



Online Courses for High School Students

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Geometry

Course Description:

Students learn to recognize and work with geometric concepts in various contexts. They build on ideas of inductive and deductive reasoning, logic, concepts, and techniques of Euclidean plane and solid geometry and develop an understanding of mathematical structure, method, and applications of Euclidean plane and solid geometry. Students use visualizations, spatial reasoning, and geometric modeling to solve problems. Topics of study include points, lines, and angles; triangles; right triangles; quadrilaterals and other polygons; circles; coordinate geometry; three-dimensional solids; geometric constructions; symmetry; the use of transformations; and non-Euclidean geometries.

Prerequisites: Algebra I

Course Length: Two semesters

Required Text: Geometry: A Reference Guide (Included in the course)

Required Material: A drawing compass, protractor, and ruler

Course Outline:

Semester I

Unit 1: An Introduction

- Semester Introduction
- Basic Geometric Terms and Definitions
- Measuring Length
- Measuring Angles
- Bisectors and Line Relationships
- Relationships between Triangles and Circles
- Transformations
- Using Algebra to Describe Geometry

Unit 2: Methods of Proof and Logic

- Reasoning, Arguments, and Proof
- Conditional Statements
- Compound Statements and Indirect Proof
- Algebraic Logic
- Inductive and Deductive Reasoning

Unit 3: Polygon Basics

- Polygons and Symmetry
- Quadrilaterals and Their Properties
- Parallel Lines and Transversals
- Converses of Parallel Line Properties
- The Triangle Sum Theorem
- Angles in Polygons
- Midsegments
- Slope

Unit 4: Congruent Polygons and Special Quadrilaterals

- Congruent Polygons and Their Corresponding Parts
- Triangle Congruence: SSS, SAS, and ASA
- Isosceles Triangles and Corresponding Parts
- Triangle Congruence: AAS and HL
- Using Triangles to Understand Quadrilaterals
- Types of Quadrilaterals
- Constructions with Polygons
- Transformations and Triangle Inequality

Unit 5: Perimeter, Area, and Right Triangles

- Perimeter and Area
- Areas of Triangles and Quadrilaterals
- Circumference and Area of Circles
- The Pythagorean Theorem
- Areas of Special Triangles and Regular Polygons
- Using the Distance Formula
- Proofs and Coordinate Geometry

Unit 6: Semester Review and Test

- Semester Review
- Semester Test

Semester II

Unit 1: Three-Dimensional Figures and Graphs

One-dimensional figures, such as line segments, have length. Two-dimensional figures, such as circles, have area. Objects we touch and feel in the real world are three-dimensional; they have volume.

- Semester Introduction
- Solid Shapes and Three-Dimensional Drawing
- Lines, Planes, and Polyhedra
- Prisms
- Coordinates in Three Dimensions
- Equations of Lines and Planes in Space

Unit 2: Surface Area and Volume

Every three-dimensional figure has surface area and volume. Some figures are more common and useful than others. Students probably see pyramids, prisms, cylinders, cones, and spheres every day. In this unit, students will learn how to calculate the surface area and volume of several common and useful three-dimensional figures.

- Surface Area and Volume
- Surface Area and Volume of Prisms
- Surface Area and Volume of Pyramids
- Surface Area and Volume of Cylinders
- Surface Area and Volume of Cones
- Surface Area and Volume of Spheres
- Three-Dimensional Symmetry

Unit 3: Similar Shapes

A map of a city has the same shape as the original city, but the map is much, much smaller. A mathematician would say that the map and the city are similar. They have the same shape but are different sizes.

- Dilations and Scale Factors
- Similar Polygons
- Triangle Similarity
- Side-Splitting Theorem
- Indirect Measurement and Additional Similarity Theorems
- Area and Volume Ratios

Unit 4: Circles

You probably know what a circle is and what the radius and diameter of a circle represent. However, a circle can have many more figures associated with it. Arcs, chords, secants, and tangents all provide a rich set of figures to draw, measure, and understand.

- Chords and Arcs
- Tangents to Circles
- Inscribed Angles and Arcs
- Angles Formed by Secants and Tangents
- Segments of Tangents, Secants, and Chords
- Circles in the Coordinate Plane

Unit 5: Trigonometry

Who uses trigonometry? Architects, engineers, surveyors, and many other professionals use trigonometric ratios such as sine, cosine, and tangent to compute distances and understand relationships in the real world.

- Tangents
- Sines and Cosines
- Special Right Triangles
- The Laws of Sines and Cosines

Unit 6: Beyond Euclidian Geometry

Some people break rules, but mathematicians are usually very good at playing by them. Creative problem solvers, including mathematicians, create new rules, and then play by their new rules to solve many kinds of problems.

- The Golden Rectangle
- Taxicab Geometry
- Graph Theory
- Topology
- Spherical Geometry
- Fractal Geometry
- Projective Geometry
- Computer Logic

Unit 7: Semester Review and Test

- Semester Review
- Semester Test