Geometry Foundations
Planning Document

Unit 1: Chromatic Numbers

Unit Overview
A variety of topics allows students to begin the year successfully, review basic fundamentals, develop cooperative learning strategies, increase skills with manipulative and geometric tools, and discover new concepts.
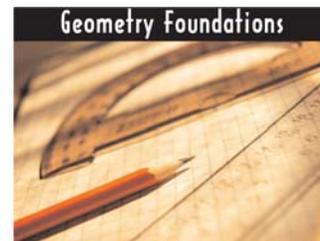
The suggested total number of days for this unit is 12 days (11 lesson days and 1 assessment day). Adjustments may be needed based upon student performance and the amount of available time until the semester ends.

Vocabulary

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Geometry	Boundary
point	Chromatic number
line of symmetry	reflection
vertical lines	horizontal lines
rotational symmetry	rhombi
rhombus	asymptotes
similarity	proportion
similar	scale factor

Materials List

Student Journal	Lesson specific cutouts
Lesson specific transparencies	Setting the Stage Transparencies
overhead projector	overhead markers
Colored Pencils	Sticky Notes
Scissors	tracing paper
Vocabulary Organizer	calculator
Straight edge	Transparent mirrors
Graphing calculator (optional)	Protractors

The table below contains lesson names, timelines, summaries of concepts covered, and essential question(s) for each lesson.

Lesson	Suggested Timeline	Concepts Covered	Essential Question(s)
Chromatic Numbers	2 Days	• Investigate careers related to geometry. • Construct understanding of chromatic number. • Determine the chromatic number of a pattern.	What is the maximum number of colors needed to color any flat map or create a quilt such that only common points and no borders share the same color?
Lines of Symmetry	2 Days	• Locate and draw lines of symmetry with transparent mirror and by folding paper. • Determine the line of symmetry equation for designs on a coordinate plane.	What is unique about an object that has at least one line of symmetry?
Rotational Symmetry	2 Days	• Construct objects that have rotational symmetry. • Determine number of rotational symmetries of an object. • Evaluate equations given values.	What is the best method to determine how many rotational symmetries exist for an object?
Cutting the Pattern	2 Days	• Determine the degree measure of rhombi that form a star. • Analyze an equation with table and graphs. • Determine which objects can fill a space.	What has to be true about objects that meet at point and completely fill the immediate area around that point?
Similarity	2 Days	• Solve for the unknown in a proportion. • Discover the properties of similar objects. • Apply proportions of similar objects.	How might you use the properties of similar objects?
The nth Term	1 Day	• Determine a sequential geometric pattern and model it with algebra. • Develop the concept of scale factor. • Use the sequential pattern to analyze problems.	What is the advantage of using an equation to describe a sequential pattern?
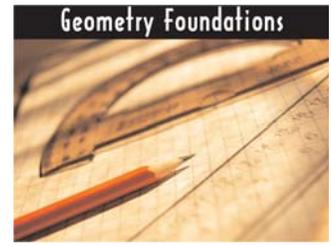
Unit 2: Measurement

Unit Overview
Students will engage in an array of measurement activities that help them conceptually understand length, area, and volume.
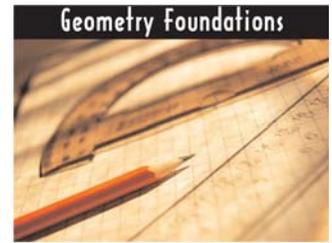
The total number of suggested days for this unit is 12 days (11 lesson days and 1 assessment day). Adjustments may be needed based upon student performance and the amount of available time until the semester ends.

Vocabulary

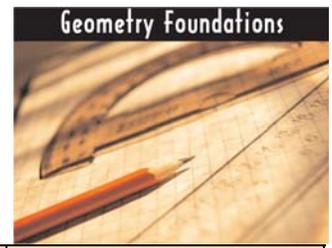|	
mean	maximum
minimum	range
square unit	area formula of a rectangle
area formula of a triangle	perimeter formula of a rectangle
approximate symbol	area formula of a circle
circumference formula of a circle	average stride length
distance walked formula	formula for number of steps
maximum value	net
edge	vertex
surface area	face
cube volume formula	cube root
volume formula of a prism	Base
area of a square	volume formula of a cylinder

Materials List

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Student Journal	Lesson specific cutouts
Lesson specific transparencies	Setting the Stage Transparencies
overhead projector	overhead markers
string	centimeter ruler
graphing calculator	inch ruler
25-foot tape measure	calculator
Tape	scissors
Centimeter cubes	rulers

The table below contains lesson names, timelines, summaries of concepts covered, and essential question(s) for each lesson.

Lesson	Suggested Timeline	Concepts Covered	Essential Question(s)
Metric Identification Card	1 Day	• Measure lengths in centimeters. • Collect and record data. • Graph scatter plots of data. • Make predictions from scatter plots.	How might you predict your height base on arm length of foot length?
Counting Squares	1 Day	• Determine the area by placing a transparency grid over an object. • Determine the area of rectangles and triangles with area formulas.	What does determining the area of object actually mean?
Approximating by Counting Squares	1 Day	• Determine the approximate are of circles and irregular shapes by counting squares. • Determine the area of circles with area formulas.	How might you approximate the area of objects that don't have clearly defined shapes?
Walking the Distance	1 Day	• Determine the average stride length. • Estimate distance by walking. • Use stride length formulas to determine estimated distance. • Use cancellation to solve problems.	How might you estimate the distance between two placed by just walking?
Distance Proportions	2 Days	• Estimate the height of an object using shadows. • Estimate the distance between people using a range finder. • Use proportions to estimate distances.	How might you determine how far it is to an object without stretching out a tape measure between you and the object?

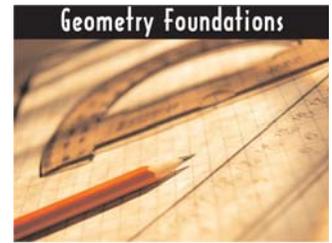| Lesson	Suggested Timeline	Concepts Covered	Essential Question(s)
Area and Perimeter	2 Days	- Determine the area of a rectangle. - Complete a scatter plot of data. - Model the relationship between area and perimeter with equations, tables, and graphs. - Determine the maximum of a graph and the corresponding x-value.	What rectangle gives the largest area for a given perimeter?
Cube Nets	1 Day	- Create a cube with a net. - Create a net for a cube. - Know the parts of a cube.	What is unique about the shape of an flat object that can fold into a cube?
Big Base	2 Days	- Estimate the volume of prisms and cylinders. - Determine the volume of prisms and cylinders. - Compare the volume of two cylinders created with the same lateral surface area.	How might different shapes with the same height have the same volume?
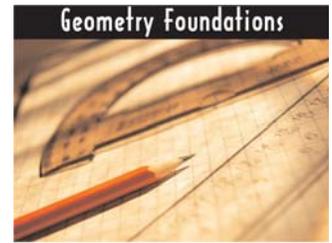
Unit 3: Properties of Objects

Unit Overview
Students investigate the common properties of basic geometric shapes by physically interacting with cutouts and drawings.

The total number of suggested days for this unit is 20 days (19 lesson days and 1 assessment day). Adjustments may be needed based upon student performance and the amount of available time until the semester ends.

Vocabulary

Circle	radius
Arc	equation for a circle centered at origin
Side(s)	vertex
Vertices	sum of a triangle's interior angles
Triangle inequality	scalene triangle
Isosceles triangle	base angles
Equilateral triangle	acute triangle
Obtuse triangle	right triangle
Right angle	hypotenuse
Obtuse scalene	obtuse isosceles
Acute scalene	acute isosceles
Right scalene	right isosceles
Triangle	quadrilateral
Pentagon	hexagon
Heptagon	octagon
Nonagon	decagon
Parallelogram	opposite sides
Opposite angles	consecutive angles
Supplementary angles	area of a rectangle
Area of a parallelogram	rectangle
Rhombus	rhombi
Square	kite
Trapezoid	area of a trapezoid
Pythagorean Theorem	hypotenuse
Legs	Pythagorean triple
Midpoint	median of a triangle
Centroid	center of mass
Perpendicular bisector	perpendicular lines
Circumscribed circle	circumcenter
Inscribed circle	incenter
Tangent	angle bisector

Materials List

Student Journal   Lesson specific
cutouts
Lesson specific transparencies   Setting the Stage Transparencies
overhead projector   overhead markers
transparent mirror   compass
inch ruler   straight edge
centimeter ruler   scissors
string   protractor
Card stock

The table below contains lesson names, timelines, summaries of concepts covered, and essential question(s) for each lesson.

Lesson	Suggested Timeline	Concepts Covered	Essential Question(s)
Circles	1 Day	- Construct a circle with a compass. - Determine the equation of a circle. - Develop the concept of equidistance. - Use the area and circumference formulas of circles.	How might you describe what a circle actually is in words?
Basic Triangles	1 Day	- Determine the type of segments that can create triangles. - Determine the sum of the angles of a triangle's interior angles. - Determine the values of a triangle's unknown angles.	How might you determine if three segments could form a triangle? What advantage is it to know that the sum of the interior angles of a triangle is 180 degrees?
Special Triangles	2 Days	- Know and understand the definition of scalene, isosceles, equilateral, acute, obtuse, and right triangles. - Construct scalene, isosceles, equilateral, acute, obtuse, and right triangles.	How might you name a triangle base on its side lengths and angle measures?
Quadrilaterals	1 Day	- Know and understand the definition of a quadrilateral. - Solve for the unknown angle of a quadrilateral.	How might you define quadrilateral in your own words?

Lesson	Suggested Timeline	Concepts Covered	Essential Question(s)
Parallelograms	3 Days	• Know and understand the definition and properties of a parallelogram. • Understand the concept and definition of supplementary angles. • Construct a parallelogram.	How might you make marks on an object to represent which sides are parallel, which angle are the same size, and which sides are the same length? Why is the area formula for a parallelogram the same as for a rectangle?
Special Quadrilaterals	3 Days	• Know and understand the definition and properties of a rectangle, trapezoid, rhombus, square, and kite. • Construct a rectangle, trapezoid, rhombus, square, and kite.	What is the advantage of naming different types of quadrilaterals?
Pythagorean Theorem	2 Days	• Determine if a set of numbers is a Pythagorean Triple. • Determine the length of a side of a right triangle. • Analyze applications based on the Pythagorean Theorem.	How might you use the Pythagorean theorem in real world problems?
Center of Mass	2 Days	• Locate the center of mass. • Locate the midpoint of a line segment. • Draw the median of a line segment.	How might you find a point on a triangle that would be the point of balancing the triangle?
Circumscribes Circles	2 Days	• Locate the perpendicular bisector of a segment. • Locate the circumcenter of a triangle. • Draw a circumscribed circle around a triangle.	Why would someone want to find a circle that goes through the three vertices of a triangle?
Inscribed Circles	2 Days	• Locate an angle bisector. • Locate the incenter of a triangle. • Draw an inscribed circle in a triangle.	How could you determine the largest circle to place in a triangle?
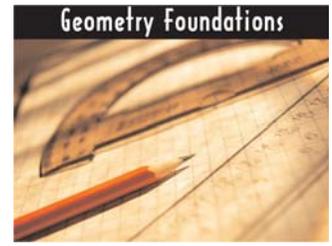
Unit 4: Coordinate Geometry

Unit Overview
Students review the fundamental skills and concepts to work effectively with the coordinate plane hands-on activities.
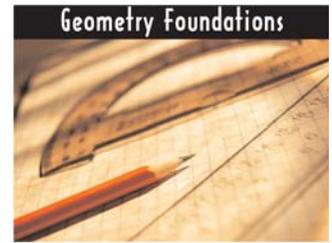
The total number of suggested days for the unit is 10 days (9 lesson days and 1 assessment day). Adjustments may be needed based upon student performance and the amount of available time until the semester ends.

Vocabulary

Cartesian coordinate plane	origin
x-axis	*y*-axis
Quadrant I	Quadrant II
Quadrant III	Quadrant IV
Origin	ordered pair
x-value	*y*-value
connected scatter plot	rise
run	slope
positive slope	negative slope
zero slope	undefined
slope formula	reciprocal
opposites	right angle
opposite reciprocals	perpendicular
parallel	parallel
distance formula	midpoint
midpoint formula	square

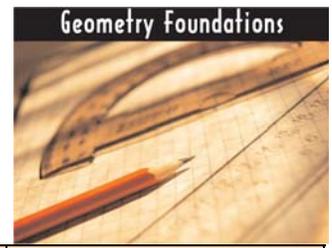## Materials List

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Student Journal	Lesson specific cutouts
Lesson specific transparencies	Setting the Stage Transparencies
overhead projector	overhead markers
Sticky notes	scissors
Graphing calculators	tape
Rulers	markers
Poster paper	straight edge
Transparent mirror	centimeter ruler
Overhead transparencies	

The table below contains lesson names, timelines, summaries of concepts covered, and essential question(s) for each lesson.

Geometry Foundations

Lesson	Suggested Timeline	Concepts Covered	Essential Question(s)
Plotting Points	1 Day	• Determine the location of points. • Plot points given the ordered pairs. • Transition between a table of values and the corresponding plot of those values. • Create a connected scatter plot of ordered pairs.	How can you use a connected scatter plot to create a drawing?
Calculator Plotting	1 Day	• Plot ordered pairs on a graphing calculator. • Adjust the display on the graphing calculator screen. • Create a connected scatter plot of ordered pairs.	What is the advantage of using a graphing calculator to draw a connected scatter plot over drawing a connected scatter plot by hand?
Rise and Run	1 Day	• Determine the slope of a roof by determining the rise and run. • Discover that a steeper roof corresponds to a larger rise over run ratio.	How might you describe the steepness of an object like a roof or a hill?
Slope	1 Day	• Count the rise and run of a segment to determine the slope. • Determine the slope of a line using the slope formula. • Categorize the four types of slope.	How might you use a table of values to determine the slope of a set of data?
Perpendicular	1 Day	• Discover that the slope of a perpendicular line segment is the opposite reciprocal.	What is the relationship between two line segments that are perpendicular?
Parallel	1 Day	• Determine which line segments are parallel based upon slope.	What is the relationship between two line segments that are parallel?

Lesson	Suggested Timeline	Concepts Covered	Essential Question(s)
Distance Formula	1 Day	• Use the Pythagorean Theorem and the distance formula to determine the distance between the endpoints of a line segment.	Why is it necessary to have a formula to determine the distance between two points instead of just using a measuring tape to measure the distance?
Midpoint	1 Day	• Use the midpoint formula to determine the midpoint of line segments. • Apply the midpoint formula to various situations.	Why is necessary to have a formula to determine the location of a point in the middle of a line segment instead of just using a ruler to measure and mark the half way point?
Coordinate Proof	1 Day	• Prove that four points create or do not create a square. • Prove that the diagonals of a square are perpendicular and bisect each other.	Why do you have to know the properties of a polygon in order to prove that an object is that particular polygon?
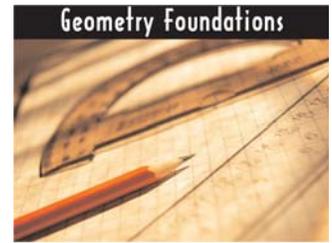
Unit 5: Languages of Geometry

Unit Overview

Students learn the formal terms and objects common to geometry. They also construct meaningful understanding of geometric terms and objects.
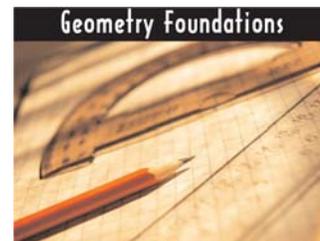
The total number of suggested days for this unit is 10 days (9 lesson days and 1 assessment day). Adjustments may be needed based upon student performance and the amount of available time until the semester ends.

Vocabulary

|	
Cartesian coordinate plane	origin
Infinite	point
Line	collinear
One dimension	plane
Two dimensions	*y*-intercept
Slope	collinear
Space	line segment
Vertex	vertices
Ray	angle
Sides of an angel	interior of an angle
Exterior of an angle	measure of an angle
Acute angle	obtuse angle
Right angle	right angle
Straight angle	vertical angles
Adjacent angles	consecutive angles
Opposite angles	congruent
Proportion	similar
Corresponding angles	corresponding sides
Polyhedron	edge
Face	base of a polyhedron
Triangular prism	rectangular prism
Hexagonal prism	oblique square prism
Square prism	triangular pyramid
Square pyramid	oblique square pyramid
Cylinder	cone
icosahedron	

Materials List

Student Journal	Lesson specific cutouts
Lesson specific transparencies	Setting the Stage Transparencies
overhead projector	overhead markers
straight edge	spaghetti (optional)
string (optional)	transparent mirror (optional)
Dry-erase Board (optional)	tape
String	scissors
Centimeter cubes	cardstock or poster board
Rulers	protractors

The table below contains lesson names, timelines, summaries of concepts covered, and essential question(s) for each lesson.

Lesson	Suggested Timeline	Concepts Covered	Essential Question(s)
Get the Point	1 Day	• Experiment with smaller and smaller dots to conclude that an infinite number of points exist in a contained space. • Locate points on a coordinate plane.	How small is a point?
Line It Up	1 Day	• Develop the concept of a line. • Determine the types of intersections of two lines. • Understand the concept of collinear.	How can you represent a line on paper?
The Plane Truth	1 Day	• Develop the concept of a plane. • Review the basic fundamentals of the coordinate plane.	How do you use a plane when you write on a piece of paper?
Space	1 Day	• Investigate the relationship of points, lines, and planes in space. • Practice drawing 3-D images on 2-D paper.	How might planes, lines, and point intersect in space?
Segments and Rays	1 Day	• Determine the characteristics of line segments and rays. • Learn the symbols for naming segments, naming rays, and measurements of line segments.	How can segments and rays be used to describe real objects in the world around you?
Angles	1 Day	• Name angles and their parts. • Recognize angle pairs. • Measure angles accurately.	What is different about measuring an angle than measuring a segment?
Congruence	1 Day	• Understand the use of congruence and equal symbols and concepts. • Determine the side-side-side method to show that triangles are congruent.	What is the difference between equal and congruence?
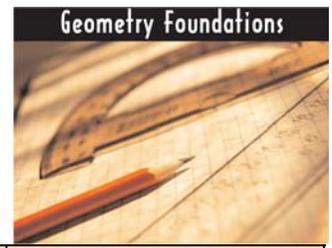
Lesson	Suggested Timeline	Concepts Covered	Essential Question(s)
Similar	1 Day	• Understand the use of similar symbols and concepts. • Use proportions and angles to determine if polygons are similar.	How can you determine if two objects are similar?
3-D Objects	1 Day	• Use nets to create prisms, pyramids, and cylinders. • Create a triangular pyramid, truncated pyramid, and an icosahedron.	How might you describe the difference between a pyramid and a prism?