Geometry With Trigonometry Course Overview

Content Area: **Math**
Course(s): **GEOMETRY WITH TRIGONOMETRY, GEO. W/TRIG**
Time Period:
Length: **Full Year**
Status: **Published**

Cover

EAST BRUNSWICK PUBLIC SCHOOLS

East Brunswick New Jersey

Superintendent of Schools

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Mathematics

Geometry with Trigonometry-Course Number: 2172

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Course Overview

COURSE DESCRIPTION:

This course develops an understanding of Euclidean geometry using basic properties, postulates and theorems in the study of triangles, quadrilaterals, and congruence. Other topics include geometric probability, similarity, circles, area, volume, coordinate geometry, transformational geometry, and an introduction to the trigonometric functions and their applications in the right triangle. Software applications such as *Geometer's Sketchpad* will also be integrated into the course as a supplementary resource to help facilitate student discovery and investigation. This is one of two courses in which students are enabled and expected to demonstrate mastery of some of the algebraic standards for mathematical content, the other course being Geometry with Trigonometry Honors. The Standards for Mathematical Practices are embedded within the instructional strategies, and not delineated specifically by unit.

Textbooks and other resources

Textbook: Text: Glencoe Geometry by Carter (2012)

- Teacher's Resource Package and online resources accompanying text
- *Geometer's Sketchpad* software package
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Scope and Sequence

Unit	Learning Goals	Marking period
UNIT 1 Foundations	**Learning Goal 1** Use the undefined notion of a point, line, and distance along a line to develop definitions for angles, perpendicular lines and line segments. **Learning Goal 2** Construct and explain formal proofs of theorems involving lines, angles, triangles, and parallelograms. **Learning Goal 3** Find the point on a directed line segment between two given points that partitions the segment in a given ratio and use coordinates to compute perimeters of polygons. **Learning Goal 4** Make formal constructions using a variety of tools (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.) and methods.	MP 1
UNIT 2 Parallel Lines	**Learning Goal 1** Use the undefined notion of a point, line, and distance along a line to develop definitions for parallel lines. **Learning Goal 2** Construct and explain formal proofs of theorems involving lines and angles. **Learning Goal 3** Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. **Learning Goal 4** Make formal constructions using a variety of tools (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.) and methods.	MP 1

UNIT 3 Transformations	**Learning Goal 1** Represent transformations in the plane using transparencies, and describe and explain transformations as functions. **Learning Goal 2** Develop formal definitions of rotations, reflections, and translations. **Learning Goal 3** Draw transformed figures using graph paper, tracing paper, and/or geometry software and identify a sequence of transformations required in order to map one figure onto another. **Learning Goal 4** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself, and identify lines of symmetry. **Learning Goal 5** Use rigid transformations to determine and explain congruence of geometric figures. **Learning Goal 6** Identify the three-dimensional figures created by the rotation of two-dimensional objects.	MP 1 & 2
UNIT 4 Triangle Congruence	**Learning Goal 1** Use rigid transformations to determine and explain congruence of geometric figures **Learning Goal 2** Show and explain that two triangles are congruent by using corresponding pairs of sides and corresponding pairs of angles, and by using rigid motions (transformations). **Learning Goal 3** Use congruence criteria for triangles to solve problems and to prove relationships in geometric figures.	MP 2
UNIT 5 Properties of Triangles	**Learning Goal 1** Construct and explain formal proofs of theorems involving triangles. **Learning Goal 2** Use coordinates to compute perimeters and areas of triangles. **Learning Goal 3** Make formal constructions using a variety of tools and methods.	MP 2
UNIT 6 Similarity	**Learning Goal 1** Verify the properties of dilations given by a center and scale factor. **Learning Goal 2** Use the definition of similarity in terms of similarity transformations to decide if two given figures are similar and explain, using similarity transformations, the meaning of	MP 3

	triangle similarity. **Learning Goal 3** Use similarity criteria for triangles to solve problems and to prove relationships in geometric figures. **Learning Goal 4** Prove theorems about triangles. **Learning Goal 5** Model real-world objects with geometric shapes based upon their measures and properties, and solve problems.	
UNIT 7 Right Triangles and Trigonometry	**Learning Goal 1** Show and explain that definitions for trigonometric ratios derive from similarity of right triangles. **Learning Goal 2** Explain and use the relationship between the sine and cosine of complementary angles; use trigonometric ratios and the Pythagorean Theorem to compute all angle measures and side lengths of triangles in applied problems. **Learning Goal 3** Model real-world objects with right triangles based upon their measures and properties, and solve problems.	MP 3
UNIT 8 Circles	**Learning Goal 1** Use the undefined notion of a point, line, distance along a line and distance around a circular arc to develop definitions for circles. **Learning Goal 2** Identify and describe relationships among inscribed angles, radii, and chords; use these relationships to solve problems. **Learning Goal 3** Derive the equation of a circle of given the center and radius using the Pythagorean Theorem. Given an equation, complete the square to find the center and radius of the circle. **Learning Goal 4** Find arc lengths and areas of sectors of circles. Derive the formula for the area of a sector. **Learning Goal 5** Prove the properties of angles for a quadrilateral inscribed in a circle. **Learning Goal 6** Use coordinates to prove simple geometric theorems algebraically.	MP 3 & 4

	Learning Goal 7 Develop informal arguments for the formula for circumference and area of a circle.	
UNIT 9 Quadrilaterals	**Learning Goal 1** Construct and explain formal proofs of theorems involving parallelograms. **Learning Goal 2** Use coordinates to prove simple geometric theorems algebraically. **Learning Goal 3** Use coordinates to compute perimeters and areas of rectangles.	MP 4
UNIT 10 Three Dimensional Figures	**Learning Goal 1** Model real-world objects with geometric shapes based upon their measures and properties, and solve problems using volume formulas for cylinders, pyramids, cones, and spheres. Identify cross-sections and three-dimensional figures. **Learning Goal 2** Using Cavalieri's principle, develop informal arguments for formulas for the volume of a cylinder, pyramid, and cone. **Learning Goal 3** Apply concepts of density based on volume and modeling situations.	MP 4

NJ Student Learning Standards

MA.G-C.A.1	Prove that all circles are similar.
MA.G-C.A.2	Identify and describe relationships among inscribed angles, radii, and chords.
MA.G-C.A.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
MA.G-C.A.4	Construct a tangent line from a point outside a given circle to the circle.
MA.G-C.B	Find arc lengths and areas of sectors of circles
MA.G-C.B.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.
MA.G-CO.A.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.
MA.G-CO.A.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).
MA.G-CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
MA.G-CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles,

	perpendicular lines, parallel lines, and line segments.
MA.G-CO.A.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.
MA.G-CO.B.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.
MA.G-CO.B.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.
MA.G-CO.C.9	Prove theorems about lines and angles.
MA.G-CO.C.10	Prove theorems about triangles.
MA.G-CO.C.11	Prove theorems about parallelograms.
MA.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
MA.G-MG.A.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).
MA.G-MG.A.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).
MA.S-CP.A.1	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”).
MA.S-CP.A.2	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
MA.S-CP.A.3	Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that 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.
MA.S-CP.B.7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.
MA.S-CP.B.9	Use permutations and combinations to compute probabilities of compound events and solve problems.
MA.S-MD.B.6	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
MA.S-MD.B.7	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
MA.G-GMD.A.1	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.
MA.G-GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
MA.G-GMD.B.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.
MA.G-GPE.A.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.
MA.G-GPE.B.4	Use coordinates to prove simple geometric theorems algebraically.
MA.G-GPE.B.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).
MA.G-GPE.B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
MA.G-GPE.B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
MA.G-SRT.A.1	Verify experimentally the properties of dilations given by a center and a scale factor:
MA.G-SRT.A.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.
MA.G-SRT.A.1a	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.
MA.G-SRT.A.1b	The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
MA.G-SRT.B.4	Prove theorems about triangles.
MA.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
MA.G-SRT.C.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.
MA.G-SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.
MA.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
MA.G-SRT.D.9	Derive the formula $A = (1/2)ab\ sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
MA.G-SRT.D.10	Prove the Laws of Sines and Cosines and use them to solve problems.
MA.G-SRT.D.11	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).

Standards for Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Grading and Evaluation Guidelines

GRADING GUIDELINES:

As per Math Department Policy, grades will be determined by a variety of assessment strategies, including

Major Assessments, Minor Assessments, and Performance Assessments. In addition to tests and quizzes, students will be evaluated on a combination of performance assessment instruments, including homework completions, cooperative group participation, note-taking, open ended question responses, lab reports and/or supplemental projects.

GRADING PROCEDURES:

Grading procedures must be described in sufficient detail so that a pupil will understand, the minimal to advanced proficiency, expected of him/her as the outcome of each unit, for the marking period and for the course as a whole. Benchmark level assessments associated with the course also need to be identified. While assessments of proficiency levels must be valid and reliable they do not need be the same for all students. Other criteria to be considered in grading must be identified and the degree to which such criteria will be considered in a grade. Each pupil must receive a copy of the grading procedures, proficiencies and criteria for each unit and/or marking period.

COURSE EVALUATION:

Course achievement will be evaluated as the percent of all pupils who achieve the minimum level of proficiency (final average grade) in the course. Student achievement levels above minimum proficiency will also be reported. Final grades, and where relevant mid-term and final exams, will be analyzed by staff for the total cohort and for sub-groups of students to determine course areas requiring greater support or modification.

In terms of proficiency the East Brunswick grades are as follows:

A	**Excellent**	**Advanced Proficient**
B	**Good**	**Above Average Proficient**
C	**Fair**	**Proficient**
D	**Poor**	**Minimally Proficient**
F	**Failing**	**Partially Proficient**

In this course the goal is that a minimum of 95% of the pupil's will meet at least the minimum proficiency level (D or better) set for the course. The department will analyze the achievement of students on Unit Assessments, Mid-term and Final Exams and Final Course Grades, and for Final Course Grades the achievement of sub-groups identified by the state to determine if modifications in the curriculum and instructional methods are needed.

Course evaluation requires the answering of the following questions:
1. Are course content, instruction and assessments aligned with the required NJSLS? 2. Is instruction sufficient for students to achieve the Standards? 3. Do all students achieve the set proficiencies/benchmarks set for the course?

Other Details

SCED

02072 Geometry with Trigonometry

Geometry with Trigonometry course work is meant to formalize and extend student geometric experiences in the middle grades. Transformations are presented early in the year to assist with the building of conceptual understandings of the geometric concepts. Triangle congruence conditions are established using analysis of rigid motion and formal constructions. Various formats will be used to prove theorems about angles, lines, triangles and other polygons. This will lead to the study of dilations and proportional reasoning to develop a formal understanding of similarity which in turn will be linked to right triangle trigonometry. Additional topics include circles and their parts, two and three-dimensional measurement and an application of geometric probability.