and a transversal.
4. Plan and write a two-column proof in a logical order that contains statements that can be justified.
5. Use angle relationships to prove that lines are parallel.
6. Relate parallel and perpendicular lines (two coplanar lines perpendicular to the same line are parallel, for example).
7. Use parallel lines to explain why the sum of the angles of a triangle is  $180^\circ$ .
8. Classify a triangle according to its sides and its angles.
9. Relate an exterior angle of a triangle to its remote interior angles.
10. Name and classify polygons.
11. Find the sums of the measures of the interior and exterior angles of a polygon. Use the sum to find a missing angle measure.
12. Find the measures of interior and exterior angles of regular polygons.
13. Write the equation of a line or graph a line given its equation.
14. Relate slope and parallel or perpendicular lines.
15. Construct parallel or perpendicular lines using a compass and straightedge.

**C. Congruent Triangles (Chapter 4)**

1. Recognize congruent figures and their corresponding parts.
2. Prove triangles congruent using SSS, SAS, ASA, and AAS postulates.
3. Investigate AAA and SSA situations and understand why they do not guarantee congruent triangles.
4. Use congruent triangles and CPCTC to prove that other parts of two triangles are congruent.
5. Apply properties of isosceles and equilateral triangles.
6. Prove right triangles congruent using HL.
7. Identify congruent overlapping triangles.

**D. Relationships Within Triangles (Chapter 5, omit section 5-4)**

1. Use properties of midsegments to identify parallel segments or to find segment lengths.
2. Recognize the relationships between perpendicular bisectors, angle bisectors, and equidistance.
3. Draw medians and altitudes of triangles and use their properties to solve problems.
4. Recognize that the relative sizes of sides and angles of a triangle are related (the longer side is opposite the larger angle, for example).
5. Understand that in order to form a triangle, the sum of the lengths of any two sides must be larger than the third side.

**E. Quadrilaterals (Chapter 6, sections 6-6 and 6-7 only if time permits)**

1. Define and classify special types of quadrilaterals.
2. Know and use the properties of a parallelogram's sides, angles, and diagonals.
3. Determine whether a quadrilateral is a parallelogram.
4. Use properties of the diagonals of rectangles and rhombuses to solve problems.
5. Verify and use properties of trapezoids and kites.
6. Position a figure on the coordinate plane and specify its vertices using general coordinates. (optional)
7. Perform proofs using coordinate geometry. (optional)

**Second Semester:****F. Similarity (Chapter 7)**

1. Use ratios and proportion to solve real-life problems (map distance, for example).
2. Recognize that similar polygons have the same shape but different sizes. Use corresponding sides and angles of similar polygons to solve problems.
3. Prove that triangles are similar using AA, SAS, or SSS.
4. Write and solve proportions based on the side-splitter theorem.
5. Write and solve proportions based on the triangle-angle-bisector theorem.

**G. Right Triangles and Trigonometry (Chapter 8)**

1. Use the Pythagorean Theorem to find a missing side of a right triangle.
2. Determine whether a triangle is a right triangle using the converse of the Pythagorean Theorem.
3. Identify and use the side relationships in special right triangles ( $30^\circ$ - $60^\circ$ - $90^\circ$  and  $45^\circ$ - $45^\circ$ - $90^\circ$ ).
4. Establish tangent, sine, and cosine ratios in right triangles and use them to solve problems.
5. Identify the angle of elevation or angle of depression in a diagram and use them to solve problems.
6. Resolve a vector into its components (horizontal and vertical).
7. Find the magnitude of a vector.
8. Use the sum of vectors to solve real-life problems.

**H. Transformations (Chapter 9)**

1. Create translation images of figures by mapping all points of a figure the same distance in the same direction.
2. Create reflection images of figures and identify the line of reflection.
3. Draw and identify rotation images of figures.
4. Identify symmetry in a figure (reflectional, rotational).
5. Use similar figures to create dilation images. Find or use a scale factor.
6. Use compositions of reflections and glide reflections.
7. Create a tessellation.

**I. Area (Chapter 10, omit sections 10-4 and 10-8)**

1. Know that height is perpendicular distance.
2. Find the area of a parallelogram or a triangle (half of a parallelogram).
3. Find the area of a trapezoid using a formula or by separating it into other shapes (rectangle, triangle).
4. Find the area of a kite or rhombus using a formula or by separating it into right triangles.
5. Find the area of regular polygons using the apothem and perimeter formula.
6. Use trigonometry to find the area of regular polygons or triangles.
7. Calculate arc length as a fraction of the circle's circumference and sector area as a fraction of the circle's area.

**J. Surface Area and Volume (Chapter 11, omit sections 11-1 and 11-7)**

1. Describe what is measured by surface area vs. volume.
2. Find the surface area of a prism or cylinder. Know that the lateral area is the product of the perimeter or circumference and height.
3. Find the surface area of a pyramid or cone.
4. Find the volume of a prism or a cylinder by multiplying its base area and height.
5. Know that the volume of a pyramid or cone is one third of the product of the base area and height.
6. Use formulas to find the surface area and volume of a sphere.

**K. Circles (Chapter 12, omit section 12-6, section 12-5 only if time permits)**

1. Draw a line tangent to a circle. Recognize that the tangent line creates a right angle with the radius at the point of contact.
2. Know that two tangents drawn to a circle from one point are congruent.
3. Make the connection between congruent chords, arcs and central angles.
4. Relate the measure of an inscribed or tangent-chord angle to half of the intercepted arc.
5. Find the measures of angles formed by chords, secants, and tangents and understand how those measures relate to the intercepted arcs.
6. Write the equation of a circle and use the equation to find the center and radius. (optional)