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.

This Tutorial is built to state standards.

Unit 1: Introduction to Geometry

- **POINTS, RAYS, LINE SEGMENTS, LINES, AND FIGURES**
  - CCSS.Math.Content.HSG-CO.A.1: Congruence Experiment with transformations in the plane Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **PARALLEL AND PERPENDICULAR LINES**
  - CCSS.Math.Content.HSG-GPE.B.5: Expressing Geometric Properties with Equations Use coordinates to prove simple geometric theorems algebraically Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).
  - CCSS.Math.Content.HSG-CO.A.1: Congruence Experiment with transformations in the plane Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

Unit 2: Lines and Angles

- **PARALLEL LINES AND ANGLE RELATIONSHIPS**

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- CCSS.Math.Content.HSG-CO.C.9: Congruence Prove geometric theorems Prove theorems about lines and angles.
- CCSS.Math.Content.HSG-CO.A.1: Congruence Experiment with transformations in the plane Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

- **PERPENDICULAR BISECTOR AND ANGLE BISECTOR THEOREMS**
  - CCSS.Math.Content.HSG-CO.C.9: Congruence Prove geometric theorems Prove theorems about lines and angles.
  - CCSS.Math.Content.HSG-CO.C.10: Congruence Prove geometric theorems Prove theorems about triangles.
  - CCSS.Math.Content.HSG-SRT.B.4: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Prove theorems about triangles.
- **SLOPE-INTERCEPT FORM OF A LINEAR EQUATION**
  - CCSS.Math.Content.HSA-REI.D.10: Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
  - CCSS.Math.Content.HSF-IF.A.1: Interpreting Functions Understand the concept of a function and use function notation Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
  - CCSS.Math.Content.HSF-IF.C.7.a: Interpreting Functions Analyze functions using different representations Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. Graph linear and quadratic functions and show intercepts, maxima, and minima.
  - CCSS.Math.Content.HSF-LE.A.2: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
  - CCSS.Math.Content.HSG-GPE.B.5: Expressing Geometric Properties with Equations Use coordinates to prove simple geometric theorems algebraically Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).
  - CCSS.Math.Content.HSF-IF.A.1: Interpreting Functions Understand the concept of a function and use function notation Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

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- CCSS.Math.Content.HSF-IF.B.6: Interpreting Functions Interpret functions that arise in applications in terms of the context Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
- CCSS.Math.Content.HSS-ID.C.7: Interpreting Categorical and Quantitative Data Interpret linear models Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

Unit 3: Coordinate Geometry

- **LENGTH AND THE DISTANCE FORMULA**
  - CCSS.Math.Content.HSG-GPE.B.6: Expressing Geometric Properties with Equations Use coordinates to prove simple geometric theorems algebraically Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
  - CCSS.Math.Content.HSG-GPE.B.7: Expressing Geometric Properties with Equations Use coordinates to prove simple geometric theorems algebraically Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
- **MIDPOINT FORMULA ON THE COORDINATE PLANE**
  - CCSS.Math.Content.HSG-GPE.B.6: Expressing Geometric Properties with Equations Use coordinates to prove simple geometric theorems algebraically Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **CONJECTURES IN COORDINATE GEOMETRY**
  - CCSS.Math.Content.HSG-CO.C.10: Congruence Prove geometric theorems Prove theorems about triangles.
  - CCSS.Math.Content.HSG-GPE.B.4: Expressing Geometric Properties with Equations Use coordinates to prove simple geometric theorems algebraically Use coordinates to prove simple geometric theorems algebraically.

Unit 4: Perimeter and Area on the Coordinate Plane

- **PERIMETER ON THE COORDINATE PLANE**
  - CCSS.Math.Content.HSG-GPE.B.7: Expressing Geometric Properties with Equations Use coordinates to prove simple geometric theorems algebraically Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g.,

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modeling a tree trunk or a human torso as a cylinder).

- CCSS.Math.Content.HSG-GPE.B.4: Expressing Geometric Properties with Equations Use coordinates to prove simple geometric theorems algebraically Use coordinates to prove simple geometric theorems algebraically.

- **AREA ON THE COORDINATE PLANE**
  - CCSS.Math.Content.HSG-GPE.B.7: Expressing Geometric Properties with Equations Use coordinates to prove simple geometric theorems algebraically Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Unit 5: Transformations on the Coordinate Plane

- **TRANSFORMATIONS ON THE COORDINATE PLANE**
  - CCSS.Math.Content.HSG-CO.A.2: Congruence Experiment with transformations in the plane Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
  - CCSS.Math.Content.HSG-CO.A.3: Congruence Experiment with transformations in the plane Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
  - CCSS.Math.Content.HSG-CO.A.4: Congruence Experiment with transformations in the plane Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
  - CCSS.Math.Content.HSG-CO.A.5: Congruence Experiment with transformations in the plane Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
  - CCSS.Math.Content.HSG-CO.B.6: Congruence Understand congruence in terms of rigid motions 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 decide if they are congruent.
  - CCSS.Math.Content.HSG-SRT.A.1.b: Similarity, Right Triangles, and Trigonometry Understand similarity in terms of similarity transformations Verify experimentally the properties of dilations given by a center and a scale factor: The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
  - CCSS.Math.Content.HSG-SRT.A.1.a: Similarity, Right Triangles, and Trigonometry Understand similarity in terms of similarity transformations Verify experimentally the properties of dilations given by a

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center and a scale factor: 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.

- CCSS.Math.Content.HSG-SRT.A.2: Similarity, Right Triangles, and Trigonometry Understand similarity in terms of similarity transformations 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.

- **DILATIONS, TRANSLATIONS, ROTATIONS, AND REFLECTIONS**
  - CCSS.Math.Content.HSG-CO.B.6: Congruence Understand congruence in terms of rigid motions 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 decide if they are congruent.
  - CCSS.Math.Content.HSG-CO.A.2: Congruence Experiment with transformations in the plane Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
  - CCSS.Math.Content.HSG-CO.A.3: Congruence Experiment with transformations in the plane Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
  - CCSS.Math.Content.HSG-CO.A.4: Congruence Experiment with transformations in the plane Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
  - CCSS.Math.Content.HSG-CO.A.5: Congruence Experiment with transformations in the plane Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
  - CCSS.Math.Content.HSG-SRT.A.1.b: Similarity, Right Triangles, and Trigonometry Understand similarity in terms of similarity transformations Verify experimentally the properties of dilations given by a center and a scale factor: The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
  - CCSS.Math.Content.HSG-SRT.A.1.a: Similarity, Right Triangles, and Trigonometry Understand similarity in terms of similarity transformations Verify experimentally the properties of dilations given by a center and a scale factor: 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.
  - CCSS.Math.Content.HSG-SRT.A.2: Similarity, Right Triangles, and Trigonometry Understand similarity in terms of similarity transformations Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the

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meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

Unit 6: Congruence

- **TRIANGLES AND CONGRUENCE TRANSFORMATIONS**
  - CCSS.Math.Content.HSG-CO.B.6: Congruence Understand congruence in terms of rigid motions 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 decide if they are congruent.
  - CCSS.Math.Content.HSG-CO.B.7: Congruence Understand congruence in terms of rigid motions 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.
  - CCSS.Math.Content.HSG-CO.B.8: Congruence Understand congruence in terms of rigid motions Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
  - CCSS.Math.Content.HSG-CO.C.10: Congruence Prove geometric theorems Prove theorems about triangles.
  - CCSS.Math.Content.HSG-SRT.B.4: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Prove theorems about triangles.
  - CCSS.Math.Content.HSG-SRT.B.5: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- **CONGRUENCE OF OTHER POLYGONS**
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
  - CCSS.Math.Content.HSG-CO.B.6: Congruence Understand congruence in terms of rigid motions 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 decide if they are congruent.
  - CCSS.Math.Content.HSG-CO.A.2: Congruence Experiment with transformations in the plane Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
  - CCSS.Math.Content.HSG-CO.A.5: Congruence Experiment with transformations in the plane Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

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- CCSS.Math.Content.HSG-CO.A.3: Congruence Experiment with transformations in the plane Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

Unit 7: Similarity

- **TRIANGLES AND SIMILARITY TRANSFORMATIONS**
  - CCSS.Math.Content.HSG-SRT.A.2: Similarity, Right Triangles, and Trigonometry Understand similarity in terms of similarity transformations 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.
  - CCSS.Math.Content.HSG-SRT.B.5: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
  - CCSS.Math.Content.HSG-CO.C.10: Congruence Prove geometric theorems Prove theorems about triangles.
  - CCSS.Math.Content.HSG-SRT.B.4: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Prove theorems about triangles.
  - CCSS.Math.Content.HSG-SRT.A.3: Similarity, Right Triangles, and Trigonometry Understand similarity in terms of similarity transformations Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
- **SIMILARITY OF OTHER POLYGONS**
  - CCSS.Math.Content.HSG-SRT.A.2: Similarity, Right Triangles, and Trigonometry Understand similarity in terms of similarity transformations 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.

Unit 8: Triangles

- **TRIANGLE ANGLE THEOREMS**
  - CCSS.Math.Content.HSG-CO.C.10: Congruence Prove geometric theorems Prove theorems about triangles.
  - CCSS.Math.Content.HSG-SRT.B.4: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Prove theorems about triangles.
- **TRIANGLE BISECTORS**
  - CCSS.Math.Content.HSG-CO.C.9: Congruence Prove geometric theorems Prove theorems about lines and angles.
  - CCSS.Math.Content.HSG-CO.C.10: Congruence Prove geometric theorems Prove theorems about triangles.

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- CCSS.Math.Content.HSG-SRT.B.4: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Prove theorems about triangles.
- CCSS.Math.Content.HSG-SRT.B.5: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- CCSS.Math.Content.HSG-CO.D.12: Congruence Make geometric constructions Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
- CCSS.Math.Content.HSG-C.A.3: Circles Understand and apply theorems about circles Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

- **MEDIANS AND ALTITUDES OF TRIANGLES**
  - CCSS.Math.Content.HSG-CO.C.10: Congruence Prove geometric theorems Prove theorems about triangles.
  - CCSS.Math.Content.HSG-SRT.B.4: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Prove theorems about triangles.

Unit 9: Quadrilaterals and Constructions

- **PARALLELOGRAMS AND RECTANGLES**
  - CCSS.Math.Content.HSG-CO.C.11: Congruence Prove geometric theorems Prove theorems about parallelograms.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **SQUARES AND RHOMBI**
  - CCSS.Math.Content.HSG-CO.C.11: Congruence Prove geometric theorems Prove theorems about parallelograms.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **CONSTRUCTIONS**
  - CCSS.Math.Content.HSG-CO.D.12: Congruence Make geometric constructions Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
  - CCSS.Math.Content.HSG-CO.D.13: Congruence Make geometric constructions Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
  - CCSS.Math.Content.HSG-C.A.4: Circles Understand and apply theorems about circles Construct a tangent line from a point outside a given circle to the circle.

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Unit 10: Right Triangles and Trigonometric Ratios

- **PYTHAGOREAN THEOREM**
  - CCSS.Math.Content.HSG-CO.C.10: Congruence Prove geometric theorems Prove theorems about triangles.
  - CCSS.Math.Content.HSG-SRT.C.8: Similarity, Right Triangles, and Trigonometry Define trigonometric ratios and solve problems involving right triangles Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
  - CCSS.Math.Content.HSG-SRT.B.4: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Prove theorems about triangles.
  - CCSS.Math.Content.HSG-SRT.B.5: Similarity, Right Triangles, and Trigonometry Prove theorems involving similarity Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- **TRIGONOMETRIC RATIOS**
  - CCSS.Math.Content.HSG-SRT.C.6: Similarity, Right Triangles, and Trigonometry Define trigonometric ratios and solve problems involving right 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.
  - CCSS.Math.Content.HSG-SRT.C.7: Similarity, Right Triangles, and Trigonometry Define trigonometric ratios and solve problems involving right triangles Explain and use the relationship between the sine and cosine of complementary angles.
  - CCSS.Math.Content.HSG-SRT.C.8: Similarity, Right Triangles, and Trigonometry Define trigonometric ratios and solve problems involving right triangles Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Unit 11: Trigonometry

- **LAWS OF SINE AND COSINE**
  - CCSS.Math.Content.HSG-SRT.D.9: Similarity, Right Triangles, and Trigonometry Apply trigonometry to general triangles Derive the formula = 1/2 ab sin() for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
  - CCSS.Math.Content.HSG-SRT.D.10: Similarity, Right Triangles, and Trigonometry Apply trigonometry to general triangles Prove the Laws of Sines and Cosines and use them to solve problems.

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- CCSS.Math.Content.HSG-SRT.D.11: Similarity, Right Triangles, and Trigonometry Apply trigonometry to general triangles Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).
- CCSS.Math.Content.HSG-SRT.C.8: Similarity, Right Triangles, and Trigonometry Define trigonometric ratios and solve problems involving right triangles Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

- **RADIANS AND THE UNIT CIRCLE**
  - CCSS.Math.Content.HSF-TF.A.1: Trigonometric Functions Extend the domain of trigonometric functions using the unit circle Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
  - CCSS.Math.Content.HSF-TF.A.2: Trigonometric Functions Extend the domain of trigonometric functions using the unit circle Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
  - CCSS.Math.Content.HSG-C.B.5: Circles Find arc lengths and areas of sectors of circles Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.
  - CCSS.Math.Content.HSF-TF.A.3: Trigonometric Functions Extend the domain of trigonometric functions using the unit circle Use special triangles to determine geometrically the values of sine, cosine, tangent for /3, /4 and /6, and use the unit circle to express the values of sine, cosine, and tangent for x, +x, and 2x in terms of their values for x, where x is any real number.
  - CCSS.Math.Content.HSF-TF.A.4: Trigonometric Functions Extend the domain of trigonometric functions using the unit circle Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
  - CCSS.Math.Content.HSG-SRT.C.8: Similarity, Right Triangles, and Trigonometry Define trigonometric ratios and solve problems involving right triangles Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Unit 12: Circles 1

- **CIRCLE BASICS**
  - CCSS.Math.Content.HSG-C.A.2: Circles Understand and apply theorems about circles Identify and describe relationships among inscribed angles, radii, and chords.
  - CCSS.Math.Content.HSG-CO.A.1: Congruence Experiment with transformations in the plane Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
- **CENTRAL ANGLES, INSCRIBED ANGLES, AND CHORDS**
  - CCSS.Math.Content.HSG-C.A.2: Circles Understand and apply theorems about circles Identify and describe relationships among inscribed angles, radii, and chords.

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- CCSS.Math.Content.HSG-C.A.3: Circles Understand and apply theorems about circles Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
- CCSS.Math.Content.HSG-CO.A.1: Congruence Experiment with transformations in the plane Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
- CCSS.Math.Content.HSG-CO.C.9: Congruence Prove geometric theorems Prove theorems about lines and angles.

Unit 13: Circles 2

- **SECANTS, ANGLES, AND INTERCEPTED ARCS**
  - CCSS.Math.Content.HSG-CO.C.9: Congruence Prove geometric theorems Prove theorems about lines and angles.
  - CCSS.Math.Content.HSG-C.A.2: Circles Understand and apply theorems about circles Identify and describe relationships among inscribed angles, radii, and chords.
- **TANGENTS, ANGLES, AND INTERCEPTED ARCS**
  - CCSS.Math.Content.HSG-CO.C.9: Congruence Prove geometric theorems Prove theorems about lines and angles.
  - CCSS.Math.Content.HSG-C.A.2: Circles Understand and apply theorems about circles Identify and describe relationships among inscribed angles, radii, and chords.

Unit 14: Properties of Circles

- **CONGRUENT AND SIMILAR CIRCLES**
  - CCSS.Math.Content.HSG-CO.B.6: Congruence Understand congruence in terms of rigid motions 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 decide if they are congruent.
  - CCSS.Math.Content.HSG-CO.A.1: Congruence Experiment with transformations in the plane Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
  - CCSS.Math.Content.HSG-C.A.1: Circles Understand and apply theorems about circles Prove that all circles are similar.
  - CCSS.Math.Content.HSG-CO.A.4: Congruence Experiment with transformations in the plane Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
  - CCSS.Math.Content.HSG-SRT.A.2: Similarity, Right Triangles, and Trigonometry Understand similarity in terms of similarity transformations Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the

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meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

- **CIRCUMFERENCE AND ARC LENGTH**
  - CCSS.Math.Content.HSG-CO.A.1: Congruence Experiment with transformations in the plane Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
  - CCSS.Math.Content.HSG-GMD.A.1: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **AREA OF CIRCLES AND SECTORS**
  - CCSS.Math.Content.HSG-GMD.A.1: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
  - CCSS.Math.Content.HSG-C.B.5: Circles Find arc lengths and areas of sectors of circles Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.
  - CCSS.Math.Content.HSG-CO.A.1: Congruence Experiment with transformations in the plane Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

Unit 15: Conic Sections

- **CIRCLES**
  - CCSS.Math.Content.HSG-GPE.A.1: Expressing Geometric Properties with Equations Translate between the geometric description and the equation for a conic section Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
- **PARABOLAS**
  - CCSS.Math.Content.HSG-GMD.B.4: Geometric Measurement and Dimension Visualize relationships between two-dimensional and three-dimensional objects Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

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- CCSS.Math.Content.HSA-CED.A.2: Creating Equations Create equations that describe numbers or relationships Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- CCSS.Math.Content.HSG-GPE.A.2: Expressing Geometric Properties with Equations Translate between the geometric description and the equation for a conic section Derive the equation of a parabola given a focus and directrix.

Unit 16: Surface Area

- **SURFACE AREA AND VOLUME OF SPHERES**
  - CCSS.Math.Content.HSG-GMD.A.2: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Give an informal argument using Cavalieris principle for the formulas for the volume of a sphere and other solid figures.
  - CCSS.Math.Content.HSG-GMD.B.4: Geometric Measurement and Dimension Visualize relationships between two-dimensional and three-dimensional objects Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
  - CCSS.Math.Content.HSG-GMD.A.3: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- **SURFACE AREA OF COMPOSITE SOLIDS**
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **SURFACE AREA OF SIMILAR SOLIDS**
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Unit 17: Volume 1

- **RELATING TWO-DIMENSIONAL FIGURES TO THREE-DIMENSIONAL SOLIDS**
  - CCSS.Math.Content.HSG-GMD.B.4: Geometric Measurement and Dimension Visualize relationships between two-dimensional and three-dimensional objects 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**

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- CCSS.Math.Content.HSG-GMD.A.2: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Give an informal argument using Cavalieris principle for the formulas for the volume of a sphere and other solid figures.
- CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- CCSS.Math.Content.HSG-GMD.A.1: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.
- CCSS.Math.Content.HSG-GMD.A.2: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Give an informal argument using Cavalieris principle for the formulas for the volume of a sphere and other solid figures.
- CCSS.Math.Content.HSG-GMD.A.3: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- CCSS.Math.Content.HSG-GMD.B.4: Geometric Measurement and Dimension Visualize relationships between two-dimensional and three-dimensional objects Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Unit 18: Volume 2

- **VOLUME OF CYLINDERS AND CONES**
  - CCSS.Math.Content.HSG-GMD.A.1: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.
  - CCSS.Math.Content.HSG-GMD.A.2: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Give an informal argument using Cavalieris principle for the formulas for the volume of a sphere and other solid figures.
  - CCSS.Math.Content.HSG-GMD.A.3: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
  - CCSS.Math.Content.HSG-GMD.A.2: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Give an informal argument using Cavalieris principle for the formulas for the volume of a sphere and other solid figures.
  - CCSS.Math.Content.HSG-GMD.B.4: Geometric Measurement and Dimension Visualize relationships between two-dimensional and three-dimensional objects Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

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- CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

- **MODELING SITUATIONS WITH GEOMETRY**
  - CCSS.Math.Content.HSG-MG.A.2: Modeling with Geometry Apply geometric concepts in modeling situations Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
  - CCSS.Math.Content.HSG-MG.A.3: Modeling with Geometry Apply geometric concepts in modeling situations 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 19: Volume of Similar and Composite Shapes

- **VOLUME OF COMPOSITE SOLIDS**
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
  - CCSS.Math.Content.HSG-GMD.A.3: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
  - CCSS.Math.Content.HSG-GMD.B.4: Geometric Measurement and Dimension Visualize relationships between two-dimensional and three-dimensional objects 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 SIMILAR SOLIDS**
  - CCSS.Math.Content.HSG-GMD.A.3: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
  - CCSS.Math.Content.HSG-MG.A.1: Modeling with Geometry Apply geometric concepts in modeling situations Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
  - CCSS.Math.Content.HSG-GMD.A.1: Geometric Measurement and Dimension Explain volume formulas and use them to solve problems Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.

Unit 20: Basic Probability Concepts

- **INTRODUCTION TO PROBABILITY**
  - CCSS.Math.Content.HSS-CP.A.2: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Understand that two events

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and are independent if the probability of and occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

- CCSS.Math.Content.HSS-CP.B.8: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Apply the general Multiplication Rule in a uniform probability model, (and) = ()() = ()(), and interpret the answer in terms of the model.
- CCSS.Math.Content.HSS-CP.A.1: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (or, and, not).
- CCSS.Math.Content.HSS-CP.A.2: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Understand that two events and are independent if the probability of and occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
- CCSS.Math.Content.HSS-CP.B.8: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Apply the general Multiplication Rule in a uniform probability model, (and) = ()() = ()(), and interpret the answer in terms of the model.
- CCSS.Math.Content.HSS-CP.B.7: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Apply the Addition Rule, (or) = () + () (and), and interpret the answer in terms of the model.

- **COMBINATIONS AND PERMUTATIONS**
  - CCSS.Math.Content.HSS-CP.B.9: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Use permutations and combinations to compute probabilities of compound events and solve problems.

Unit 21: Advanced Probability Concepts

- **CONDITIONAL PROBABILITY**
  - CCSS.Math.Content.HSS-CP.A.3: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Understand the conditional probability of given as (and)/(), and interpret independence of and as saying that the conditional probability of given is the same as the probability of , and the conditional probability of given is the same as the probability of .
  - CCSS.Math.Content.HSS-CP.A.5: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
  - CCSS.Math.Content.HSS-CP.B.6: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Find the conditional probability of given as the fraction of s outcomes that also belong to , and interpret the answer in terms of the model.

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- CCSS.Math.Content.HSS-CP.A.2: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Understand that two events and are independent if the probability of and occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
- CCSS.Math.Content.HSS-CP.A.3: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Understand the conditional probability of given as (and)/(), and interpret independence of and as saying that the conditional probability of given is the same as the probability of , and the conditional probability of given is the same as the probability of .
- CCSS.Math.Content.HSS-CP.B.6: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Find the conditional probability of given as the fraction of s outcomes that also belong to , and interpret the answer in terms of the model.
- CCSS.Math.Content.HSS-ID.B.5: Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on two categorical and quantitative variables Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
- CCSS.Math.Content.HSS-CP.A.4: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.
- CCSS.Math.Content.HSS-CP.A.3: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Understand the conditional probability of given as (and)/(), and interpret independence of and as saying that the conditional probability of given is the same as the probability of , and the conditional probability of given is the same as the probability of .
- CCSS.Math.Content.HSS-CP.B.6: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Find the conditional probability of given as the fraction of s outcomes that also belong to , and interpret the answer in terms of the model.
- CCSS.Math.Content.HSS-CP.A.3: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Understand the conditional probability of given as (and)/(), and interpret independence of and as saying that the conditional probability of given is the same as the probability of , and the conditional probability of given is the same as the probability of .
- CCSS.Math.Content.HSS-CP.B.6: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Find the

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conditional probability of given as the fraction of s outcomes that also belong to , and interpret the answer in terms of the model.

- CCSS.Math.Content.HSS-CP.A.3: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Understand the conditional probability of given as (and)/(), and interpret independence of and as saying that the conditional probability of given is the same as the probability of , and the conditional probability of given is the same as the probability of .
- CCSS.Math.Content.HSS-CP.B.6: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Find the conditional probability of given as the fraction of s outcomes that also belong to , and interpret the answer in terms of the model.

- **GEOMETRIC PROBABILITIES**
  - CCSS.Math.Content.HSS-MD.B.7: Using Probability to Make Decisions Use probability to evaluate outcomes of decisions Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
  - CCSS.Math.Content.HSS-CP.A.1: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (or, and, not).
  - CCSS.Math.Content.HSS-CP.A.1: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (or, and, not).
  - CCSS.Math.Content.HSS-CP.B.7: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Apply the Addition Rule, (or) = () + () (and), and interpret the answer in terms of the model.
  - CCSS.Math.Content.HSS-CP.A.1: Conditional Probability and the Rules of Probability Understand independence and conditional probability and use them to interpret data Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (or, and, not).
  - CCSS.Math.Content.HSS-CP.B.7: Conditional Probability and the Rules of Probability Use the rules of probability to compute probabilities of compound events in a uniform probability model Apply the Addition Rule, (or) = () + () (and), and interpret the answer in terms of the model.
- **ANALYZING DECISIONS IN PROBABILITY**
  - CCSS.Math.Content.HSS-MD.B.6: Using Probability to Make Decisions Use probability to evaluate outcomes of decisions Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
  - CCSS.Math.Content.HSS-MD.B.7: Using Probability to Make Decisions Use probability to evaluate outcomes of decisions Analyze decisions and strategies using probability concepts (e.g., product

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testing, medical testing, pulling a hockey goalie at the end of a game).

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