Lesson Overview

Title: Mathematics 7

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Subject: circumference and area of circles

Grade Level: 7

Lesson Description for Day

Taking this lesson comes after a study on circumferences. Additionally, students need to understand how circumference, pi, and the area of a circle relate to later topics, such as finding the surface area and volume of three-dimensional shapes (cylinder, cone).

Students will be working individually in small groups to measure and calculate the area using the formula for area. A formula can be used to determine the area of a circle and point to a method that is non-equational.

The constant ratio between the circumference and diameter of circles can be used to describe, measure, and compare spatial relationships.

Standards

Core Standards:

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

- CCSS.MATH.CONTENT.7.G.B.4

  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.6

  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.

BC Standards:

- 7.CC.3.1 Use mathematical vocabulary and language to contribute to mathematical discussions
- 7.CC.3.2 Explain and justify mathematical ideas and decisions
- 7.CC.3.3 Communicate mathematical thinking in many ways

Goals

Lesson Goals:

Mathematical considerations:

- Use reasoning and logic to explore, analyze, and apply mathematical ideas.
- Estimate reasonably.
- Demonstrate and apply mental math strategies.
- Model mathematics in contextualized experiences.

Students will be able to:

- Find the circumference of a circle given its radius or diameter, or vice versa.
- Find the area of a circle given its radius, diameter, or circumference, or vice versa
- Finding relationships between radius, diameter, circumference, and area to develop the $\underline{C = \pi \times d}$ formula

- Applying the A = π x r x r formula to find the area given radius or diameter
- Solve real-life problems involving the areas and circumferences of circles.

Prerequisites

Students should already be familiar with

- what a circle is and identify its radius and diameter,
- real numbers and operations on them.

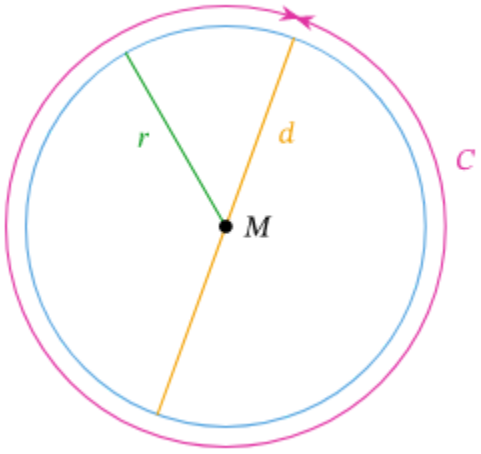
Methods

Anticipatory Set:

- Name some circular shapes we usually find in natural environments.
- Name technologies and tools that are possible using circle-shaped pieces.
- Give students a G5 (or any card-shaped) card information related to circle calculations.
- Watch the video about the fun of circular movements https://www.youtube.com/watch?v=snHKEpCv0Hk

Introduction to the formula for the area of a circle

We will define some essential elements to make students feel more comfortable with the basics and then introduce them to the formula for the area of a circle.



- Definition: Circle

A circle is composed of points at the same distance from the center, which we have labelled here by M.
A circle radius is a line segment that goes from the center to the edge, which we have labelled here by r.
A circle's diameter is a line segment that starts and ends at two points on the edge of the circle and passes through the center, which we labelled by d.
Diameters are twice the length of radii.
Finally, the circumference is the distance going around the circle, which we have labelled C.

- Formula: Circumference of a Circle

For a circle with diameter d and circumference C, their lengths are related by $C = \pi d$.
In addition, the circumference can be expressed in terms of a radius r as $C=2\pi r$.

- Formula: Area of a Circle

For a circle with a radius r, its area A is given by $A=\pi r * r$.

Provide Guided Practice:

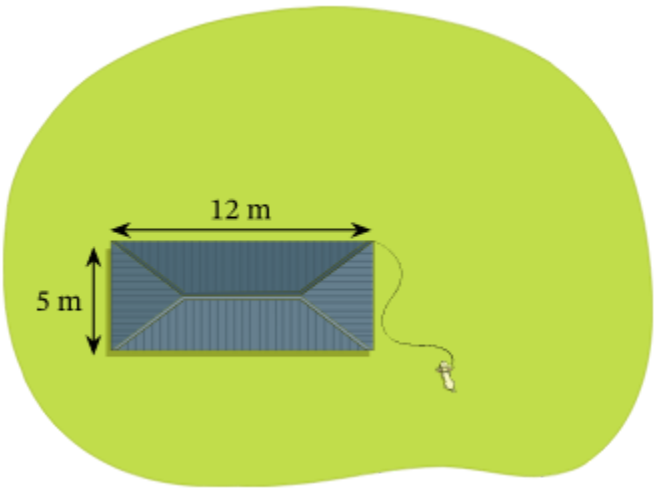
Ask students to complete the following problems in pairs:

1. Hold each other hands and draw a circle; one will follow the role of the centre point, and the other will walk around and draw the like on the floor.
2. Calculate the distance between each other.
3. Use the formula to calculate the area
4. Write the formula measurements and the result on the floor.

Provide Independent Practice:

Question,

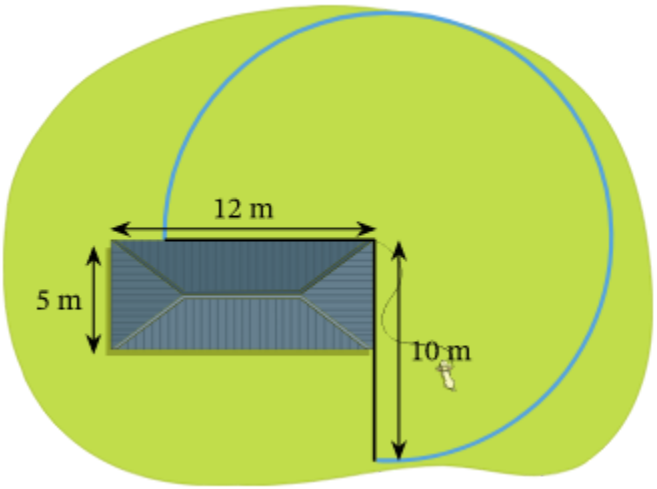
A goat, is tethered by a 10-metre-long rope to the corner of a barn. What area of the field can the goat reach?



Answer

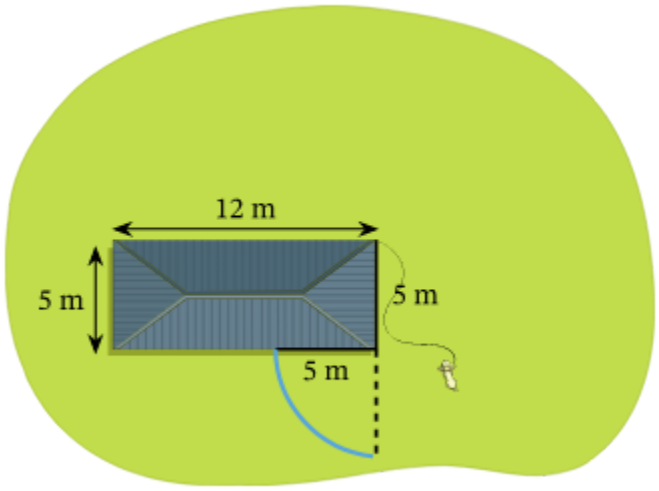
This example effectively has two parts. First, we must find what area is covered by the goat by keeping the length of the rope and the barn's dimensions. Then, we must calculate this area using the formula for the area of a circle, modified to find portions of a circle.

First, let us consider what space the goat can cover above and to the right of the barn. We can see that in this case, since the rope is 10 metres long, the area forms part of a circle with a radius of 10 metres, as shown below.



In addition to this area, it is also possible for the goat to move below the barn. In that case, 5 metres of the rope will be stuck against the right wall, leaving 5 metres of length left in the rope. Thus, a quarter of a circle with a radius of 5 metres is formed, which we show below.

Thus, the total area is the addition of both of these areas together. To find these areas, we can use the formula for the area of a circle, which is $A=\pi r * r$.



For the larger area, we can see that the area forms three-quarters of a full circle. Another way to think of this is to have a full circle with one quarter cut out. Thus, if we calculate the area of a circle with a radius r=10 and multiply it by 34, we will get this area. That is, the area of the larger part is $34\pi \times 10$.

For the smaller area, we have a quarter-circle with a radius $r = 5$. Therefore, its area is the area of a circle with a radius of 5 multiplied by 14, which is the Area of the smaller part = $14\pi \times 5$.

Adding these two areas together, we get total area

Area = $34\pi \times 10 + 14\pi \times 5 = 3004\pi + 254\pi = 3254\pi$.

Warmup (10~15 minutes)

Students will count problems that can be solved using circle calculations.

We will discuss planets' orbits as examples of circles and also will draw graphics using circles. It could be a donut, a ball in 2D perspective, or anything they like.

Watch a video about calculating PI using the area of a circle and rectangle.

Suggested Video: https://www.youtube.com/watch?v=ELetCV_wX_c

Assessment

Formative/Ongoing Assessment:

Students will participate in an outdoor activity in which they will walk around the school to find circular objects and do the surface area calculations.

Also, they will be able to walk around an area circularly based on how many steps they took. They will be able to calculate the area of the circle inside.

By the end of the lesson, they will create a map of the school area using circles.

The student will take this assessment home and return the result (Use 3.14 for PI)

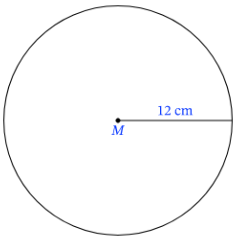
Summative/End Of Lesson Assessment:

1. The area of a circle of diameter d is

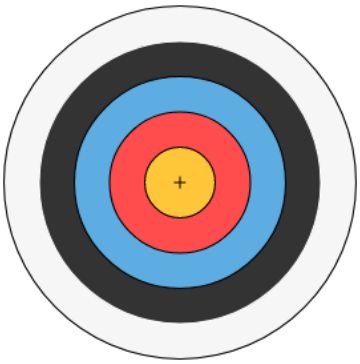
   [ ] $2\pi d^2$ [ ] πd^2 [ ] $\frac{\pi d^2}{2}$ [ ] $\frac{\pi d^2}{4}$

2. Find the area of a circle when the diameter is 4 cm

3. Find the area of the circle below



4. The bull's eye on the given archery target has a radius of 3 cm. The entire target has a radius of 15 cm. Determine the target area outside of the bull's eye rounded to the nearest square cm.



Rubric for assessment

Objective (Possible Point)	0	1	2
Right Formula (1)	Wrong Formula	Right Formula	
Calculate right area (2)	Do not answer the question or answer it in a way that does not match 1 or 2 point answers.	Miss calculation and use 4 as radius.	Write the correct answer.
Calculate the right area (2)	Do not answer the question;		Write the correct answer.
Calculate the bull's eye area.	Do not answer the question or answer it in a way that does not match 1 or 2-point answers.	Miss calculation due to analytical issues.	Write the suitable answer

Materials

- Paper for calculations
- Rulers

References

CAST UDL Lesson Builder. (n.d.). Lessonbuilder.cast.org. Retrieved June 25, 2022, from http://lessonbuilder.cast.org/explore.php?op=static&pid=rocks_6

Formative Assessment: Measurement | DREME TE. (n.d.). Prek-Math-Te.stanford.edu. https://prek-math-te.stanford.edu/measurement-data/formative-assessment-measurement

KNILT. (2019). Albany.edu. https://knilt.arcc.albany.edu/images/7/71/Audio_Lesson.pdf

Lesson: Areas and Circumferences of Circles | Nagwa. (n.d.). Www.nagwa.com. Retrieved June 25, 2022, from https://www.nagwa.com/en/lessons/840181618052

Lesson Plan: Calculating Perimeter and Area of 2-D Shapes. (2022). Scholastic.com. https://www.scholastic.com/teachers/teaching-tools/articles/lessons/perimeter-area-worksheets.html