

### **Experiment with transformations in the plane:**

**G.CO.A.1** Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, plane, distance along a line, and distance around a circular arc.

Learning objectives:

- I can determine defined terms.
- I can determine undefined terms.
- I can define/identify
  - Angles,
  - Circles,
  - Perpendicular lines,
  - Parallel lines, and
  - Line segments

**G.CO.A.2** Represent transformations in the plane in multiple ways, including technology. Describe transformations as functions that take points in the plane (pre-image) as inputs and give other points (image) as outputs. Compare transformations that preserve distance and angle measure to those that do not (e.g., translation versus horizontal stretch).

Learning objectives:

- I can find the values for functions.
- I can use coordinate rules.
- I can determine if transformations are isometric.
- I can use coordinate rules and determine if the image is isometric.
- I can use the properties of isometric transformations.
- I can recognize and understand notations for isometric transformations.

**G.CO.A.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry the shape onto itself.

Learning objectives:

- I can determine the transformations that have been performed on a figure.
  - Composite
  - Non-composite
- I can identify the
  - line of reflection for reflection with reflective symmetry,
  - center of rotation for rotations, and
  - the order of rotation.

**G.CO.A.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

Learning objectives:

I can determine the transformations that preserve

- angles,
- circles,
- perpendicular lines,
- parallel lines, and
- line segments.

**G.CO.A.5** Given a geometric figure and a rigid motion, draw the image of the figure in multiple ways, including technology. Specify a sequence of rigid motions that will carry a given figure onto another.

Learning objectives:

- I can draw translations with
  - tracing paper,
  - shifting paper, and
  - technology.
- I can draw rotations with
  - tracing paper,
  - rotating paper, and
  - technology.
- I can draw reflections with
  - tracing paper,
  - folding paper, and
  - technology.

**Understand congruence in terms of rigid motions.**

**G.CO.B.6** Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to determine informally if they are congruent.

Learning objectives:

- I can determine if there is a single transformation or composite (series of) transformation that maps one figure onto another.
- I can determine congruence by rigid motion transformations.

**G.CO.B.7** Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

Learning objectives:

- I can use triangle congruence theorems and postulates.
- I can write congruent statements based on corresponding sides and angles.

**G.CO.B.8** Explain how the criteria for triangle congruence (ASA, SAS, AAS, and SSS) follow from the definition of congruence in terms of rigid motions.

Learning objectives:

- I can use the Angle Side Angle (ASA) Postulate to test for triangle congruence.
- I can use the Side Angle Side (SAS) Postulate to test for triangle congruence.
- I can use the Angle Angle Side (AAS) Theorem to test for Triangle congruence.
- I can use the Side Side Side (SSS) Postulate to test for triangle congruence.

### **Prove geometric theorems.**

**G.CO.C.9** Prove theorems about lines and angles.

Learning objectives:

- I can prove basic theorems of angles such as:
  - vertical angles are congruent;
  - when a transversal crosses parallel lines,
    - alternate interior angles are congruent;
    - corresponding angles are congruent; and
    - same-side interior are supplementary;
  - points on a perpendicular bisector of a line segment are equidistant from the segments endpoints.

**G.CO.C.10** Prove theorems about triangles.

Learning objectives:

- I can apply the Triangle Sum Theorem.
- I can apply the Exterior Angle Sum Theorem.
- I can use properties of Isosceles Triangles.
- I can use properties of Equilateral Triangles.
- I can solve problems using the Side Splitting Theorem.
- I can identify the centroid of a triangle by using the medians.

**G.CO.C.11** Prove theorems about parallelograms.

Learning objectives:

- I can use the properties of parallelograms.
- I can use the properties of rectangles.
- I can use the properties of squares.
- I can use the properties of rhombi.
- I can use the properties of kites.
- I can use the properties of trapezoid.

**Make geometric constructions.**

**G.CO.D.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

Learning objectives:

- I can construct
  - copying a segment;
  - copying an angle;
  - bisecting a segment;
  - bisecting an angle;
  - perpendicular lines, including:
    - perpendicular bisector of a line segment;
    - constructing a line parallel to a given line through a point on the line; and
  - the following objects
    - inscribed in a circle:
      - an equilateral triangle
      - square, and
      - regular hexagon.

**Understand similarity in terms of similarity transformations.**

**G.SRT.A.1** Verify informally the properties of dilations given by a center and a scale factor.

Learning objectives:

- I can distinguish between a dilation and a stretch.
- I can determine if a dilation is a reduction or enlargement.
- I can draw dilations that are enlargements.
- I can draw dilations that are reductions.
- I can draw dilations of figures with the center of dilation in different locations.
- I can determine centers of dilations and scale factors.
- I can determine scale factors for scale drawings.
- I can construct dilations of lines.

**G.SRT.A.2** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

Learning objectives:

- I can solve problems using proportions of similar polygons.

**G.SRT.A.3** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Learning objectives:

- I can prove the AA criteria to determine similarity.

**Prove theorems involving similarity.**

**G.SRT.B.4** Prove theorems about similar triangles.

Learning objectives:

- I can determine side and angle measures from ratios.
- I can determine if figures are similar.
- I can make and use similarity statements.
- I can find missing measures for similar triangles.
- I can use ratios to find missing side measures.

**G.SRT.B.5** Use congruence and similarity criteria for triangles to solve problems and to justify relationships in geometric figures. Learning objectives:

Learning objectives:

- I can use word problems to solve indirect measures.
- I can solve word problems involving similar triangles.

**Define trigonometric ratios and solve problems involving triangles.**

**G.SRT.C.6** Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

Learning objectives:

- I can use properties of  $45^\circ$ - $45^\circ$ - $90^\circ$  triangles.
- I can use properties of  $30^\circ$ - $60^\circ$ - $90^\circ$  triangles.
- I can find trigonometric ratios using right triangles.

**G.SRT.C.7** Explain and use the relationship between the sine and cosine of complementary angles.

Learning objectives:

- I can find where sine and cosine are equal.

**G.SRT.C.8** Solve triangles. ★

a. Know and use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

b. Know and use the Law of Sines and Law of Cosines to solve problems in real life situations. Recognize when it is appropriate to use each.

Learning objectives:

- I can use trigonometric ratios to find angle measures in right triangles.
- I can find angles of elevations.
- I can find angles of depression.

### **Understand and apply theorems about circles.**

**G.C.A.1** Recognize that all circles are similar.

Learning objectives:

- I can recognize that all circles are similar.

**G.C.A.2** Identify and describe relationships among inscribed angles, radii, and chords.

Learning objectives:

- I can find the measures of inscribed angles.
- I can find the measures of central angles of circles.
- I can use the relationship of arcs, chords, and diameters of circles.

**G.C.A.3** Construct the incenter and circumcenter of a triangle and use their properties to solve problems in context.

Learning objectives:

- I can construct the
  - incenter
  - circumcenter
- I can use properties of incenters and circumcenters to solve contextual problems.

### **Find areas of sectors of circles.**

**G.C.B.4** Know the formula and find the area of a sector of a circle in a real-world context.

Learning objectives:

- I can use arcs and semi circles and find their measures.
- I can find the area of a sector.

### **Translate between the geometric description and the equation for a circle.**

**G.GPE.A.1** Know and write the equation of a circle of given center and radius using the Pythagorean Theorem.

Learning objectives:

- I can identify the center and radius of any given circle from the equation.
- I can write the equation of a circle given its radius and center.

### **Use coordinates to prove simple geometric theorems algebraically.**

**G.GPE.B.2** Use coordinates to prove simple centered at the origin and containing geometric theorems algebraically.

Learning objectives:

- I can prove that a set of coordinate points define a;
  - circle (on inside, or outside of the circle)
  - square
  - rectangle
  - rhombus
  - parallelogram
  - triangle (equilateral, isosceles, etc.)

**G.GPE.B.3** Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.

Learning objectives:

- I can find the equation of a line parallel to a given line that goes through a given point.
- I can find the equation of a line perpendicular to a given line that goes through a given point.

**G.GPE.B.4** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

Learning objectives:

- I can find a point on a directed line segment given a certain ratio.

**G.GPE.B.5** Know and use coordinates to compute perimeters of polygons and areas of triangles and rectangles.★

Learning objectives:

- I can determine the perimeter of triangles and other polygons with given coordinates.
- I can determine the area of triangles and other polygons with given coordinates.

**Explain volume and surface area formulas and use them to solve problems.**

**G.GMD.A.2** Know and use volume and surface area formulas for cylinders, cones, prisms, pyramids, and spheres to solve problems.★

Learning objectives:

- I can find the surface area of
  - cylinders,
  - cones,
  - prisms,
  - pyramids, and
  - spheres.
- I can find the volume of
  - cylinders,
  - cones,
  - prisms,
  - pyramids, and
  - spheres.

**Apply geometric concepts in modeling situations.**

**G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.★

Learning objectives:

- I can find a cross section of a three dimensional figure.

**G.MG.A.2** Apply geometric methods to solve real-world problems.★

- I can apply geometric methods to solve real-world problems.