

# High School Mathematics

## Geometry

Geometry is a study of the properties and relationships of angles, triangles, polygons, and circles. The course begins with a few accepted terms and statements and proceeds inductively to build a solid body of mathematical reasoning. Work in the course involves intuitive discovery, constructions using a compass and straight edge, projects, and basic proofs.

### Learning Opportunities

Special projects (transformations, tilings and Escher style designs, polyhedra, history of math essays and class presentations, construction project, classroom discussion, isometric drawings group work and discussion.

### Standards

Fields of Knowledge: Mathematics, Science, Technology  
*Inquiry, Experimentation, and Theory*

**7.2** Investigation: Students design and conduct a variety of their own investigations and projects.

*Mathematical Understanding*

**7.7** Geometric and Measurement Concepts: Students use geometric and measurement concepts.

**7.8** Function and Algebra Concepts: Students use function and algebra concepts.

*Mathematical Problem Solving and Reasoning*

**7.10** Applications: Students use concrete, formal, and informal strategies to solve mathematical problems, apply the process of mathematical modeling, and extend and generalize mathematical concepts.

## **Content Knowledge and Skills**

### **Geometric Art**

- a. reflective, rotational, point symmetry
- b. constructing daisy designs
- c. properties of op art, line designs, mandalas, daisy designs, Islamic art, knot designs

### **Inductive Reasoning**

- a. definition of inductive reasoning
- b. number and picture patterns
- c. finding the  $n$ th term
- d. mathematical modeling

### **Introducing Geometry**

- a. building blocks of geometry
- b. writing good definitions
- c. defining line and angle relationships
- d. defining polygons and triangles
- e. special quadrilaterals
- f. three dimensional geometric figures
- g. applications

### **Using Tools of Geometry**

- a. duplicating angles and segments
- b. constructing perpendicular bisectors, perpendiculars, angle
- c. bisectors, parallel lines;
- d. constructing points of concurrency
- e. the centroid
- f. construction problems

### **Line and Angle properties**

- a. angle relationships
- b. properties of parallel lines
- c. midpoint and slope of a line
- d. slopes of parallel and perpendicular lines
- e. geometric probability

### **Triangle Properties**

- a. sum of the angles of a triangle

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- b. properties of isosceles triangles
- c. triangle inequalities
- d. triangle congruency shortcuts: SSS, SAS, ASA, SAA
- e. two-column proof
- f. additional isosceles triangle properties

### **Polygon Properties**

- a. sum of the angles of a polygon
- b. exterior angles of a polygon
- c. kite and trapezoid properties
- d. properties of mid segments
- e. properties of parallelograms
- f. properties of special parallelograms

### **Circles**

- a. defining circles
- b. chord properties
- c. tangent properties
- d. arcs and angles
- e. the circumference/diameter ratio
- f. arc length

### **Transformations and Tessellations**

- a. transformation
- b. properties of isometries
- c. tessellations with regular polygons
- d. tessellations with non-regular polygons
- e. tessellations using translations, rotations, and glide reflections

### **Area**

- a. areas of rectangles and parallelograms
- b. areas of triangles, trapezoids, and kites
- c. area problems
- d. areas of regular polygons
- e. areas of circles
- f. surface area
- g. applications

### **Pythagorean Theorem**

- a. the Pythagorean theorem and its converse

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- b. two special right triangles
- c. distance in coordinate geometry
- d. circles and the Pythagorean theorem
- e. applications

### **Volume**

- a. polyhedrons, prisms, and pyramids
- b. solids with curved surfaces
- c. volume of prisms and cylinders
- d. volume of pyramids and cones
- e. displacement and density
- f. volume of a sphere
- g. surface area of a sphere
- h. applications

### **Similarity**

- a. ratio and proportion
- b. similarity
- c. similar triangles
- d. indirect measurement with similar triangles
- e. corresponding parts of similar triangles
- f. proportions with area and volume
- g. proportional segments of parallel lines

### **Assessment Criteria**

Students are able to...

complete a mathematical model of a physical phenomena ( 7.2)

synthesize concepts that are derived throughout the year regarding lines, angles, and polygons.

extrapolate two-dimensional concepts into three dimensional figures.

### **Resources**

**Text:** *Discovering Geometry* , Michael Serra (Key Curriculum Press)

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