



Geometry - Unit F - Circles & Physical Properties

Unit Focus

This unit introduces students to the foundational properties and theorems of circles in Chapter 10. Students will explore key vocabulary and relationships. This foundational understanding is critical for the application of measurement concepts later in the unit.

Chapter 11 extends these principles by focusing on the two-dimensional measurement of circles. Students will apply their knowledge of circle properties to master the formulas for circumference and area, solving a range of problems that connect these concepts to real-world contexts.

The unit culminates in Chapter 12, where students synthesize their understanding of two-dimensional area and transition to the third dimension. This chapter focuses on the surface area and volume of three-dimensional solids, including prisms, pyramids, cones, cylinders, and spheres. The emphasis is on building a comprehensive framework for geometric measurement that progresses logically from plane figures to solid objects.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
Common Core Mathematics: 9-12 - 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. (CCSS.MATH.CONTENT.HSG.CO.A.1) - Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals. (CCSS.MATH.CONTENT.HSG.CO.C.11) - Prove that all circles are similar. (CCSS.MATH.CONTENT.HSG.C.A.1) - Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle. (CCSS.MATH.CONTENT.HSG.C.A.2) - Construct a tangent line from a point outside a given circle to the circle. (CCSS.MATH.CONTENT.HSG.C.A.4) - 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;	<i>Students will be able to independently use their learning to...</i> T1 Understand the attributes and relative property of objects. T2 Initiate a plan using a variety of methods/strategies appropriately, execute it, and evaluate the reasonableness and accuracy of the solution. T3 Represent situations using mathematical reasoning and symbols. T4 Choose appropriate tools to make reaching solutions more efficient, accessible and accurate. T5 Demonstrate fluency with mathematical computations and definitions.	
	Meaning	
	Understanding(s)	Essential Question(s)
	<i>Students will understand that...</i> U1 The fundamental relationships and theorems of circles provide the groundwork for understanding and applying geometric principles to a wide range of circular objects. U2 The concepts of circumference and area are distinct measurements that quantify two-dimensional shapes, and mastering their application allows for the solution of real-world problems involving circles. U3 The principles of two-dimensional measurement extend logically to three-dimensional solids, requiring specific formulas and methods to calculate their surface area and volume.	<i>Students will keep considering...</i> Q1 How do the properties of a circle inform the way we define and understand its components and the relationships between them? Q2 Why are there different formulas for measuring the distance around a circle versus the space it occupies, and how do these measurements apply to the world around us? Q3 What is the relationship between the measurement of two-dimensional shapes and three-dimensional solids, and how does this relationship help us quantify our physical world?

Stage 1: Desired Results - Key Understandings

derive the formula for the area of a sector. (CCSS.MATH.CONTENT.HSG.C.B.5) - 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. (CCSS.MATH.CONTENT.HSG.GPE.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. Use dissection arguments, Cavalieri's principle, and informal limit arguments. (CCSS.MATH.CONTENT.HSG.GMD.A.1) - Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. (CCSS.MATH.CONTENT.HSG.GMD.A. 3) - Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. (CCSS.MATH.CONTENT.HSG.GMD.B.4) - Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). (CCSS.MATH.CONTENT.HSG.MG.A. 1) - Make sense of problems and persevere in solving them. (CCSS.MATH.MP.1) - Reason abstractly and quantitatively. (CCSS.MATH.MP.2) - Use appropriate tools strategically. (CCSS.MATH.MP.5) - Attend to precision. (CCSS.MATH.MP.6) Madison Public Schools Profile of a Graduate - Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2) - Collective Intelligence: Working respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective. (POG.3.1)	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
	<i>Students will know...</i> K1 The definitions of key terms related to circles, including radius, diameter, chord, tangent, secant, arc, and central angle. K2 The relationships between parts of a circle, such as the relationship between a central angle and its intercepted arc. K3 The formulas for circumference and area of a circle. K4 The equations for circles in the coordinate plane. K5 The difference between surface area and volume. K6 The formulas for the surface area and volume of various three-dimensional figures, including prisms, pyramids, cylinders, cones, and spheres. K7 Vocabulary: - Circle - Center - Radius - Chord - Diameter - Secant - Tangent - Concentric Circles - Central angle - Minor and Major arc - Semicircle - Inscribed angle - Circumference - Arc length - Regular Polygon - Polyhedron - Cross section - Volume - Surface Area - Sphere	<i>Students will be skilled at...</i> S1 Identify and label parts of a circle. S2 Calculate the measures of central angles, inscribed angles, and arcs. S3 Use the formulas for circumference and area to solve problems. S4 Write and graph the equation of a circle. S5 Find angle measures of polygons S6 Use properties of circles to solve real-world problems. S7 Calculate the surface area and volume of prisms, pyramids, cylinders, cones, and spheres. S8 Solve real-world problems involving volume and surface area. S9 Identify and sketch cross-sections of three-dimensional figures. S10 Calculate the circumference and area of a circle when given the radius or diameter. S11 Solve real-world problems involving circle measurements, such as finding the distance around a circular track or the amount of material needed to cover a circular table. S12 Determine the radius or diameter of a circle when given its circumference or area. S13 Find the area of a sector or the length of an arc given a central angle. S14 Apply these concepts to solve composite shapes that include circles or parts of circles.