

| | |
|-------------------------|--|
| Grade/Subject | Grade 7/Accelerated Mathematics |
| Unit Title | Unit 2: Measuring Circles |
| Overview of Unit | In this unit students will draw, construct, and describe geometrical figures and describe the relationships between them. Students will also solve real-life and mathematical problems involving angle measure, area, surface area, and volume. Surface area and volume may be new concepts for some students. |
| Pacing | Grade 7 Accelerated Mathematics: 6 - 8 days |

Background Information For The Teacher

It is expected that students will have prior knowledge/experience related to the concepts and skills identified below. It may be necessary to pre-assess in order to determine if time needs to be spent on conceptual activities that help students develop a deeper understanding of these ideas.

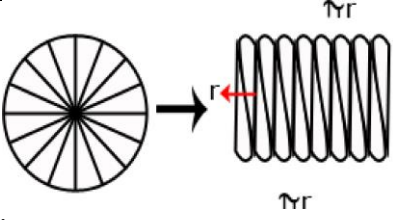
- number sense
- computation with whole numbers and decimals, including application of order of operations
- addition and subtraction of common fractions with like denominators
- measuring length and finding perimeter and area of rectangles and squares
- characteristics of 2-D and 3-D shapes
- angle measurement

In sixth grade, students will be introduced to volume and surface area but not to area and circumference of circles.

In this unit students will:

- draw geometric figures using rulers and protractor with emphasis on triangles
- write and solve equations involving angle relationships
- explore two-dimensional cross-sections of cylinders, cones, pyramids, and prisms
- know and use the formula for the circumference and area of a circle
- solve engaging problems that require determining the area, volume, and surface area of fundamental solid figures.

| Essential Questions (and Corresponding Big Ideas) | |
|--|--|
| <p>How are the area and circumference of a circle related?</p> <ul style="list-style-type: none"> By sectioning a circle and laying out the pie pieces to form a parallelogram, students will write an expression for the area of the parallelogram related to the radius; length πr (half the circumference) and width r. They then explain why the area of the circle is $\pi r \times r = \pi r^2$ using the rearranged figure. <p>How are algebra and geometry related?</p> <ul style="list-style-type: none"> We can write and solve equations to find unknown angles of figures. | |
| Core Content Standards | Explanations and Examples |
| <p>7.G.4 Know the formulas for the area and circumference of a circle and solve problems; give an informal derivation of the relationship between the circumference and area of a circle.</p> <p>Students learn formulas for area ($A=\pi r^2$) and circumference ($C=2\pi r$) of circles and then solve problems (mathematical and real world) using these formulas. Students participate in discovering the relationship between two formulas.</p> <p><u>What the Teacher does:</u></p> <ul style="list-style-type: none"> Provide students an opportunity to discover the relationship between circumference and diameter. Have students work in groups to measure the circumference and diameter of several round objects in the classroom such as the clock face. Students combine their data and look for a relationship between the circumference and diameter. Facilitate a discussion about circumference to lead students to the formula for circumference of a circle. Do the same for area. Pose problems to solve that apply area and circumference formulas such as the following: "The seventh grade is building a ring toss game to raise money for a field trip. The bottles where we toss the rings will be placed | <p>7.G.4 Examples:</p> <ul style="list-style-type: none"> The seventh grade class is building a mini golf game for the school carnival. The end of the putting green will be a circle. If the circle is 10 feet in diameter, how many square feet of grass carpet will they need to buy to cover the circle? How might you communicate this information to the salesperson to make sure you receive a piece of carpet that is the correct size? Students measure the circumference and diameter of several circular objects in the room (clock, trash can, door knob, wheel, etc.). Students organize their information and discover the relationship between circumference and diameter by noticing the pattern in the ratio of the measures. Students write an expression that could be used to find the circumference of a circle with any diameter and check their expression on other circles. Students will use a circle as a model to make several equal parts as you would in a pie model. The greater number the cuts, the better. The pie pieces are laid out to form a shape similar to a parallelogram. Students will then write an expression for the area of the parallelogram related to the radius (note: the length of the base of the parallelogram is half the circumference, or πr, and the height is r, resulting in an area of πr^2. Extension: If students are given the circumference of a circle, could they write a formula to determine the circle's area or given the area of a circle, could they write the formula for the circumference? |

| | |
|---|---|
| <p>on a green circle. If the circle is 10 feet in diameter, how many square feet of carpet will they need to buy to cover the circle? How might you communicate this information to the salesperson to make sure you receive a piece of carpet that is the correct size?"</p> <ul style="list-style-type: none"> • Guide a derivation of the relationship between the circumference and area of a circle. Use a circle as a model. Cut the circle into as many equal-sized pie pieces as possible. Lay the pie pieces to form a shape similar to a parallelogram. Have students write an expression for the area of parallelogram related to the radius (note: the length of the base of the parallelogram is half the circumference, or πr, and the height is r, resulting in an area of πr^2, which is the area of the circle). | <div style="text-align: center;">  </div> <p>What the Students do:</p> <ul style="list-style-type: none"> • Explain the relationship between circumference and diameter of a circle using correct mathematical vocabulary. • Solve mathematical and real-world problems by applying the area of a circle and circumference formulas. • Discover through hands-on experiences, and explain the relationship between the circumference and area of a circle. <p>Misconceptions and Common Errors:</p> <p>The formulas for the area of a circle and the circumference of a circle are often confused by students. Teaching students to memorize these formulas without any understanding of how they relate to a circle increases the chance for confusion. Build the understanding before presenting the formulas.</p> |
| <p>Standards for Mathematical Practice</p> | <p>Explanations and Examples</p> |
| <p>7.G.4, 7.G.5, 7.G.6</p> <p>MP1. Make sense of problems and persevere in solving them.</p> <p>MP4. Model with mathematics.</p> | <p>Students solve problems involving geometric principles.</p> <p>Students use geometric models to solve problems.</p> |

| <p style="text-align: center;">K-U-D</p> | |
|---|---|
| <p style="text-align: center;">KNOW</p> <p style="text-align: center;"><i>Facts, formulas, information, vocabulary</i></p> | <p style="text-align: center;">DO</p> <p style="text-align: center;"><i>Skills of the discipline, social skills, production skills, processes (usually verbs/verb phrases)</i></p> |
| <ul style="list-style-type: none"> • Formulas <ul style="list-style-type: none"> ○ area of two dimensional figures (circles, rectangles, triangles) ○ circumference of a circle | <ul style="list-style-type: none"> • SOLVE problems using formulas • DERIVE informally the relationship between circumference and area of a circle |
| <p style="text-align: center;">UNDERSTAND</p> <p style="text-align: center;"><i>Big ideas, generalizations, principles, concepts, ideas that transfer across situations</i></p> | |
| <ul style="list-style-type: none"> • Parallelograms and rectangles can be used to derive the formula for the area of a circle. • Coordinate geometry can be a useful tool for understanding geometric shapes and transformations. • “Pi” (π) is the relationship between a circle’s circumference and diameter. • Algebraic equations can be used to find unknown angles of geometric figures. | |

| Common Student Misconceptions for this Unit |
|--|
| |

| Unit Assessment/Performance Task | DOK |
|---|------------|
| Unit 2 Test Unit 2 Performance Task | |

| Vocabulary |
|--|
| <ul style="list-style-type: none"> ● Circumference, Diameter, Radius ● Complementary Angle, Supplementary angle ● Congruent Figures ● Irregular Polygon, Regular Polygon ● Names of Geometric Figures – rectangular prism, pyramid, cone, sphere, cylinder, triangular prism, trapezoid, square, parallelogram, circle, etc. ● Parallel Lines, Perpendicular Lines ● Pi ● Plane ● Similar Figures ● Surface Area, Volume |
| Key Learning Activities/Possible Lesson Focuses (order may vary) |
| <p>Pre-assessment (Recall prior knowledge) and Pre-requisite skills review (if needed)</p> <p>Lesson Ideas:</p> <p>Relationship between circumference and diameter of a circle. <i>Know the formulas for the area and circumference of a circle and solve problems; give an informal derivation of the relationship between the circumference and area of a circle. (7.G.4)</i></p> <ul style="list-style-type: none"> ● Working cooperatively students will measure the circumference and diameter of several circular objects in the room (clock, trash can, door knob, wheel, etc.). ● Students will organize their information and discover the relationship between circumference and diameter by noticing the pattern in the ratio of the measures. (circumference / diameter = Pi.) ● Students write an expression that could be used to find the circumference of a circle with any diameter and check their expression on other circles. <p><u>Activities:</u></p> |

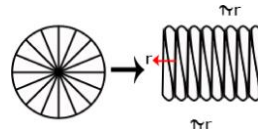
It's easy as Pi (Georgia Unit) https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS_Math_7_7thGrade_Unit5SE.pdf

Saving Sir Cumference (Georgia Unit) https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS_Math_7_7thGrade_Unit5SE.pdf

Relationship between circumference and area of a circle.

Using models, students will discover the relationship between the circumference and the area of a circle.

- Students will use a circle as a model to make several equal parts as you would in a pie model. The greater number the cuts, the better. The pie pieces are laid out to form a shape similar to a parallelogram. Students will then write an expression for the area of the parallelogram related to the radius (note: the length of the base of the parallelogram is half the circumference, or πr , and the height is r , resulting in an area of πr^2 . Extension: If students are given the circumference of a circle, could they write a formula to determine the circle's area or given the area of a circle, could they write the formula for the circumference?



- The seventh grade class is building a mini golf game for the school carnival. The end of the putting green will be a circle. If the circle is 10 feet in diameter, how many square feet of grass carpet will they need to buy to cover the circle? How might you communicate this information to the salesperson to make sure you receive a piece of carpet that is the correct size?

Activities:

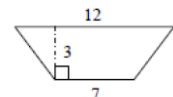
Circle Cover-Up (Georgia Unit) https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS_Math_7_7thGrade_Unit5SE.pdf

Circle Cover Up – Circles and Parallelograms (Georgia Unit)
https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS_Math_7_7thGrade_Unit5SE.pdf

Area

Students will review perimeter and area of polygons. They will find the area of irregular and regular polygons by decomposing the polygon into triangles, squares, and rectangles. Students will use estimation to solve real-world problems.

- Review with students finding perimeter and using formulas to find the area of polygons: square, rectangle, triangle, parallelogram.
- Estimating: Counting Trees
<http://map.mathshell.org.uk/materials/lessons.php?taskid=422&subpage=problem>
- Estimations and Approximations: The Money Munchers
<http://map.mathshell.org.uk/materials/lessons.php?taskid=220&subpage=problem>



- Find the area of a triangle with a base length of three units and a height of four units.
- Find the area of the trapezoid shown at the right using the formulas for rectangles and triangles.
- Choose one of the figures shown below and write a step-by-step procedure for determining the area. Find another person that chose the same figure as you did. How are your procedures the same and different? Do they yield the same result?

Activity:

Most Square? Great Tasks Handout 2012



Formative Assessment:

Maximizing Area: Gold Rush <http://map.mathshell.org.uk/materials/lessons.php?taskid=415>

Supplemental Materials and Resources

Online Lessons

- Using Dimensions: Designing a Sports Bag
<http://map.mathshell.org.uk/materials/lessons.php?taskid=416&subpage=problem>
- Applying Angle Theorems
<http://map.mathshell.org.uk/materials/lessons.php?taskid=214&subpage=concept>
- Roman Mosaic
<http://map.mathshell.org.uk/materials/tasks.php?taskid=391&subpage=expert>
- Historic Bicycle
<http://map.mathshell.org.uk/materials/tasks.php?taskid=370&subpage=apprentice>
- Photographs
<http://map.mathshell.org.uk/materials/tasks.php?taskid=380&subpage=apprentice>
- Short Tasks – Geometry
<http://map.mathshell.org.uk/materials/tasks.php?taskid=401&subpage=novice>

Worksheets

- Angles Worksheets for Practice and Study
<http://www.math-aids.com/Geometry/Angles/>
- Area and Perimeter Worksheets
<http://www.math-aids.com/Geometry/Perimeter/>
- Circle Worksheets
<http://www.math-aids.com/Geometry/Circles/>

Videos

- Circle Song
<http://www.gamequarium.org/cgi-bin/search/linfo.cgi?id=9591>
- Visualizing Geometry (from TeachingChannel.org)
<https://www.teachingchannel.org/videos/visualizing-geometry-lesson?fd=1>
- Mr. McCloud: Discovering Surface Area of a Cylinder (from TeachingChannel.org)
<https://www.teachingchannel.org/videos/surface-area-lesson>
- Khan Academy Videos on Geometry
<http://www.khanacademy.org/math/geometry?k>

SMART Board Lessons

- Area of a Circle – Formula for area of a circle and how to use a grid and squares to check reasonableness or answer.
<http://exchange.smarttech.com/details.html?id=2b739b92-4d4a-46f1-9bf7-03dd7aebb28b>
- Angle Relationships – Students will identify congruent, vertical, supplementary, and complementary angles.
<http://exchange.smarttech.com/details.html?id=4b322c56-62c8-4c5c-9bbd-8a08dcefe18e>

Online Interactive Activities & Games

- [Kung Fu Angles](#)
- [Banana Hunt](#) (Angle Practice)
- [Complementary and Supplementary Angle Pairs Practice](#)
- [Complementary and Supplementary Angle Pairs Memory Match](#)
- [Finding Volume](#)
- [Area of a Circle](#)

Literature connections:

Girls Get Curves: Geometry Takes Shape by Danica McKellar

Nonfiction Writing Prompts for Geometry by Advanced Learning Press

Interdisciplinary connections:

Art:

- Recognition of 2D and 3D shapes

Science:

- Measurement
- Surface Area

Tools/Manipulatives

- Geoboards
- Protractors
- Rulers
- Graph Paper
- Small cubes – inch or centimeters
- Circular objects to measure circumference such as lids, CDs, cans, etc.
- String
- Modeling clay
- Geometric Solid figures
- Nets of solid figures
- Styrofoam 3-D figures such as cones and prisms

Suggested Formative Assessment Practices/Processes

Teacher created exit slips, quizzes

Maximizing Area: Gold Rush <http://map.mathshell.org.uk/materials/lessons.php?taskid=415>

Using Dimensions: Designing a Sports Bag

<http://map.mathshell.org.uk/materials/lessons.php?taskid=416&subpage=problem>

Differentiation and Accommodations

- Provide graphic organizers
- Provide additional examples and opportunities for repetition
- Provide tutoring opportunities
- Provide retesting opportunities after remediation (up to teacher and district discretion)
- Teach for mastery not test
- Teaching concepts in different modalities
- Adjust homework assignments