Indiana Tutorials are designed specifically for the Indiana Academic Standards to prepare students for the Indiana Statewide Testing for Educational Progress-Plus (ISTEP+) End-of-Course Assessments (ECAs).

Math Tutorials offer targeted instruction, practice and review designed to develop computational fluency, deepen conceptual understanding, and apply mathematical practices. They automatically identify and address learning gaps down to elementary-level content, using adaptive remediation to bring students to grade-level no matter where they start. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By constantly honing the ability to apply their knowledge in abstract and real world scenarios, students build the depth of knowledge and higher order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible to students through focused content, modeled logic and process, multi-modal representations, and personalized feedback as students reason through increasingly challenging problems. The Review It offers a high impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

Unit 1: Points, Lines, and Angles

- **POINTS, RAYS, LINE SEGMENTS, LINES, AND FIGURES**
  - G.LP.1: Logic and Proofs Understand and describe the structure of and relationships within an axiomatic system (undefined terms, definitions, axioms and postulates, methods of reasoning, and theorems). Understand the differences among supporting evidence, counterexamples, and actual proofs.
  - G.LP.2: Logic and Proofs Know precise definitions for angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.
  - G.PL.1: Points, Lines, Angles, and Planes Identify, justify, and apply properties of planes.
- **PARALLEL AND PERPENDICULAR LINES**
  - G.LP.2: Logic and Proofs Know precise definitions for angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.
  - G.PL.4: Points, Lines, Angles, and Planes Know that parallel lines have the same slope and perpendicular lines have opposite reciprocal slopes. Determine if a pair of lines are parallel,

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perpendicular, or neither by comparing the slopes in coordinate graphs and in equations. Find the equation of a line, passing through a given point, that is parallel or perpendicular to a given line.

- G.LP.4: Logic and Proofs Develop geometric proofs, including direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry, using two-column, paragraphs, and flow charts formats.

- **PARALLEL LINES AND ANGLE RELATIONSHIPS**
  - G.PL.3: Points, Lines, Angles, and Planes Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.
  - G.LP.2: Logic and Proofs Know precise definitions for angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.
  - G.LP.4: Logic and Proofs Develop geometric proofs, including direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry, using two-column, paragraphs, and flow charts formats.
- **PERPENDICULAR BISECTOR AND ANGLE BISECTOR THEOREMS**
  - G.LP.4: Logic and Proofs Develop geometric proofs, including direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry, using two-column, paragraphs, and flow charts formats.
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.
  - G.PL.3: Points, Lines, Angles, and Planes Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two

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proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.

Unit 2: Coordinate Geometry

- **SLOPE-INTERCEPT FORM OF A LINEAR EQUATION**
  - G.PL.4: Points, Lines, Angles, and Planes Know that parallel lines have the same slope and perpendicular lines have opposite reciprocal slopes. Determine if a pair of lines are parallel, perpendicular, or neither by comparing the slopes in coordinate graphs and in equations. Find the equation of a line, passing through a given point, that is parallel or perpendicular to a given line.
- **POINT-SLOPE FORM OF A LINEAR EQUATION**
  - G.PL.4: Points, Lines, Angles, and Planes Know that parallel lines have the same slope and perpendicular lines have opposite reciprocal slopes. Determine if a pair of lines are parallel, perpendicular, or neither by comparing the slopes in coordinate graphs and in equations. Find the equation of a line, passing through a given point, that is parallel or perpendicular to a given line.
- **LENGTH AND THE DISTANCE FORMULA**
  - G.T.8: Triangles Develop the distance formula using the Pythagorean Theorem. Find the lengths and midpoints of line segments in one- or two-dimensional coordinate systems. Find measures of the sides of polygons in the coordinate plane; apply this technique to compute the perimeters and areas of polygons in real-world and mathematical problems.
- **CONJECTURES IN COORDINATE GEOMETRY**
  - G.LP.1: Logic and Proofs Understand and describe the structure of and relationships within an axiomatic system (undefined terms, definitions, axioms and postulates, methods of reasoning, and theorems). Understand the differences among supporting evidence, counterexamples, and actual proofs.
  - G.LP.4: Logic and Proofs Develop geometric proofs, including direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry, using two-column, paragraphs, and flow charts formats.
  - G.QP.2: Quadrilaterals and Other Polygons Prove that given quadrilaterals are parallelograms, rhombuses, rectangles, squares or trapezoids. Include coordinate proofs of quadrilaterals in the coordinate plane.

Unit 3: Perimeter, Area, and Transformations on the Coordinate Plane

- **TRANSFORMATIONS ON THE COORDINATE PLANE**
  - G.TR.1: Transformations Use geometric descriptions of rigid motions to transform figures and to predict and describe the results of translations, reflections and rotations on a given figure. Describe a motion or series of motions that will show two shapes are congruent.
  - G.T.4: Triangles Given two triangles, 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, and to establish the AA criterion for two triangles to be similar.

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- G.TR.2: Transformations Understand a dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. Verify experimentally the properties of dilations given by a center and a scale factor. Understand the dilation of a line segment is longer or shorter in the ratio given by the scale factor.

- **DILATIONS, TRANSLATIONS, ROTATIONS, AND REFLECTIONS**
  - G.TR.1: Transformations Use geometric descriptions of rigid motions to transform figures and to predict and describe the results of translations, reflections and rotations on a given figure. Describe a motion or series of motions that will show two shapes are congruent.
  - G.T.4: Triangles Given two triangles, 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, and to establish the AA criterion for two triangles to be similar.
  - G.TR.2: Transformations Understand a dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. Verify experimentally the properties of dilations given by a center and a scale factor. Understand the dilation of a line segment is longer or shorter in the ratio given by the scale factor.
  - G.TS.3: Three-Dimensional Solids Know properties of congruent and similar solids, including prisms, regular pyramids, cylinders, cones, and spheres; solve problems involving congruent and similar solids.

Unit 4: Congruence and Similarity

- **TRIANGLES AND CONGRUENCE TRANSFORMATIONS**
  - G.T.5: Triangles Use properties of congruent and similar triangles to solve real-world and mathematical problems involving sides, perimeters, and areas of triangles.
  - G.TR.1: Transformations Use geometric descriptions of rigid motions to transform figures and to predict and describe the results of translations, reflections and rotations on a given figure. Describe a motion or series of motions that will show two shapes are congruent.
  - G.T.2: Triangles Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
- **TRIANGLES AND SIMILARITY TRANSFORMATIONS**
  - G.T.4: Triangles Given two triangles, 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, and to establish the AA criterion for two triangles to be similar.
  - G.T.5: Triangles Use properties of congruent and similar triangles to solve real-world and mathematical problems involving sides, perimeters, and areas of triangles.
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the

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medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.

- G.LP.4: Logic and Proofs Develop geometric proofs, including direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry, using two-column, paragraphs, and flow charts formats.
- G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.

- **CONGRUENCE OF OTHER POLYGONS**
  - G.TR.1: Transformations Use geometric descriptions of rigid motions to transform figures and to predict and describe the results of translations, reflections and rotations on a given figure. Describe a motion or series of motions that will show two shapes are congruent.

Unit 5: Triangles

- **TRIANGLE ANGLE THEOREMS**
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.
  - G.QP.3: Quadrilaterals and Other Polygons Find measures of interior and exterior angles of polygons. Explain and justify the method used.
  - G.LP.4: Logic and Proofs Develop geometric proofs, including direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry, using two-column, paragraphs, and flow charts formats.
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.
- **TRIANGLE BISECTORS**
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the

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medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.

- G.PL.3: Points, Lines, Angles, and Planes Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.
- G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.
- G.CI.5: Circles Construct a circle that passes through three given points not on a line and justify the process used.
- G.CI.7: Circles Construct the inscribed and circumscribed circles of a triangle with or without technology, and prove properties of angles for a quadrilateral inscribed in a circle.

- **MEDIANS AND ALTITUDES OF TRIANGLES**
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.

Unit 6: Quadrilaterals and Constructions

- **PARALLELOGRAMS AND RECTANGLES**
  - G.QP.1: Quadrilaterals and Other Polygons Prove and apply theorems about parallelograms, including the following: opposite sides are congruent; opposite angles are congruent; the diagonals of a parallelogram bisect each other; and rectangles are parallelograms with congruent diagonals.
  - G.QP.2: Quadrilaterals and Other Polygons Prove that given quadrilaterals are parallelograms, rhombuses, rectangles, squares or trapezoids. Include coordinate proofs of quadrilaterals in the coordinate plane.
- **CONSTRUCTIONS**
  - G.PL.5: Points, Lines, Angles, and Planes Explain and justify the process used to construct, with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.), congruent segments and angles, angle bisectors, perpendicular bisectors, altitudes, medians, and parallel and perpendicular lines.

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- G.T.3: Triangles Explain and justify the process used to construct congruent triangles with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
- G.CI.6: Circles Construct a tangent line to a circle through a point on the circle, and construct a tangent line from a point outside a given circle to the circle; justify the process used for each construction.

Unit 7: Triangles and Trigonometry

- **PYTHAGOREAN THEOREM**
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.
  - G.T.10: Triangles Use trigonometric ratios (sine, cosine and tangent) and the Pythagorean Theorem to solve real-world and mathematical problems involving right triangles.
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.
  - G.T.1: Triangles Prove and apply theorems about triangles, including the following: measures of interior angles of a triangle sum to 180; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem, using triangle similarity; and the isosceles triangle theorem and its converse.
- **TRIGONOMETRIC RATIOS**
  - G.T.9: Triangles 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.
  - G.T.10: Triangles Use trigonometric ratios (sine, cosine and tangent) and the Pythagorean Theorem to solve real-world and mathematical problems involving right triangles.

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- **LAWS OF SINE AND COSINE**
  - G.T.10: Triangles Use trigonometric ratios (sine, cosine and tangent) and the Pythagorean Theorem to solve real-world and mathematical problems involving right triangles.
  - G.T.7: Triangles State and apply the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle. Understand and use the geometric mean to solve for missing parts of triangles.
- **RADIANS AND THE UNIT CIRCLE**
  - G.CI.2: Circles Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius; derive the formula for the area of a sector.
  - G.CI.1: Circles Define, identify and use relationships among the following: radius, diameter, arc, measure of an arc, chord, secant, tangent, and congruent concentric circles.

Unit 8: Circles

- **CIRCLE BASICS**
  - G.PL.3: Points, Lines, Angles, and Planes Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.
  - G.CI.1: Circles Define, identify and use relationships among the following: radius, diameter, arc, measure of an arc, chord, secant, tangent, and congruent concentric circles.
  - G.CI.3: Circles Identify and describe relationships among inscribed angles, radii, and chords, including the following: the relationship that exists between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; and the radius of a circle is perpendicular to a tangent where the radius intersects the circle.
  - G.LP.2: Logic and Proofs Know precise definitions for angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.
- **CENTRAL ANGLES, INSCRIBED ANGLES, AND CHORDS**
  - G.CI.1: Circles Define, identify and use relationships among the following: radius, diameter, arc, measure of an arc, chord, secant, tangent, and congruent concentric circles.
  - G.CI.3: Circles Identify and describe relationships among inscribed angles, radii, and chords, including the following: the relationship that exists between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; and the radius of a circle is perpendicular to a tangent where the radius intersects the circle.
  - G.CI.4: Circles Solve real-world and other mathematical problems that involve finding measures of circumference, areas of circles and sectors, and arc lengths and related angles (central, inscribed, and intersections of secants and tangents).

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- G.LP.2: Logic and Proofs Know precise definitions for angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.
- G.LP.4: Logic and Proofs Develop geometric proofs, including direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry, using two-column, paragraphs, and flow charts formats.
- G.CI.5: Circles Construct a circle that passes through three given points not on a line and justify the process used.
- G.CI.7: Circles Construct the inscribed and circumscribed circles of a triangle with or without technology, and prove properties of angles for a quadrilateral inscribed in a circle.

- **SECANTS, ANGLES, AND INTERCEPTED ARCS**
  - G.LP.4: Logic and Proofs Develop geometric proofs, including direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry, using two-column, paragraphs, and flow charts formats.
  - G.CI.1: Circles Define, identify and use relationships among the following: radius, diameter, arc, measure of an arc, chord, secant, tangent, and congruent concentric circles.
  - G.CI.4: Circles Solve real-world and other mathematical problems that involve finding measures of circumference, areas of circles and sectors, and arc lengths and related angles (central, inscribed, and intersections of secants and tangents).
  - G.PL.3: Points, Lines, Angles, and Planes Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.
  - G.CI.3: Circles Identify and describe relationships among inscribed angles, radii, and chords, including the following: the relationship that exists between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; and the radius of a circle is perpendicular to a tangent where the radius intersects the circle.
- **TANGENTS, ANGLES, AND INTERCEPTED ARCS**
  - G.CI.1: Circles Define, identify and use relationships among the following: radius, diameter, arc, measure of an arc, chord, secant, tangent, and congruent concentric circles.
  - G.CI.4: Circles Solve real-world and other mathematical problems that involve finding measures of circumference, areas of circles and sectors, and arc lengths and related angles (central, inscribed, and intersections of secants and tangents).
  - G.PL.3: Points, Lines, Angles, and Planes Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are

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congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.

- G.LP.4: Logic and Proofs Develop geometric proofs, including direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry, using two-column, paragraphs, and flow charts formats.
- G.CI.3: Circles Identify and describe relationships among inscribed angles, radii, and chords, including the following: the relationship that exists between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; and the radius of a circle is perpendicular to a tangent where the radius intersects the circle.

Unit 9: Properties of Circles

- **CONGRUENT AND SIMILAR CIRCLES**
  - G.LP.2: Logic and Proofs Know precise definitions for angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.
  - G.TR.1: Transformations Use geometric descriptions of rigid motions to transform figures and to predict and describe the results of translations, reflections and rotations on a given figure. Describe a motion or series of motions that will show two shapes are congruent.
  - G.T.4: Triangles Given two triangles, 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, and to establish the AA criterion for two triangles to be similar.
  - G.CI.1: Circles Define, identify and use relationships among the following: radius, diameter, arc, measure of an arc, chord, secant, tangent, and congruent concentric circles.
- **CIRCUMFERENCE AND ARC LENGTH**
  - G.LP.2: Logic and Proofs Know precise definitions for angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.
  - G.QP.5: Quadrilaterals and Other Polygons Deduce formulas relating lengths and sides, perimeters, and areas of regular polygons. Understand how limiting cases of such formulas lead to expressions for the circumference and the area of a circle.
  - G.CI.4: Circles Solve real-world and other mathematical problems that involve finding measures of circumference, areas of circles and sectors, and arc lengths and related angles (central, inscribed, and intersections of secants and tangents).
  - G.CI.1: Circles Define, identify and use relationships among the following: radius, diameter, arc, measure of an arc, chord, secant, tangent, and congruent concentric circles.
- **AREA OF CIRCLES AND SECTORS**

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- G.CI.4: Circles Solve real-world and other mathematical problems that involve finding measures of circumference, areas of circles and sectors, and arc lengths and related angles (central, inscribed, and intersections of secants and tangents).
- G.QP.5: Quadrilaterals and Other Polygons Deduce formulas relating lengths and sides, perimeters, and areas of regular polygons. Understand how limiting cases of such formulas lead to expressions for the circumference and the area of a circle.
- G.CI.2: Circles Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius; derive the formula for the area of a sector.
- G.LP.2: Logic and Proofs Know precise definitions for angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.
- G.CI.1: Circles Define, identify and use relationships among the following: radius, diameter, arc, measure of an arc, chord, secant, tangent, and congruent concentric circles.

Unit 10: Surface Area

- **SURFACE AREA AND VOLUME OF SPHERES**
  - G.TS.9: Three-Dimensional Solids Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
  - G.TS.5: Three-Dimensional Solids Solve real-world and other mathematical problems involving volume and surface area of prisms, cylinders, cones, spheres, and pyramids, including problems that involve algebraic expressions.
  - G.TS.4: Three-Dimensional Solids Describe sets of points on spheres, including chords, tangents, and great circles.
  - G.TS.1: Three-Dimensional Solids Describe relationships between the faces, edges, and vertices of three-dimensional solids. Create a net for a given three-dimensional solid. Describe the three-dimensional solid that can be made from a given net (or pattern).
- **SURFACE AREA OF SIMILAR SOLIDS**
  - G.TS.3: Three-Dimensional Solids Know properties of congruent and similar solids, including prisms, regular pyramids, cylinders, cones, and spheres; solve problems involving congruent and similar solids.
  - G.TS.5: Three-Dimensional Solids Solve real-world and other mathematical problems involving volume and surface area of prisms, cylinders, cones, spheres, and pyramids, including problems that involve algebraic expressions.
  - G.TS.6: Three-Dimensional Solids Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Unit 11: Volume

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- **RELATING TWO-DIMENSIONAL FIGURES TO THREE-DIMENSIONAL SOLIDS**
  - G.TS.9: Three-Dimensional Solids Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- **VOLUME OF PRISMS AND PYRAMIDS**
  - G.TS.5: Three-Dimensional Solids Solve real-world and other mathematical problems involving volume and surface area of prisms, cylinders, cones, spheres, and pyramids, including problems that involve algebraic expressions.
  - G.TS.1: Three-Dimensional Solids Describe relationships between the faces, edges, and vertices of three-dimensional solids. Create a net for a given three-dimensional solid. Describe the three-dimensional solid that can be made from a given net (or pattern).
- **VOLUME OF CYLINDERS AND CONES**
  - G.TS.5: Three-Dimensional Solids Solve real-world and other mathematical problems involving volume and surface area of prisms, cylinders, cones, spheres, and pyramids, including problems that involve algebraic expressions.
  - G.TS.1: Three-Dimensional Solids Describe relationships between the faces, edges, and vertices of three-dimensional solids. Create a net for a given three-dimensional solid. Describe the three-dimensional solid that can be made from a given net (or pattern).
  - G.TS.6: Three-Dimensional Solids Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).
- **VOLUME OF SIMILAR SOLIDS**
  - G.TS.3: Three-Dimensional Solids Know properties of congruent and similar solids, including prisms, regular pyramids, cylinders, cones, and spheres; solve problems involving congruent and similar solids.
  - G.TS.5: Three-Dimensional Solids Solve real-world and other mathematical problems involving volume and surface area of prisms, cylinders, cones, spheres, and pyramids, including problems that involve algebraic expressions.
  - G.TS.6: Three-Dimensional Solids Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

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