



Grade 7 Pre-Algebra - Unit B - Measuring Circles

Unit Focus

In this brief unit students apply their knowledge of proportional relationships to the study of circles. The unit begins with activities designed to help students come to a more precise understanding of the characteristics of a circle. Students measure circular objects, investigating the relationship between measurements of circumference and diameter by making tables and graphs. Next, students encounter at least one informal derivation of the fact that the area of a circle is equal to times the square of its radius.

Students select and use formulas for the area and circumference of a circle to solve abstract and real-world problems that involve calculating lengths and areas. They express measurements in terms of pi or using appropriate approximations of pi to express them numerically. Finally, students work with volume, using abilities developed in earlier work with geometry and geometric measurement to calculate the volume of a sphere, a cylinder, and a cone.

The PBA about stained glass windows gives students an opportunity to once again use their collective intelligence to inform their solution. They are asked to create a design with specific criteria and support their choices through mathematics.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer			
Common Core Mathematics: 7 - Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional $\frac{1}{10}$ of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar $9\frac{3}{4}$ inches long in the center of a door that is $27\frac{1}{2}$ inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation. (CCSS.MATH.CONTENT.7.EE.B.3) - Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. (CCSS.MATH.CONTENT.7.G.B.4) - Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. (CCSS.MATH.CONTENT.7.G.B.6)	<i>Students will be able to independently use their learning to...</i> T1 Construct viable arguments using clear and appropriate mathematical language and critique the reasoning of others. T2 Apply models to solve problems.			
	Meaning			
	<table><tr><th>Understanding(s)</th><th>Essential Question(s)</th></tr><tr><td><i>Students will understand that...</i> U1 Mathematicians construct viable arguments to explain problems, solutions, and mathematical representations. U2 Mathematicians can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments. U3 Mathematicians create or use models to generalize, represent, and solve problems.</td><td><i>Students will keep considering...</i> Q1 Have I sufficiently supported my answer and shown my work? Q2 What model best represents this problem?</td></tr></table>	Understanding(s)	Essential Question(s)	<i>Students will understand that...</i> U1 Mathematicians construct viable arguments to explain problems, solutions, and mathematical representations. U2 Mathematicians can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments. U3 Mathematicians create or use models to generalize, represent, and solve problems.
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Stage 1: Desired Results - Key Understandings

Mathematics: 8

- Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems. (CCSS.MATH.CONTENT.8.G.C.9)
- Construct viable arguments and critique the reasoning of others. (CCSS.MATH.MP.3)
- Model with mathematics. (CCSS.MATH.MP.4)

Madison Public Schools Profile of a Graduate

- Collective Intelligence: Working respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective. (POG.3.1)
- Product Creation: Effectively use a medium to communicate important information. (POG.3.2)

Acquisition of Knowledge and Skill

Knowledge

Students will know...

K1 Vocabulary: radius, diameter, circumference, center (of a circle), half circle, rotation, approximation, estimate, area of a circle, squared, sphere, cone, cylinder, hemisphere

K2 that pi is a constant of proportionality for the relation between diameter and circumference.

K3 that 3.14 and $22/7$ are used as approximations for pi.

K4 the formulas for area of a circle, circumference of a circle, volume of a cylinder, volume of a cone, volume of a sphere.

K5 A cone's volume is a third of a cylinder's volume with same dimensions.

K6 The volume of a hemisphere is half the volume of a sphere with the same dimensions.

Skill(s)

Students will be skilled at...

S1 finding the radius and diameter of a circle using the circumference formula.

S2 finding the circumference (or perimeter) of a circle or part of a circle using the circumference formula.

S3 choosing the correct formula (area or circumference) to solve application problems.

S4 finding the area of a circle or of part of a circle using the area formula.

S5 Finding the volume of a cylinder, cone, and a sphere in mathematical and realworld situations.

S6 Finding missing information about a cylinder and a cone if I know its volume and some other information.