# Geometry GT
# Essential Curriculum

## Unit I: Fundamental Concepts and Patterns in Geometry

**Goal:** The student will demonstrate the ability to use the fundamental concepts of geometry including the definitions and coordinate geometry.

Objectives: The student will be able to:

a. Explore and recognize geometric patterns.
b. Identify and apply basic definitions of geometry.
c. Identify and apply segment relationships including segment addition, midpoint of a segment, and the concept of betweenness.
d. Graph points and lines in the coordinate plane.
e. Calculate the distance between two points in the coordinate plane.
f. Find the midpoint of a given segment in the coordinate plane.
g. Identify and apply angle relationships including complementary, supplementary, vertical, and adjacent angles.
h. Represent a point in space as an ordered triple.
i. Use distance and midpoint formulas for segments in three-dimensional space.
j. Explore relationships given a set of points in space such as collinear, coplanar, and relative placement inside or outside a figure.

## Unit II: Geometric Reasoning and Proof

**Goal:** The student will demonstrate the ability to apply geometric properties and relationships through inductive and deductive reasoning.

Objectives: The student will be able to:

a. Use inductive reasoning to arrive at a valid conclusion.
b. Analyze and rewrite conditional and biconditional statements.
c. Find a counterexample to disprove a conjecture.
d. Write the inverse, converse, and contrapositive of a conditional statement.
e. Use point, line, and plane postulates to solve problems and prove theorems about segments and angles.
f. Use deductive reasoning to prove a conjecture.
g. Use the properties of equality in a geometric situation.
h. Present valid arguments in the form of a narrative, flow chart, and two-column proof.
i. Identify errors in mathematical and logical reasoning.
j. Draw conclusions from a Venn diagram.
k. Use indirect proof to justify algebraic and geometric conjectures.

## Unit III: Parallel and Perpendicular Lines

**Goal:** The student will demonstrate the ability to apply the properties of parallel and perpendicular lines.

Objectives: The student will be able to:

a. Identify parallel and perpendicular lines and planes.
b. Draw and graph parallel lines, intersecting lines, and perpendicular bisectors.
c. Determine the measures of angles formed by parallel lines, perpendicular lines, and transversals.
d. Determine the slope and equation of a line parallel or perpendicular to a given line.
e. Prove statements and theorems using parallel and perpendicular lines and their converses.

## Unit IV: Triangle Relationships and Triangle Congruence

**Goal:** The student will demonstrate the ability to apply the definitions and theorems of triangles.

Objectives: The student will be able to:

a. Classify triangles by their sides and by their angles.
b. Apply the Triangle-Angle Sum Theorem, the Isosceles Triangle Theorem and its converse, and the Exterior Angle Theorem.
c. Name corresponding parts of congruent polygons.
d. Prove triangles congruent using SSS, SAS, ASA, AAS, and HL Theorems.
e. Use congruent triangle to prove statements and theorems.
f. Use the Perpendicular Bisector Theorem and its converse.
g. Use the Angle Bisector Theorem and its converse.
h. Identify and apply the properties of the median, the altitude, and the perpendicular bisector of the sides of a triangle.
i. Identify and apply the properties of the midsegments of a triangle.
j. Use the Triangle Inequality Theorem and compare the side and angle measure in a triangle.

**Unit V: Constructions**

**Goal:** The student will demonstrate the ability to perform geometric constructions.

Objectives: The student will be able to:

a. Construct a segment bisector, angle bisector, and perpendicular bisector.
b. Construct a segment congruent to a given segment and an angle congruent to a given angle.
c. Construct a line parallel to a given line through a given point.
d. Construct a line perpendicular to a line at a given point and a line perpendicular from a given point to a line.
e. Use the properties of construction to identify the center of a triangle or a circle.

**Unit VI: Exploring Quadrilaterals**

**Goal:** The student will demonstrate the ability to explore and verify the properties of quadrilaterals.

Objectives: The student will be able to:

a. Identify regular and non-regular polygons.
b. Describe the characteristics of a quadrilateral.
c. Apply the properties of parallelograms.
d. Justify that a quadrilateral is a parallelogram including coordinate proofs.
e. Use the properties of special quadrilaterals.
f. Investigate the family hierarchy of quadrilaterals.
g. Calculate the area of triangles and quadrilaterals.
h. Justify that a quadrilateral is a rectangle, rhombus, or a square.

**Unit VII: Transformation and Similarity**

**Goal:** The student will demonstrate the ability to analyze the effects of transformations and identify and use similar polygons.

Objectives: The student will be able to:

a. Perform geometric transformations including reflections, rotations, translations, and dilations.
b. Describe how transformations affect the properties of geometric figures.
c. Name the corresponding parts of similar figures.
d. Apply the proportions to similar figures in real-world problems.
e. Prove triangles similar using AA, SSS, and SAS Similarity Theorems.
f. Write and plot ordered pairs from matrix notation and find the transformation image, including rotations, reflections, dilations, and translations using matrices.
g. Determine the magnitude and direction of a given vector and determine the resultant of vectors.
h. Describe translations using vectors and find translation images using vector sums.

## Unit VIII: Investigating Right Triangles

**Goal:** The student will demonstrate the ability to solve problems using properties of right triangles, including trigonometric ratios.

Objectives: The student will be able to:

a. State and apply the theorem involving the altitude to the hypotenuse as the geometric mean in right triangles.
b. Define and apply the Pythagorean Theorem and its converse.
c. Use the Pythagorean Theorem to develop and solve problems involving right triangles and special right triangles $(30\text{-}60\text{-}90)^{\circ}$ and $(45\text{-}45\text{-}90)^{\circ}$.
d. Define sine, cosine, and tangent ratios in right triangles.
e. Use the appropriate keystrokes on a graphing calculator to find the trigonometric ratios and measures of angles.
f. Find the missing parts of a right triangle using the trigonometric ratios and inverse trigonometric ratios.
g. Apply right triangle trigonometry to real-world situations.
h. Apply the Law of Sines and Law of Cosines to solve problems involving oblique triangles, disregarding problems that use the ambiguous case for Law of Sines.

## Unit IX: Polygons and Circles

**Goal:** The student will demonstrate the ability to find one- and two- dimensional measures relating to polygons and circles.

Objectives: The student will be able to:

a. Find the measures of interior and exterior angles of polygons.
b. Determine the perimeter and area of polygons.
c. Determine the circumference, arc length and area of a circle and a sector.
d. Find the area of similar figures.
e. Compare the perimeter and area of congruent and similar figures.
f. Apply the relationships among central angles, inscribed angles, and arcs of circles.
g. Solve problems involving inscribed and circumscribed polygons.
h. Apply the properties of tangency to a circle.
i. Construct a tangent to a circle at a point given when that given point is on that circle and when the point is not on the circle.
j. Explore the relationship between radian measure and the corresponding degree measure between 0 and $2\boldsymbol{\pi}$.

**Unit X: Surface Area and Volume**

**Goal:** The student will demonstrate the ability to find two-and-three dimensional measures relating to geometric solids.

Objectives: The student will be able to:

a. Explore nets of three-dimensional figures.
b. Calculate the volume and surface area of solid figures including composite figures.
c. Compare linear dimensions, surface area, and volume of similar figures using ratios.
d. Apply formulas for surface area and volume to real-world situations.
e. Analyze the properties and relationships of geometric solids with bases other than rectangles, triangles, or circles.
f. Analyze the properties and relationships of truncated three-dimensional solids.

**Unit XI: Non-Euclidean Geometry**

**Goal:** The student will demonstrate the ability to contrast geometric properties in Euclidean geometry and non-Euclidean geometry.

Objectives: The student will be able to:

a. Investigate why the parallel postulate is invalid in spherical geometry.
b. Investigate other geometric properties in spherical geometry, using spheres as physical models.
c. Investigate why the parallel postulate is invalid in hyperbolic geometry.
d. Investigate other geometric properties in hyperbolic geometry, using Non-Euclid computer software.

**Unit XII: Algebra Review**

**Goal:** The student will demonstrate the ability to apply algebraic skills necessary for success in Algebra II GT.

Objectives: The student will be able to:

a. Solve linear equations.
b. Solve quadratic equations by graphing, factoring, or the use of the quadratic formula.
c. Solve systems of equations and inequalities.
d. Simplify rational expressions.
e. Simplify expressions using the laws of exponents.
f. Solve equations involving the absolute value function.
g. Simplify radical expressions.
h. Write equations using function notation.