

Curriculum Development
In the Fairfield Public Schools

FAIRFIELD PUBLIC SCHOOLS
FAIRFIELD, CONNECTICUT

GEOMETRY 21

Board of Education Approved February 28, 2006

GEOMETRY 21

Statement of Purpose

Geometry 21 is offered for students to learn geometry in an independent setting to focus on analyzing and using spatial relationships and basic concepts of geometry to draw, measure, and compare geometric models and their transformations. This course will incorporate formal proofs as students make use of geometric relationships and patterns to solve real world problems.

Audience

Geometry 21 is intended for grade 9 and 10 honors students.

Prerequisites

Geometry 21 requires successful completion of grade 8 Algebra with a B+ or better or Algebra 12 with grade of A or A+. Teacher recommendation also required.

Course Description

Geometry 21 offers accelerated coursework with emphasis on concepts of mathematical structure and formal proof (postulates, theorems and corollaries). The properties of 1, 2, and 3 dimensional figures will be investigated and algebraic skills and concepts will be applied to geometric relationships (e.g., a study of points, lines, angles, and polygons on a plane surface and in space.) The study of coordinate geometry is integrated throughout the course. In addition, students will perform constructions with compass and straightedge, logic and truth tables and indirect reasoning.

Course Objectives

Students will be able to:

- demonstrate an understanding of the language of geometry.
- use inductive and deductive reasoning to make conjectures and conclusions.
- solve problems using the relationships of angles formed by parallel lines and their transversals.
- demonstrate an understanding of congruent and similar polygons.
- use triangles to model and problem solve real-world situations.
- apply the properties of special polygons and circles in problem solving.
- calculate the measure of one, two, and three-dimensional figures.
- recognize and use properties of transformations with geometric figures.

Skill Objectives

Students will:

- graph ordered pairs on a coordinate plane.
- identify and draw models of point, lines, and planes.
- identify collinear and coplanar points and intersecting lines and planes.
- find the distance between two points in a number line.
- find the distance between points in a coordinate plane.
- find the midpoint of a segment.

- identify and use congruent segments.
- identify and use parts of angles.
- use the angle addition postulate to find the measure of angles.
- classify angles as acute, obtuse, right and straight.
- identify and use congruent angles and the bisector of an angle.
- identify and use adjacent angles, vertical angles, linear pairs of angles, and supplementary angles.
- identify and use right angles and perpendicular lines.
- determine what information can and cannot be assumed from a figure.
- make geometric conjectures based on inductive reasoning.
- identify the hypothesis and conclusion of an “if-then” statement.
- write the converse of an “if-then” statement.
- write the inverse, contra-positive, and negation of an “if-then” statement.
- identify and use the basic postulates about points, lines and planes.
- use properties of equality in algebraic and geometric proofs.
- use the principles of logic to create valid arguments.
- display the validity of logical statements using truth tables.
- describe the relationships between two lines and between two planes.
- identify the relationships among pairs of angles formed by pairs of lines and transversals.
- use the properties of parallel lines to determine angle measures.
- recognize angle conditions that produce parallel lines.
- prove two lines parallel based on given angle relationships.
- find the slope of a line.
- use slope to identify parallel and perpendicular lines.
- recognize and use distance relationships among points, lines and planes.
- identify the parts of a triangle.
- classify triangles.
- apply the angle sum theorem.
- apply the exterior angle theorem.
- identify congruent triangles.
- name and label corresponding parts of congruent triangles.
- use SAS, SSS, and ASA postulates to test for triangle congruence.
- use AAS theorem to test for triangle congruence.
- use properties of isosceles and equilateral triangles.
- identify and use medians, altitudes, angle bisectors, perpendicular bisectors, and midsegments in a triangle.
- recognize and use tests for congruence of right triangles.
- use indirect reasoning and indirect proof to reach a conclusion.
- recognize and apply the properties of inequalities to the measures of segments and angles.
- apply the triangle inequality theorem.
- recognize and define a parallelogram.
- recognize, use and prove the properties of a parallelogram.

- recognize and apply the conditions that ensure that a quadrilateral is a parallelogram.
- recognize the properties of rectangles.
- use properties of rectangles in proofs.
- recognize the properties of squares and rhombi.
- use properties of squares and rhombi in proofs.
- recognize the properties of trapezoids.
- use properties of trapezoids in proofs and other problems.
- recognize and use ratios and proportions.
- apply and use the properties of proportions.
- identify similar figures.
- solve problems involving similar figures.
- identify similar triangles.
- use similar triangles to solve problems.
- use self-similarity and iteration to build fractal designs.
- use the Pythagorean Theorem and its converse.
- use the properties of 45-45-90 and 30-60-90 triangles.
- express trigonometric ratios as fractions or decimals.
- recognize trigonometric relationships from right triangles.
- use a calculator to find values of trigonometric ratios or measures of angles.
- recognize angles of depression or elevation.
- use trigonometry to solve triangles.
- name parts of circles.
- determine relationships between lines and circles.
- write an equation of a circle in the coordinate plane.
- find the measures of arcs and central angles.
- recognize and find the measure of inscribed angles.
- use properties of inscribed figures.
- recognize and find the measure of angles by secants and tangents of circles.
- recognize and find the measure of segments related to circles, including secant-secant, secant-tangent, and chord-chord segments.
- identify and name polygons.
- identify faces, edges, and vertices of a polyhedron.
- find the sum of the measures of the interior and exterior angles of a convex polygon.
- find the measure of each interior and exterior angle of a regular polygon.
- use angle measures of polygons in problem solving.
- find areas of parallelograms.
- find the areas of triangles, rhombi, and trapezoids.
- find the area of regular polygons.
- find the circumference and area of circles and sectors.
- use area and length to solve problems involving geometric probability.
- create, draw, and fold three-dimensional figures.
- make two-dimensional nets for three-dimensional solids.

- identify parts of prisms and cylinders.
- find the lateral areas and surface areas of right prisms and right cylinders.
- find the lateral area of a regular pyramid.
- find the lateral area and surface area of a right circular cone.
- find the volume of a right prism and a right cylinder.
- find the volume of a pyramid and a circular cone.
- recognize and define basic properties of spheres.
- find the surface area of a sphere.
- find the volume of a sphere.
- calculate, develop, and apply algebraic formulas of slope, distance, and midpoint.
- prove theorems using coordinate proofs.
- name the image and preimage of a mapping.
- recognize an isometry or congruence transformation.
- name a reflection image with respect to a line.
- recognize line symmetry and point symmetry.
- draw reflection images, lines of symmetry, and points of symmetry.
- name and draw translation images of figures.
- name and draw rotation images of figures.
- use scale factors to determine if a dilation is an enlargement, a reduction, or a congruence transformation.
- find the center and scale factor for a given dilation.
- find the dilation image for a given center and scale factor.

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

2.2b Students should solve proportional reasoning problems.

Extended

2.2a Students should investigate mathematical properties and operations related to objects that are not numbers.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.1b Students should explore non-Euclidean Geometries.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

Extended

3.2a Students should use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technology.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Core

3.3a Students should solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.

Extended

3.3a Students should approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

Working with Data: Probability and Statistics - Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.

4.3 Students should understand and apply basic concepts of probability.

Core

4.3a Students should understand and apply the principles of probability in a variety of situations.

Information and Technology Standards (to be added)

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions

- How does geometry model the physical world?
- How are appropriate techniques, tools, and formulas used in geometry to determine measurements?
- How can the language of geometry be used to communicate mathematical ideas coherently and precisely?
- How can a variety of appropriate strategies be applied in solving geometric problems?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How does algebra relate to geometry graphically?
- How does the language of geometry provide immediate experience with the physical world?
- How do reasoning and proofs provide the ideas and concepts that lead to an understanding of the deductive nature of geometry?
- How can various types of reasoning be used to make, investigate, and prove mathematical conjectures?
- How do parallel lines, transversals, and related angles model the physical world?
- How does the geometric principle of congruence in triangles apply to the real world?
- How do triangles, their sides, angles, and special segments model the physical world?
- How does the set of quadrilaterals and their properties model the world around us?
- How is similarity used to measure indirectly and explore comparable objects?
- How is trigonometry used to understand the functional and aesthetic uses of right triangles?
- How do circles and their parts relate to the physical world?
- How do the calculations and concepts of area and volume relate to two and three dimensional objects?
- How do the algebraic formulas of slope, midpoint, and distance relate to geometry graphically?
- How do transformations provide a way of studying figures?

UNITS OF STUDY

1. The Language of Geometry

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Extended

3.3a Students should approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions

- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How does geometry model the physical world?
- How can the language of geometry be used to communicate mathematical ideas coherently and precisely?
- How does the language of geometry provide immediate experience with the physical world?

Core Topics

- Undefined terms of geometry: point, line, plane
- Definitions of geometrical terms
- Postulates
- Measuring length and angles

Unit Objective

Students will be able to:

- demonstrate an understanding of the language of geometry.

Skill Objectives

Students will:

- graph ordered pairs on a coordinate plane.
- identify and draw models of point, lines, and planes.
- identify collinear and coplanar points and intersecting lines and planes.
- find the distance between two points in a number line.
- find the distance between points in a coordinate plane.
- find the midpoint of a segment.
- identify and use congruent segments.
- identify and use parts of angles.
- use the angle addition postulate to find the measure of angles.
- classify angles as acute, obtuse, right and straight.
- identify and use congruent angles and the bisector of an angle.
- identify and use adjacent angles, vertical angles, linear pairs of angles, and supplementary angles.
- identify and use right angles and perpendicular lines.
- determine what information can and cannot be assumed from a figure.

Sample Assessment

Crossing Geometry

Pacing

2 weeks

2. Reasoning and Proof

Math Standards

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

Essential Question

- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions

- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How do reasoning and proofs provide the ideas and concepts that lead to an understanding of the deductive nature of geometry?
- How can various types of reasoning be used to make, investigate, and prove mathematical conjectures?

Core Topics

- Introduction to Proofs
- Theorems

Unit Objective

Students will be able to:

- use inductive and deductive reasoning to make conjectures and conclusions.

Skill Objectives

Students will:

- make geometric conjectures based on inductive reasoning.
- identify the hypothesis and conclusion of an “if-then” statement.
- write the converse of an “if-then” statement.
- write the inverse, contra-positive, and negation of an “if-then” statement.

- identify and use the basic postulates about points, lines and planes.
- use properties of equality in algebraic and geometric proofs.
- use the principles of logic to create valid arguments.
- display the validity of logical statements using truth tables.

Sample Assessment

Murder Mystery

Pacing

5 weeks

3. Parallels

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

Extended

2.2a Students should investigate mathematical properties and operations related to objects that are not numbers.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.1b Students should explore non-Euclidean Geometries.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions

- How does geometry model the physical world?
- How can a variety of appropriate strategies be applied in solving geometric problems?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How does algebra relate to geometry graphically?
- How do parallel lines, transversals, and related angles model the physical world?

Core Topics

- Parallel lines
- Transversals and their related angles
- Proofs proving lines are parallel

Unit Objective

Students will be able to:

- solve problems using the relationships of angles formed by parallel lines and their transversals.

Skill Objectives

Students will:

- describe the relationships between two lines and between two planes.
- identify the relationships among pairs of angles formed by pairs of lines and transversals.
- use the properties of parallel lines to determine angle measures.
- recognize angle conditions that produce parallel lines.
- prove two lines parallel based on given angle relationships.
- find the slope of a line.
- use slope to identify parallel and perpendicular lines.
- recognize and use distance relationships among points, lines and planes.

Sample Assessment

Ferris Wheel

Pacing

3 weeks

4. Congruent triangles

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

Extended

2.2a Students should investigate mathematical properties and operations related to objects that are not numbers.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Core

3.3a Students should solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.

Extended

3.3a Students should approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions

- How does geometry model the physical world?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How does the geometric principle of congruence in triangles apply to the real world?

Core Topics

- Congruent polygons
- Congruent triangles
- Proving triangles congruent

Unit Objective

Students will be able to:

- demonstrate an understanding of congruent and similar polygons.

Skill Objectives

Students will:

- identify the parts of a triangle.
- classify triangles.
- apply the angle sum theorem.
- apply the exterior angle theorem.
- identify congruent triangles.
- name and label corresponding parts of congruent triangles.
- use SAS, SSS, and ASA postulates to test for triangle congruence.
- use AAS theorem to test for triangle congruence.
- use properties of isosceles and equilateral triangles.

Sample Assessment

Buried Treasure

Pacing

3 weeks

5. Triangles

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

2.2b Students should solve proportional reasoning problems.

Extended

2.2a Students should investigate mathematical properties and operations related to objects that are not numbers.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Core

3.3a Students should solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.

Extended

3.3a Students should approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions

- How does geometry model the physical world?
- How can a variety of appropriate strategies be applied in solving geometric problems?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How do triangles, their sides, angles, and special segments model the physical world?

Core Topics

- Special line segments of a triangle
- Right triangle congruence
- Indirect reasoning
- Inequalities in a triangle

Unit Objective

Students will be able to:

- use triangles to model and problem solve real-world situations.

Skill Objectives

Students will:

- identify and use medians, altitudes, angle bisectors, perpendicular bisectors, and midsegments in a triangle.
- recognize and use tests for congruence of right triangles.
- use indirect reasoning and indirect proof to reach a conclusion.
- recognize and apply the properties of inequalities to the measures of segments and angles.
- apply the triangle inequality theorem.

Sample Assessment

Amusement Park

Pacing

2 weeks

6. Quadrilaterals

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

Extended

2.2a Students should investigate mathematical properties and operations related to objects that are not numbers.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

Extended

3.2a Students should use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technology.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Core

3.3a Students should solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.

Extended

3.3a Students should approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions

- How does geometry model the physical world?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How can a variety of appropriate strategies be applied in solving geometric problems?
- How does the set of quadrilaterals and their properties mode the world around us?

Core Topics

- Parallelograms, rectangles, squares, rhombi, trapezoids
- Proving a quadrilateral is a special one

Unit Objective

Students will be able to:

- apply the properties of special polygons in problem solving.

Skill Objectives

Students will:

- recognize and define a parallelogram.
- recognize, use and prove the properties of a parallelogram.
- recognize and apply the conditions that ensure that a quadrilateral is a parallelogram.
- recognize the properties of rectangles.
- use properties of rectangles in proofs.
- recognize the properties of squares and rhombi.
- use properties of squares and rhombi in proofs.
- recognize the properties of trapezoids.
- use properties of trapezoids in proofs and other problems.

Sample Assessment

Home Foundation

Pacing

2 weeks

7. Similarity

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

2.2b Students should solve proportional reasoning problems.

Extended

2.2a Students should investigate mathematical properties and operations related to objects that are not numbers.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

Extended

3.2a Students should use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technology.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Core

3.3a Students should solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.

Extended

3.3a Students should approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions

- How does geometry model the physical world?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How are appropriate techniques, tools, and formulas used in geometry to determine measurements?
- How can a variety of appropriate strategies be applied in solving geometric problems?
- How is similarity used to measure indirectly and explore comparable objects?

Core Topics

- Similar polygons
- Dilations and scale factors
- Similar triangle postulates and theorems

Unit Objective

Students will be able to:

- demonstrate an understanding of congruent and similar polygons.

Skill Objectives

Students will:

- recognize and use ratios and proportions.
- apply and use the properties of proportions.
- identify similar figures.
- solve problems involving similar figures.
- identify similar triangles.
- use similar triangles to solve problems.
- use self-similarity and iteration to build fractal designs.

Sample Assessment

Cropping a Photo

Pacing

3 weeks

8. Right Triangles and Trigonometry

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

2.2b Students should solve proportional reasoning problems.

Extended

2.2a Students should investigate mathematical properties and operations related to objects that are not numbers.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

Extended

3.2a Students should use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technology.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Core

3.3a Students should solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.

Extended

3.3a Students should approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions

- How does geometry model the physical world?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How can a variety of appropriate strategies be applied in solving geometric problems?
- How is trigonometry used to understand the functional and aesthetic uses of right triangles?
- How do triangles, their sides, angles, and special segments model the physical world?

Core Topics

- The Pythagorean Theorem
- Special right triangles
- Sine, cosine, tangent

Unit Objective

Students will be able to:

- use triangles to model and problem solve real-world situations.

Skill Objectives

Students will:

- use the Pythagorean Theorem and its converse.
- use the properties of 45-45-90 and 30-60-90 triangles.
- express trigonometric ratios as fractions or decimals.
- recognize trigonometric relationships from right triangles.
- use a calculator to find values of trigonometric ratios or measures of angles.
- recognize angles of depression or elevation.
- use trigonometry to solve triangles.

Sample Assessment

Staircase Railing

Pacing

2 weeks

9. Circles

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Core

3.3a Students should solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.

Extended

3.3a Students should approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

Working with Data: Probability and Statistics - Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.

4.3 Students should understand and apply basic concepts of probability.

Core

4.3a Students should understand and apply the principles of probability in a variety of situations.

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?
- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions

- How does geometry model the physical world?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How can a variety of appropriate strategies be applied in solving geometric problems?
- How do circles and their parts relate to the physical world?

Core Topics

- Special lines and line segments of a circle
- Angles formed in circles
- Measurements of angles and line segments of a circle

Unit Objective

Students will be able to:

- apply the properties of special polygons and circles in problem solving.

Skill Objectives

Students will:

- name parts of circles.
- determine relationships between lines and circles.
- write an equation of a circle in the coordinate plane.
- find the measures of arcs and central angles.
- recognize and find the measure of inscribed angles.
- use properties of inscribed figures.
- recognize and find the measure of angles by secants and tangents of circles.
- recognize and find the measure of segments related to circles, including secant-secant, secant-tangent, and chord-chord segments.

Sample Assessment

Billiard Balls

Pacing

2 weeks

10. Area and volume of polygons and polyhedra

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

2.2b Students should solve proportional reasoning problems.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

Extended

3.2a Students should use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technology.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Core

3.3a Students should solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.

Extended

3.3a Students should approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

Working with Data: Probability and Statistics - Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.

4.3 Students should understand and apply basic concepts of probability.

Core

4.3a Students should understand and apply the principles of probability in a variety of situations.

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?
- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions

- How does geometry model the physical world?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How can a variety of appropriate strategies be applied in solving geometric problems?
- How do the calculations and concepts of area and volume relate to two and three-dimensional objects?
- How do triangles, their sides, angles, and special segments model the physical world?
- How is trigonometry used to understand the functional and aesthetic uses of right triangles?
- How does algebra relate to geometry graphically?

Core Topics

- Definitions of polygons
- Area of polygons
- Angles of a polygon
- Circumference and area of a circle
- Surface area
- Volume of three-dimensional figures

Unit Objective

Students will be able to:

- calculate the measure of one, two, and three-dimensional figures.

Skill Objectives

Students will:

- identify and name polygons.
- identify faces, edges, and vertices of a polyhedron.
- find the sum of the measures of the interior and exterior angles of a convex polygon.
- find the measure of each interior and exterior angle of a regular polygon.
- use angle measures of polygons in problem solving.
- find areas of parallelograms.
- find the areas of triangles, rhombi, and trapezoids.
- find the area of regular polygons.
- find the circumference and area of circles and sectors.
- use area and length to solve problems involving geometric probability.
- create, draw, and fold three-dimensional figures.
- make two-dimensional nets for three-dimensional solids.
- identify parts of prisms and cylinders.
- find the lateral areas and surface areas of right prisms and right cylinders.
- find the lateral area of a regular pyramid.
- find the lateral area and surface area of a right circular cone.
- find the volume of a right prism and a right cylinder.
- find the volume of a pyramid and a circular cone.
- recognize and define basic properties of spheres.
- find the surface area of a sphere.
- find the volume of a sphere.

Sample Assessment

The Seven Ancient Wonders of the World

Pacing

4 weeks

11. Coordinate Geometry

Math Standards

Algebraic Reasoning: Patterns and Functions - Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.

1.1 Students should understand and describe patterns and functional relationships.

Extended

1.1a Students should model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

2.2b Students should solve proportional reasoning problems.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.1b Students should develop and evaluate mathematical arguments using reasoning and proof.

Extended

3.1a Students should use methods of deductive and inductive reasoning to make, test, and validate geometric conjectures.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

Extended

3.2a Students should use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technology.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Core

3.3a Students should solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.

Extended

3.3a Students should approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

Essential Questions

- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions

- How does geometry model the physical world?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How does algebra relate to geometry graphically?

Core Topics

- Slope
- Distance
- Midpoint
- Coordinate geometry proofs

Unit Objective

Students will be able to:

- calculate the measure of one, two, and three-dimensional figures.

Skill Objectives

Students will:

- calculate, develop, and apply algebraic formulas of slope, distance, and midpoint.
- prove theorems using coordinate proofs.

Sample Assessment

Name That Triangle

Pacing

1 ½ weeks

12. Transformations

Math Standards

Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

2.2 Students should use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Core

2.2a Students should develop strategies for computation and estimation using properties of number systems to solve problems.

2.2b Students should solve proportional reasoning problems.

Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools, and technology.

3.1 Students should use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.

Core

3.1a Students should investigate relationships among plane and solid geometric figures using geometric models, constructions and tools.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Core

3.2a Students should verify geometric relationships using algebra, coordinate geometry, and transformations.

Extended

3.2a Students should use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technology.

Essential Questions

- How are quantitative relationships represented by numbers?
- How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions

- How does geometry model the physical world?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- How do transformations provide a way of studying figures?

Core Topics

- Mappings
- Isometries
- Reflections, rotations, and translations
- Dilations

Unit Objective

Students will be able to:

- recognize and use properties of transformations with geometric figures.

Skill Objectives

Students will:

- name the image and preimage of a mapping.
- recognize an isometry or congruence transformation.
- name a reflection image with respect to a line.
- recognize line symmetry and point symmetry.
- draw reflection images, lines of symmetry, and points of symmetry.
- name and draw translation images of figures.
- name and draw rotation images of figures.
- use scale factors to determine if a dilation is an enlargement, a reduction, or a congruence transformation.
- find the center and scale factor for a given dilation.
- find the dilation image for a given center and scale factor.

Sample Assessment

Escher Fish

Pacing

2 weeks