

Georgia Tutorials are designed specifically for the Georgia Standards of Excellence and the Georgia Performance Standards to prepare students for the Georgia Milestones.

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.

1. POINTS, LINES, AND ANGLES

● POINTS, RAYS, LINE SEGMENTS, LINES, AND FIGURES

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

● PERPENDICULAR BISECTOR AND ANGLE BISECTOR THEOREMS

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.CO.9** Prove theorems about lines and angles.
- **MGSE9-12.G.CO.10** Prove theorems about triangles.

2. PERPENDICULAR AND PARALLEL LINES

● PARALLEL AND PERPENDICULAR LINES

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.GPE.5** 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).

● PARALLEL LINES AND ANGLE RELATIONSHIPS

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.CO.9** Prove theorems about lines and angles.

3. INTRODUCTION TO COORDINATE GEOMETRY

● SLOPE-INTERCEPT FORM OF A LINEAR EQUATION

- **MGSE9-12.G.GPE.5** 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).

- **LENGTH AND THE DISTANCE FORMULA**

- **MGSE9-12.G.GPE.6** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
- **MGSE9-12.G.GPE.7** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

- **MIDPOINT FORMULA ON THE COORDINATE PLANE**

- **MGSE9-12.G.GPE.6** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **MGSE9-12.G.GPE.7** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

4. COORDINATE GEOMETRY

- **CONJECTURES IN COORDINATE GEOMETRY**

- **MGSE9-12.G.CO.10** Prove theorems about triangles.
- **MGSE9-12.G.GPE.4** Use coordinates to prove simple geometric theorems algebraically.

- **PERIMETER ON THE COORDINATE PLANE**

- **MGSE9-12.G.GPE.7** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **MGSE9-12.G.GPE.4** Use coordinates to prove simple geometric theorems algebraically.

- **AREA ON THE COORDINATE PLANE**

- **MGSE9-12.G.GPE.7** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

5. TRANSFORMATIONS ON THE PLANE

- **TRANSFORMATIONS ON THE COORDINATE PLANE**

- **MGSE9-12.G.CO.2** 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).
- **MGSE9-12.G.CO.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
- **MGSE9-12.G.CO.5** 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.
- **MGSE9-12.G.CO.6** Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
- **MGSE9-12.G.CO.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
- **MGSE9-12.G.SRT.2** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they

are similar; explain, using similarity transformations, the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

- **MGSE9-12.G.SRT.1a** The dilation of a line not passing through the center of the dilation results in a parallel line and leaves a line passing through the center unchanged.
- **MGSE9-12.G.SRT.1b** The dilation of a line segment is longer or shorter according to the ratio given by the scale factor.

● **DILATIONS, TRANSLATIONS, ROTATIONS, AND REFLECTIONS**

- **MGSE9-12.G.CO.5** 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.
- **MGSE9-12.G.CO.6** Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
- **MGSE9-12.G.SRT.2** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain, using similarity transformations, the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
- **MGSE9-12.G.SRT.1a** The dilation of a line not passing through the center of the dilation results in a parallel line and leaves a line passing through the center unchanged.
- **MGSE9-12.G.CO.2** 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).
- **MGSE9-12.G.CO.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
- **MGSE9-12.G.CO.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
- **MGSE9-12.G.SRT.3** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

6. TRIANGLES AND TRANSFORMATIONS

● **TRIANGLES AND CONGRUENCE TRANSFORMATIONS**

- **MGSE9-12.G.CO.6** Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
- **MGSE9-12.G.CO.7** Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
- **MGSE9-12.G.CO.8** Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. (Extend to include HL and AAS.)
- **MGSE9-12.G.CO.10** Prove theorems about triangles.
- **MGSE9-12.G.SRT.5** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

● **TRIANGLES AND SIMILARITY TRANSFORMATIONS**

- **MGSE9-12.G.CO.10** Prove theorems about triangles.
- **MGSE9-12.G.SRT.2** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain, using similarity transformations, the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
- **MGSE9-12.G.SRT.4** Prove theorems about triangles.
- **MGSE9-12.G.SRT.5** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- **MGSE9-12.G.SRT.3** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

7. CONGRUENCE AND SIMILARITY OF OTHER POLYGONS

● **CONGRUENCE OF OTHER POLYGONS**

- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **MGSE9-12.G.CO.5** 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.
- **MGSE9-12.G.CO.6** Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
- **MGSE9-12.G.CO.2** 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).
- **MGSE9-12.G.CO.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

- **SIMILARITY OF OTHER POLYGONS**

- **MGSE9-12.G.SRT.2** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain, using similarity transformations, the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

8. TRIANGLES

- **TRIANGLE ANGLE THEOREMS**

- **MGSE9-12.G.CO.10** Prove theorems about triangles.

- **TRIANGLE BISECTORS**

- **MGSE9-12.G.CO.9** Prove theorems about lines and angles.
- **MGSE9-12.G.CO.10** Prove theorems about triangles.
- **MGSE9-12.G.SRT.5** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- **MGSE9-12.G.SRT.4** Prove theorems about triangles.
- **MGSE9-12.G.CO.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
- **MGSE9-12.G.C.3** Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

- **MEDIANS AND ALTIITUDES OF TRIANGLES**

- **MGSE9-12.G.CO.10** Prove theorems about triangles.

9. QUADRILATERALS AND CONSTRUCTIONS

- **PARALLELOGRAMS AND RECTANGLES**

- **MGSE9-12.G.CO.11** Prove theorems about parallelograms.
- **MGSE9-12.G.MG.1** 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**

- **MGSE9-12.G.CO.11** Prove theorems about parallelograms.
- **MGSE9-12.G.MG.1** 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**

- **MGSE9-12.G.CO.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
- **MGSE9-12.G.CO.13** Construct an equilateral triangle, a square, and a regular hexagon, each inscribed in a circle.
- **MGSE9-12.G.C.4** Construct a tangent line from a point outside a given circle to the circle.

10. RIGHT TRIANGLES

● PYTHAGOREAN THEOREM

- **MGSE9-12.G.SRT.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **MGSE9-12.G.SRT.4** Prove theorems about triangles.
- **MGSE9-12.G.SRT.5** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- **MGSE9-12.G.CO.10** Prove theorems about triangles.

● TRIGONOMETRIC RATIOS

- **MGSE9-12.G.SRT.6** Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
- **MGSE9-12.G.SRT.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- **MGSE9-12.G.SRT.7** Explain and use the relationship between the sine and cosine of complementary angles.
- **MGSE9-12.G.SRT.5** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

11. TRIANGLES AND TRIGONOMETRY

● LAWS OF SINE AND COSINE

- **MGSE9-12.G.SRT.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- **MGSE9-12.G.SRT.7** Explain and use the relationship between the sine and cosine of complementary angles.

● RADIANS AND THE UNIT CIRCLE

- **MGSE9-12.G.C.5** 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.
- **MGSE9-12.G.SRT.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

12. CIRCLES AND CONGRUENT CIRCLES

● CIRCLE BASICS

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.C.2** Identify and describe relationships among inscribed angles, radii, chords, tangents, and secants. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

● CONGRUENT AND SIMILAR CIRCLES

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.C.1** Understand that all circles are similar.

- **MGSE9-12.G.CO.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
- **MGSE9-12.G.CO.6** Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
- **MGSE9-12.G.SRT.2** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain, using similarity transformations, the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

13. CIRCLES AND ANGLES

● CENTRAL ANGLES, INSCRIBED ANGLES, AND CHORDS

- **MGSE9-12.G.C.2** Identify and describe relationships among inscribed angles, radii, chords, tangents, and secants. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.
- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.CO.9** Prove theorems about lines and angles.
- **MGSE9-12.G.C.3** Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
- **MGSE9-12.G.C.5** 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.

● SECANTS, ANGLES, AND INTERCEPTED ARCS

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.CO.9** Prove theorems about lines and angles.
- **MGSE9-12.G.C.2** Identify and describe relationships among inscribed angles, radii, chords, tangents, and secants. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

● TANGENTS, ANGLES, AND INTERCEPTED ARCS

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.CO.9** Prove theorems about lines and angles.
- **MGSE9-12.G.C.2** Identify and describe relationships among inscribed angles, radii, chords, tangents, and secants. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

14. MEASURING CIRCLES

● CIRCUMFERENCE AND ARC LENGTH

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.GMD.1a** Give informal arguments for the formulas of the circumference of a circle and area of a circle using dissection arguments and informal limit arguments.
- **MGSE9-12.G.MG.1** 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

- **MGSE9-12.G.GMD.1a** Give informal arguments for the formulas of the circumference of a circle and area of a circle using dissection arguments and informal limit arguments.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.C.5** 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.

- **CIRCLES**

- **MGSE9-12.G.CO.1** 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.
- **MGSE9-12.G.GPE.1** 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.

15. SURFACE AREA

- **SURFACE AREA AND VOLUME OF SPHERES**

- **MGSE9-12.G.GMD.2** Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
- **MGSE9-12.G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- **MGSE9-12.G.GMD.4** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- **MGSE9-12.G.MG.1** 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 COMPOSITE SOLIDS**

- **MGSE9-12.G.MG.1** 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**

- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

16. VOLUME 1

- **RELATING TWO-DIMENSIONAL FIGURES TO THREE-DIMENSIONAL SOLIDS**

- **MGSE9-12.G.GMD.4** 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**

- **MGSE9-12.G.GMD.2** Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
- **MGSE9-12.G.GMD.1b** Give informal arguments for the formula of the volume of a cylinder, pyramid, and cone using Cavalieri's principle.
- **MGSE9-12.G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **MGSE9-12.G.GMD.4** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

17. VOLUME 2

- **VOLUME OF CYLINDERS AND CONES**

- **MGSE9-12.G.GMD.1b** Give informal arguments for the formula of the volume of a cylinder, pyramid, and cone using Cavalieri's principle.

- **MGSE9-12.G.GMD.2** Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
- **MGSE9-12.G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **MGSE9-12.G.GMD.4** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

- **MODELING SITUATIONS WITH GEOMETRY**

- **MGSE9-12.G.MG.2** Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
- **MGSE9-12.G.MG.3** 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).

18. VOLUME OF SIMILAR AND COMPOSITE SHAPES

- **VOLUME OF COMPOSITE SOLIDS**

- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- **MGSE9-12.G.GMD.2** Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
- **MGSE9-12.G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

- **VOLUME OF SIMILAR SOLIDS**

- **MGSE9-12.G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- **MGSE9-12.G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

19. PROBABILITY

- **INTRODUCTION TO PROBABILITY**

- **MGSE9-12.S.CP.2** Understand that if two events A and B are independent, the probability of A and B occurring together is the product of their probabilities, and that if the probability of two events A and B occurring together is the product of their probabilities, the two events are independent.
- **MGSE9-12.S.CP.1** Describe categories of events as subsets of a sample space using unions, intersections, or complements of other events (or, and, not).
- **MGSE9-12.S.CP.5** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
- **MGSE9-12.S.CP.7** Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answers in context.

- **CONDITIONAL PROBABILITY**

- **MGSE9-12.S.CP.3** Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$. Interpret independence of A and B in terms of conditional probability; that is, the conditional probability of A given B is the same as the probability of A , and the conditional probability of B given A is the same as the probability of B .
- **MGSE9-12.S.CP.5** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
- **MGSE9-12.S.CP.6** Find the conditional probability of A given B as the fraction of B 's outcomes that also belong to A , and interpret the answer in context.
- **MGSE9-12.S.CP.2** Understand that if two events A and B are independent, the probability of A and B occurring together is the product of their probabilities, and that if the probability of two events A and B occurring together is the product of their probabilities, the two events are independent.
- **MGSE9-12.S.CP.4** 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.

- **GEOMETRIC PROBABILITIES**

- **MGSE9-12.G.MG.3** 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).
- **MGSE9-12.S.CP.1** Describe categories of events as subsets of a sample space using unions, intersections, or complements of other events (or, and, not).
- **MGSE9-12.S.CP.7** Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answers in context.