

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.

Unit 1: Polynomials

- **FORMULATING AND SIMPLIFYING ALGEBRAIC EXPRESSIONS**

- G.MP.6: Attend to precision.
- G.PAR.2.1: Interpret polynomial expressions of varying degrees that represent a quantity in terms of its given geometric framework.
- G.MM.1.1: Explain mathematically applicable problems using a mathematical model.
- G.MM.1.4: Use various mathematical representations and structures with this information to represent and solve real-life problems.

- **ADDITION AND SUBTRACTION OF POLYNOMIALS**

- G.PAR.2.3: Using algebraic reasoning, add, subtract, and multiply single variable polynomials.
- G.PAR.2.2: Perform operations with polynomials and prove that polynomials form a system analogous to the integers in that they are closed under these operations.
- G.PAR.2.1: Interpret polynomial expressions of varying degrees that represent a quantity in terms of its given geometric framework.

- **MULTIPLICATION OF POLYNOMIALS**

- G.PAR.2.3: Using algebraic reasoning, add, subtract, and multiply single variable polynomials.
- G.PAR.2.2: Perform operations with polynomials and prove that polynomials form a system analogous to the integers in that they are closed under these operations.
- G.PAR.2.1: Interpret polynomial expressions of varying degrees that represent a quantity in terms of its given geometric framework.

Unit 2: Points, Lines, and Angles

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

- G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.

• PERPENDICULAR BISECTOR AND ANGLE BISECTOR THEOREMS

- G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
- G.GSR.4.4: Prove and apply theorems about lines and angles to solve problems.
- G.GSR.5.4: Construct formal proofs to justify and apply theorems about triangles.
- G.GSR.4.3: Make formal geometric constructions with a variety of tools and methods.
- G.MP.1: Make sense of problems and persevere in solving them.

• CONSTRUCTIONS

- G.GSR.4.3: Make formal geometric constructions with a variety of tools and methods.

Unit 3: Parallel and Perpendicular Lines

• PARALLEL AND PERPENDICULAR LINES

- G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
- G.GSR.4.2: Classify quadrilaterals in the coordinate plane by proving simple geometric theorems algebraically.

• PARALLEL LINES AND ANGLE RELATIONSHIPS

- G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
- G.GSR.4.5: Use geometric reasoning to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle

criterion for similarity of triangles.

- G.GSR.4.4: Prove and apply theorems about lines and angles to solve problems.

Unit 4: Introduction to Coordinate Geometry

• LENGTH AND THE DISTANCE FORMULA

- G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
- G.GSR.5.4: Construct formal proofs to justify and apply theorems about triangles.
- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.

• MIDPOINT FORMULA ON THE COORDINATE PLANE

- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.
- G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.

Unit 5: Coordinate Geometry

• CONJECTURES IN COORDINATE GEOMETRY

- G.GSR.4.4: Prove and apply theorems about lines and angles to solve problems.
- G.GSR.5.4: Construct formal proofs to justify and apply theorems about triangles.
- G.GSR.4.2: Classify quadrilaterals in the coordinate plane by proving simple geometric theorems algebraically.
- G.GSR.8.3: Write and graph the equation of circles in standard form.

• PERIMETER ON THE COORDINATE PLANE

- G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.
- G.GSR.4.2: Classify quadrilaterals in the coordinate plane by proving simple geometric theorems algebraically.

• AREA ON THE COORDINATE PLANE

- G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.

- G.GSR.4.2: Classify quadrilaterals in the coordinate plane by proving simple geometric theorems algebraically.

Unit 6: Transformations on the Plane

• TRANSFORMATIONS ON THE COORDINATE PLANE

- G.GSR.5.1: Verify experimentally the properties of dilations.
- G.GSR.3.1: Use geometric reasoning and symmetries of regular polygons to develop definitions of rotations, reflections, and translations.
- G.GSR.3.3: Use geometric descriptions of rigid motions to draw the transformed figures and to predict the effect on a given figure. Describe a sequence of transformations from one figure to another and use transformation properties to determine congruence.
- G.GSR.3.2: Verify experimentally the congruence properties of rotations, reflections, and translations: lines are taken to lines and line segments to line segments of the same length; angles are taken to angles of the same measure; parallel lines are taken to parallel lines.
- G.GSR.5.2: Given two figures, use and apply the definition of similarity in terms of similarity transformations.

• DILATIONS, TRANSLATIONS, ROTATIONS, AND REFLECTIONS

- G.GSR.3.1: Use geometric reasoning and symmetries of regular polygons to develop definitions of rotations, reflections, and translations.
- G.GSR.3.3: Use geometric descriptions of rigid motions to draw the transformed figures and to predict the effect on a given figure. Describe a sequence of transformations from one figure to another and use transformation properties to determine congruence.
- G.GSR.5.1: Verify experimentally the properties of dilations.
- G.GSR.5.2: Given two figures, use and apply the definition of similarity in terms of similarity transformations.
- G.GSR.3.2: Verify experimentally the congruence properties of rotations, reflections, and translations: lines are taken to lines and line segments to line segments of the same length; angles are taken to angles of the same measure; parallel lines are taken to parallel lines.

Unit 7: Triangles and Transformations

• TRIANGLES AND CONGRUENCE TRANSFORMATIONS

- G.GSR.5.4: Construct formal proofs to justify and apply theorems about triangles.
- G.GSR.3.1: Use geometric reasoning and symmetries of regular polygons to develop definitions of rotations, reflections, and translations.
- G.GSR.3.3: Use geometric descriptions of rigid motions to draw the transformed figures and to predict the effect on a given figure. Describe a sequence of transformations from one figure to another and use transformation properties to determine congruence.

- G.GSR.3.4: Explain how the criteria for triangle congruence follow from the definition of congruence in terms of rigid motions. Use congruency criteria for triangles to solve problems and to prove relationships in geometric figures.
- G.GSR.3.2: Verify experimentally the congruence properties of rotations, reflections, and translations: lines are taken to lines and line segments to line segments of the same length; angles are taken to angles of the same measure; parallel lines are taken to parallel lines.
- **TRIANGLE CONGRUENCE**
 - G.GSR.3.4: Explain how the criteria for triangle congruence follow from the definition of congruence in terms of rigid motions. Use congruency criteria for triangles to solve problems and to prove relationships in geometric figures.
- **TRIANGLES AND SIMILARITY TRANSFORMATIONS**
 - G.GSR.4.5: Use geometric reasoning to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
 - G.GSR.5.4: Construct formal proofs to justify and apply theorems about triangles.
 - G.GSR.5.3: Use the properties of similarity transformations to establish criterion for two triangles to be similar. Use similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
 - G.GSR.5.2: Given two figures, use and apply the definition of similarity in terms of similarity transformations.

Unit 8: Congruence and Similarity of Other Polygons

- **CONGRUENCE OF OTHER POLYGONS**
 - G.GSR.3.3: Use geometric descriptions of rigid motions to draw the transformed figures and to predict the effect on a given figure. Describe a sequence of transformations from one figure to another and use transformation properties to determine congruence.
 - G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.
 - G.GSR.3.1: Use geometric reasoning and symmetries of regular polygons to develop definitions of rotations, reflections, and translations.
 - G.GSR.3.2: Verify experimentally the congruence properties of rotations, reflections, and translations: lines are taken to lines and line segments to line segments of the same length; angles are taken to angles of the same measure; parallel lines are taken to parallel lines.
- **SIMILARITY OF OTHER POLYGONS**
 - G.GSR.5.2: Given two figures, use and apply the definition of similarity in terms of similarity transformations.
 - G.GSR.3.3: Use geometric descriptions of rigid motions to draw the transformed figures and to predict the effect on a given figure. Describe a sequence of transformations from one figure to another and

use transformation properties to determine congruence.

Unit 9: Triangles

• TRIANGLE ANGLE THEOREMS

- G.GSR.4.5: Use geometric reasoning to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
- G.GSR.5.4: Construct formal proofs to justify and apply theorems about triangles.

• TRIANGLE BISECTORS

- G.GSR.4.4: Prove and apply theorems about lines and angles to solve problems.
- G.GSR.5.4: Construct formal proofs to justify and apply theorems about triangles.
- G.GSR.8.1: Identify and apply angle relationships formed by chords, tangents, secants and radii with circles.
- G.GSR.4.3: Make formal geometric constructions with a variety of tools and methods.

• MEDIANS AND ALTITUDES OF TRIANGLES

- G.GSR.5.4: Construct formal proofs to justify and apply theorems about triangles.

Unit 10: Triangles and Trigonometry

• PYTHAGOREAN THEOREM

- G.GSR.6.3: Use trigonometric ratios and the Pythagorean Theorem to solve for sides and angles of right triangles in applied problems.
- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.
- G.GSR.5.4: Construct formal proofs to justify and apply theorems about triangles.
- G.GSR.5.3: Use the properties of similarity transformations to establish criterion for two triangles to be similar. Use similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

• TRIGONOMETRIC RATIOS

- G.GSR.6.1: Explain 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.GSR.6.3: Use trigonometric ratios and the Pythagorean Theorem to solve for sides and angles of right triangles in applied problems.
- G.GSR.6.2: Explain and use the relationship between the sine and cosine of complementary angles.
- G.GSR.4.5: Use geometric reasoning to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

- G.GSR.5.3: Use the properties of similarity transformations to establish criterion for two triangles to be similar. Use similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.
- **RADIANS AND THE UNIT CIRCLE**
 - G.MP.6: Attend to precision.
 - G.GSR.7.2: Explore and explain the relationship between radian measures and degree measures and convert fluently between degree and radian measures.
 - G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
 - G.GSR.7.1: Explore and interpret a radian as the ratio of the arc length to the radius of a circle.
 - G.GSR.7.3: Use special right triangles on the unit circle to determine the values of sine, cosine, and tangent for 30 ($/6$), 45 ($/4$) and 60 ($/3$) angle measures. Use reflections of triangles to determine reference angles and identify coordinate values in all four quadrants of the coordinate plane.
 - G.GSR.7.3: Use special right triangles on the unit circle to determine the values of sine, cosine, and tangent for 30 ($/6$), 45 ($/4$) and 60 ($/3$) angle measures. Use reflections of triangles to determine reference angles and identify coordinate values in all four quadrants of the coordinate plane.

Unit 11: Introduction to Circles

- **CIRCLE BASICS**
 - G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
 - G.GSR.8.1: Identify and apply angle relationships formed by chords, tangents, secants and radii with circles.
 - G.GSR.4.4: Prove and apply theorems about lines and angles to solve problems.
- **CENTRAL ANGLES, INSCRIBED ANGLES, AND CHORDS**
 - G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
 - G.GSR.8.1: Identify and apply angle relationships formed by chords, tangents, secants and radii with circles.
 - G.GSR.4.4: Prove and apply theorems about lines and angles to solve problems.

Unit 12: Circles and Angles

- **SECANTS, ANGLES, AND INTERCEPTED ARCS**

- G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
- G.GSR.8.1: Identify and apply angle relationships formed by chords, tangents, secants and radii with circles.
- G.GSR.4.4: Prove and apply theorems about lines and angles to solve problems.
- **TANGENTS, ANGLES, AND INTERCEPTED ARCS**
 - G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
 - G.GSR.8.1: Identify and apply angle relationships formed by chords, tangents, secants and radii with circles.
 - G.GSR.4.4: Prove and apply theorems about lines and angles to solve problems.

Unit 13: Measuring Circles

- **CIRCUMFERENCE AND ARC LENGTH**
 - G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
 - G.GSR.8.2: Using similarity, derive the fact that the length of the arc (arc length) intercepted by an angle is proportional to the radius; derive the formula for the area of a sector. Solve mathematically applicable problems involving applications of arc length and area of sector.
 - G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.
- **AREA OF CIRCLES AND SECTORS**
 - G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.
 - G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.
 - G.GSR.8.2: Using similarity, derive the fact that the length of the arc (arc length) intercepted by an angle is proportional to the radius; derive the formula for the area of a sector. Solve mathematically applicable problems involving applications of arc length and area of sector.
- **CIRCLES**
 - G.GSR.4.1: Use the undefined notions of point, line, line segment, plane, distance along a line segment, and distance around a circular arc to develop and use precise definitions and symbolic notations to prove theorems and solve geometric problems.

- G.GSR.8.3: Write and graph the equation of circles in standard form.

Unit 14: Volume 1

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

- G.GSR.9.1: Use volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems including right and oblique solids.

- **VOLUME OF PRISMS AND PYRAMIDS**

- G.GSR.9.1: Use volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems including right and oblique solids.
- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.

Unit 15: Volume 2

- **VOLUME OF CYLINDERS AND CONES**

- G.GSR.9.1: Use volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems including right and oblique solids.
- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.

- **SURFACE AREA AND VOLUME OF SPHERES**

- G.GSR.9.1: Use volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems including right and oblique solids.
- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.

- **MODELING SITUATIONS WITH GEOMETRY**

- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.
- G.GSR.9.3: Apply concepts of density based on area and volume in modeling situations.

Unit 16: Volume of Similar and Composite Shapes

- **VOLUME OF COMPOSITE SOLIDS**

- G.GSR.9.1: Use volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems including right and oblique solids.
- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.
- G.MP.1: Make sense of problems and persevere in solving them.

- **VOLUME OF SIMILAR SOLIDS**

- G.GSR.9.1: Use volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems including right and oblique solids.

- G.GSR.9.2: Use geometric shapes, their measures, and their properties to describe objects and approximate volumes.

Unit 17: Probability

- **INTRODUCTION TO PROBABILITY**

- G.PR.10.2: Apply and interpret the general Multiplication Rule conceptually to independent events of a sample space, (and) = () () using contingency tables or tree diagrams.
- G.PR.10.1: Describe categories of events as subsets of a sample space using unions, intersections, or complements of other events. Apply the Addition Rule conceptually, (or) = () + () (and), and interpret the answers in context.

- **CONDITIONAL PROBABILITY**

- G.PR.10.2: Apply and interpret the general Multiplication Rule conceptually to independent events of a sample space, (and) = () () using contingency tables or tree diagrams.
- G.DSR.11.1: Construct and summarize categorical data for two categories in two-way frequency tables.
- G.DSR.11.2: Use categorical data in two-way frequency tables to calculate and interpret probabilities based on the investigation.
- G.PR.10.1: Describe categories of events as subsets of a sample space using unions, intersections, or complements of other events. Apply the Addition Rule conceptually, (or) = () + () (and), and interpret the answers in context.

- **GEOMETRIC PROBABILITIES**

- G.PR.10.1: Describe categories of events as subsets of a sample space using unions, intersections, or complements of other events. Apply the Addition Rule conceptually, (or) = () + () (and), and interpret the answers in context.
- G.PR.10.1: Describe categories of events as subsets of a sample space using unions, intersections, or complements of other events. Apply the Addition Rule conceptually, (or) = () + () (and), and interpret the answers in context.
- G.GSR.8.2: Using similarity, derive the fact that the length of the arc (arc length) intercepted by an angle is proportional to the radius; derive the formula for the area of a sector. Solve mathematically applicable problems involving applications of arc length and area of sector.

Unit 18: Probability Concepts

- **COMBINATIONS AND PERMUTATIONS**

- G.PR.10.4: Define permutations and combinations and apply this understanding to compute probabilities of compound events and solve meaningful problems.

- **ANALYZING DECISIONS IN PROBABILITY**

- G.PR.10.8: Compare the payoff values associated with the probability distribution for a random variable and make informed decisions based on expected value and measures of variability.

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- G.PR.10.5: Interpret the probability distribution for a given random variable and interpret the expected value.
 - G.PR.10.6: Develop a probability distribution for variables of interest using theoretical and empirical (observed) probabilities and calculate and interpret the expected value.
 - G.PR.10.7: Calculate the expected value of a random variable and interpret it as the mean of a given probability distribution.
 - G.PR.10.3: Use conditional probability to interpret risk in terms of decision-making and investigate questions such as those involving false positives or false negatives from screening tests.
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