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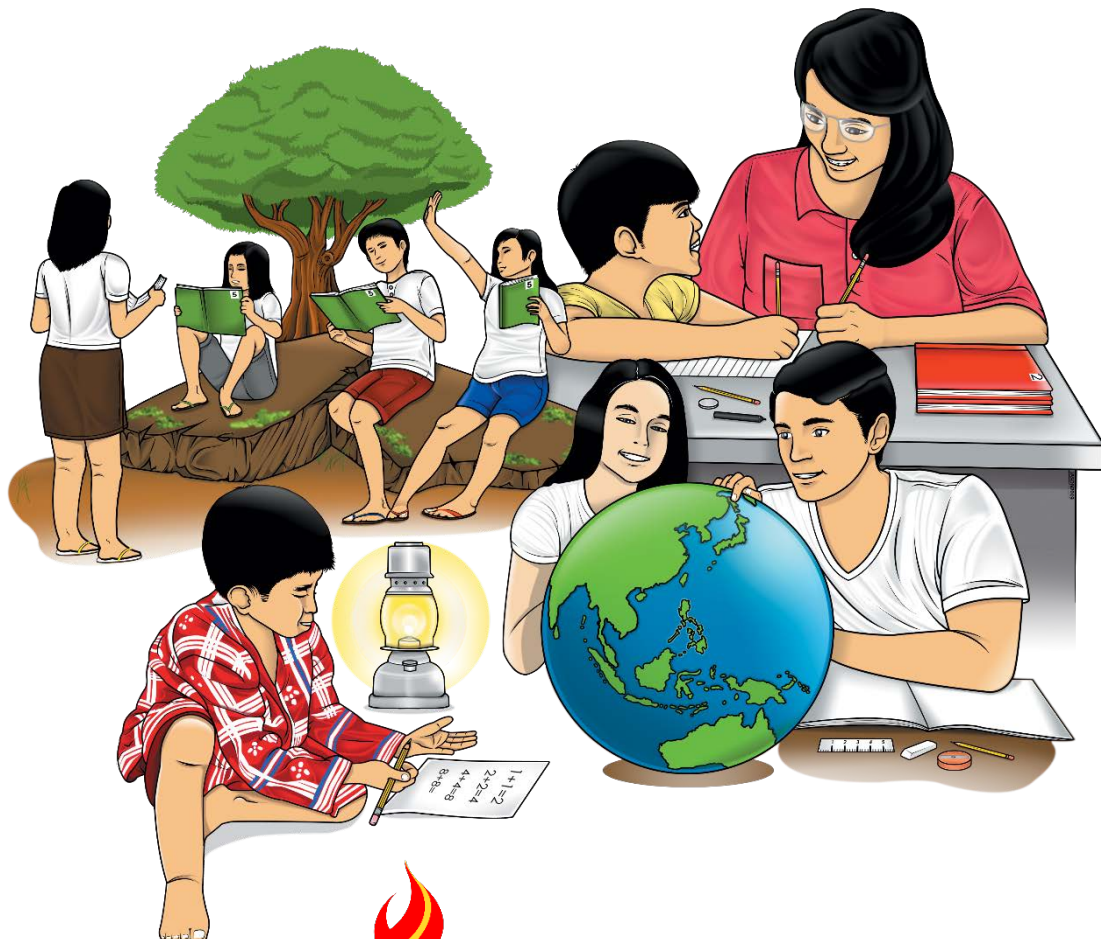# Mathematics
Quarter 3 – Module 21:
Solving Routine and Non-routine Problems Involving the Circumference of a Circle

Mathematics – Grade 5
Alternative Delivery Mode
Quarter 3 – Module 21: Solving Routine and Non-routine Problems Involving
 Circumference of a Circle
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Mathematics
Quarter 3 – Module 21:
Solving Routine and Non-routine Problems Involving the Circumference of a Circle

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

Hi, Mathletes! In this module, you will learn how to solve routine and non-routine problems involving the circumference of a circle.

Routine problems use clear procedures. You may follow a step-by-step process to solve them. In contrast, non-routine problems use procedures that are not immediately clear. Such problems challenge our thinking skills. They may be solved using different strategies.

After going through this module, you are expected to:
- solve routine and non-routine problems involving the circumference of circle.

What I Know

Directions: Read each problem and answer the questions that follow. Write the letter of your answer on a separate answer sheet.


What is the radius of a circle whose circumference is 31.4 meters?

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1. Which of the following formulas should be used to solve the problem?

    A. $C = \pi r$
    B. $r = \frac{C}{2\pi}$
    C. $r = 2\pi C$
    D. $r = \frac{2\pi}{C}$

2. What is the radius of the circle?

    A. 5
    B. 8
    C. 9
    D. 10

A circular garden's diameter is 5 meters. If Jose walks around the garden three times, how far will he have walked?

---

3. Which of the following formulas may be used to solve the problem?

    A. $C = \pi d$
    B. $C = 2\pi$
    C. $C = 2\pi d$
    D. $C = 2d$

4. What is the total distance covered by Jose if he walks around the garden three times?

    A. 15.7 m
    B. 31.4 m
    C. 47.1 m
    D. 94.2 m

Reina's old cylindrical pen holder has a height of 13 cm and a radius of 5 cm. She wants to wrap a decorative paper around its curved surface to give the pen holder a new look. What are the dimensions of the decorative paper needed for this purpose?
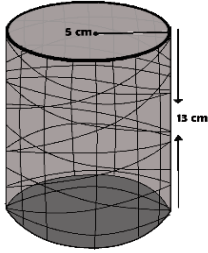
5. What is the shape of the decorative paper that will be wrapped around the cylindrical pen holder?
   A. cube   B. rectangle   C. rhombus   D. square

6. What is the formula for finding the area of the rectangle?
   A. length x radius
   B. (2 x length) + (2 x width)
   C. width x width
   D. length x width

7. What is the circumference of the pen holder?
   A. 15.7 cm   B. 24.6 cm   C. 31.4 cm   D. 62.8 cm

8. In this problem, which dimension of the decorative paper is given by the circumference of the pen holder?
   A. width   B. length   C. diagonal   D. perimeter

9. What is the width of the decorative paper needed to cover the curved surface of the cylinder?

   A. 5 cm   B. 13 cm   C. 18 cm   D. 31.4 cm

10. What are the dimensions (in cm) of the decorative paper needed to cover the curved surface of the cylinder?

    A. 5 x 13   C. 13 x 18
    B. 5 x 31.4   D. 13 x 31.4

CONGRATULATIONS! If you got a score of 9 or 10, you should not have any difficulty studying the lesson in this module.

If you got a score of 8 or below, you may need to study the lesson more carefully and do all the given activities.

Lesson 1 — Solving Routine and Non-routine Problems Involving the Circumference of a Circle

Problem solving is a fundamental skill that any mathematics learner should possess. In many countries, developing problem solving skills is the primary goal of learning mathematics.

What's In

In the previous module, you learned that to find the circumference or distance around the circle, you can use the following formulas:

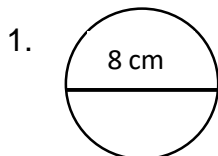a. If the diameter is given:
$$C = \pi d$$

b. If the radius is given:
$$C = 2\pi r$$

*where **d** is the diameter, **r** is the radius, and **π = 3.14** (as approximation).*

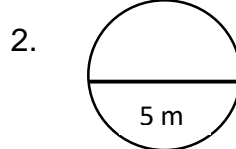Note that the diameter is twice as long as the radius. That is, **d = 2r.**

Let's try the following exercises.

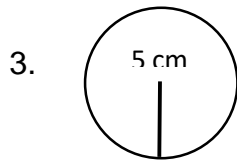Directions: Find the circumference of each circle. (Use **π = 3.14**)

1.

8 cm

d = 8 cm

C = _____

2.

5 m

d = 5 m

C = _____

3.

5 cm

r = 5 cm
C = _____

5.

6 cm

r = 6 cm
C = _____

4.

7 dm
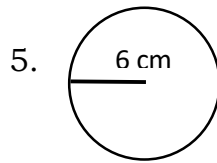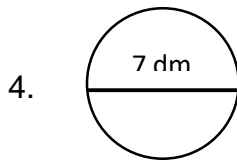
d = 7 dm
C = _____

What's New

Now that you know the circle and its parts and you know how to find its circumference, you are now ready to solve routine and non-routine problems involving the circumference of a circle.

We know that many situations in real life require finding the circumference of a circle. Here is one example.

Every morning Mario jogs around a circular path that measures 20 meters across the center. He wants to know how far he has run when he goes around it once.

How will he find the answer? Can you help him?

What Is It

As discussed in the previous modules, **problem solving** is a process or an act of defining or finding a solution to a problem. To solve a problem, one must begin by identifying the given facts and what is being asked, and devising a plan to find the answer.

When solving problems involving the circumference of a circle, it helps to remember the formulas for finding the circumference of the circle given its diameter **(C = πd)** or radius **(C = 2πr).**

.

The **four-step plan** below is a helpful guide in solving any problem.

1. **Understand** by identifying what is being asked and what the relevant facts are in the problem.
2. **Plan** by choosing a strategy to solve the problem. You may draw or illustrate the situation in the problem, use a table, graph, variable, or an equation. Some key words may help in identifying the operation/s to be used.
3. **Solve** by performing the operations needed to find the answer.
4. **Check** by verifying if the answer is correct or not.

Let us use the ***four-step plan*** to solve the problem introduced in the previous page.

    Every morning Mario jogs around a circular path which measures 20 meters across the center. He wants to know how far he has run when he goes around it once.

• **Understand**	
- What is being asked in the problem? - What are the given facts?	- How far does Mario run by going around the path once? - The circular path measures 20 meters across the center.

• **Plan** Choose a strategy. Select the operation (use **clue/key** words in the problem).	Since the path is circular, the distance around it is its circumference and the distance across passing through the center is its diameter. The circumference is unknown and $d = 20\ m$. Use the formula for finding the circumference of a circle when the diameter is given. $$C = \pi\ d$$
• **Solve** Perform the strategies.	$C = \pi d$ $\quad = 3.14 \times 20\ m$ $\quad = 62.8\ meters$ ***Answer****: Mario runs **62.8 meters** when he goes around the circular path once.*
• **Check** Verify if the answer is correct.	$C \quad = \pi d$ $62.8\ m \ = 3.14 \times 20\ m$ $62.8\ m \ = 62.8\ m$ Double check the computations and make sure that you use the correct unit of measure.

Here are other examples of real-life problems involving the circumference of a circle.

These problems will be solved using the four-step plan.

Problem 1

Ally wants to reuse an old cylindrical coin bank whose length is 18 cm and whose diameter is 4 cm. She wants to give the coin bank a new look by wrapping a decorative paper around its curved surface. What are the dimensions of the decorative paper needed to wrap around it?

Before solving this problem, consider the following information or facts about the cylinder:

- A cylinder has **two congruent bases** and a **curved surface.** It is formed by a rectangle, which is the side (or curved surface) of the cylinder, and two circles, which are the two bases of the cylinder. The net of a cylinder is shown below.
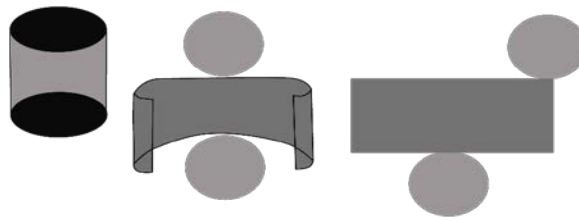
- The cylinder's net consists of two circles and a rectangle. The rectangle's dimensions (height and width) are given by the **circumference** of the circle and the height of the cylinder. In a rectangle, the longer side is the length while the shorter side is the width.

Now you are ready to solve the problem following the ***four-step plan***.

- **Understand** - What is being asked in the problem? - What are the given facts?	- What are the dimensions (length and width) of the decorative paper needed to wrap around the coin bank? - The coin bank is a cylinder whose height is 18 cm and whose diameter is 4 cm.
- **Plan** - Choose a strategy - select the operation (use **clue/key** words in the problem)	The height of the cylinder gives one side of the rectangular paper, that is, 18 cm. The measure of the other side of the rectangular paper is the circumference of the circle. - Use the formula for finding the circumference of a circle when the diameter is given. That is, $$C = \pi d$$

| • **Solve**
- Perform the strategies
	$C = πd$
	     $= 3.14 \times 4\ cm$
	     $= 12.56\ cm$
	
	Thus, rectangular paper has a width of 12.56 cm. Recall that the length of the decorative paper is 18 cm.
	
	Answer: *The decorative paper needed is 18 cm long and 12.56 cm wide.*

• **Check** - Verify if the answer is correct	Double check the computations. The cylinder is 18 cm long and the distance around it is 12.56 cm. Hence, a rectangular paper that is 18 cm long and 12.56 cm wide will be able to cover the entire side of the cylinder.

Here is another example.

The wheel of a bicycle has a radius of 20 cm. Find the distance it covers in one complete turn.

Using the four-step plan, we have:

• **Understand** - What is being asked in the problem? - What are the given facts?	What is the distance the bicycle wheel covers in one complete turn? The wheel has a radius of 20 cm.
• **Plan** - Choose a strategy - select the operation (use **clue/key** words in the problem)	Since the circumference of the wheel is the distance covered when it completes one turn, we need to find the circumference of the circle whose radius is 20 cm. We can use the following formula: **C = 2πr** since the radius is given (***r = 20 cm***).

• **Solve**
- Perform the strategies
	$C = 2πr$
	    $= 2 \times 3.14 \times 20\ cm$
	    $= 125.6\ cm$
	Answer: *The wheel covers a distance of **125.6 cm** in one complete one turn.*

• **Check**
- Verify if the answer is correct
	Using the previous discussion:
	   C ÷ 2r = π
	125.6 ÷ 2(20) = 3.14
	125.6 ÷ 40 = 3.14
	      3.14 = 3.14
	
	The answer is correct.

I'm sure, you are now ready to take on some exciting exercises involving the circumference of a circle. Just remember to do the tasks following the guide as explained earlier. You can do it!
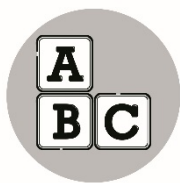
What's More

Activity 1: MATCH Me, Ney Ney...

Directions: Match the questions in Column A with their corresponding answers in Column B. Write your answers on a separate sheet of paper. Refer to the problem below.

Manuel wants to build a fence around a circular pond. The radius of the pond is 3.2 m. How long should the fence be?

Column A	Column B
1. What is being asked in the problem?	*a*. 6.4 m
2. What is/are the given fact/s?	*b*. 20.1 m
3. What is the formula to be used?	*c*. length of the fence needed to enclose the pond
4. What is the answer?	*d*. r = 3.2 m
5. What is the diameter of the garden?	*e*. C = 2 π r

Activity 2: I Can FILL It!

Directions: Read and solve the problem below.

1. The diameter of a circle is 12 decimeters. What is its circumference?
   Formula: _____
   Answer: _____

2. A circular tablecloth will be decorated with lace trimmings. Its diameter is 124 cm How many meters of lace will be used?
   Formula: _____
   Answer: _____

3. The bicycle covered a distance 188.4 cm with one turn of the wheel. What is the radius of wheel?
   Formula: _____
   Answer: _____

Activity 3: It's FOUR You!

Directions: Read each problem and fill in the needed information using the four-step plan.

The perimeter of a square is 50 cm. What is the circumference of the largest circle that can be drawn inside the square?

• **Understand** 1. What is being asked in the problem? 2. What are the given facts?	1._____ 2. _____
• **Plan** 3. Choose a strategy - select the operation (use **clue/key** words in the problem)	3._____
• **Solve** **4.** Perform the strategies	4._____
• **Check** **5.** Verify if the answer is correct	5._____

What I Have Learned

Directions. Fill in the blanks

After going through this module and performing all the activities, I have learned that

(1) _____is the distance around the circle. When the diameter is given, the circumference can be found using the formula (2)_____. When the radius is given, the formula for finding the circumference is (3)_____. To solve a problem, first we need to identify what is being (4)_____ and what are the given (5)_____.

Truly, mathematics provides us with the strategies and tools to solve problems in real life. It teaches us how to analyze a situation, think critically, and work systematically and patiently until we arrive at the solution.

So, give it a try in this next exercise. Have fun!

What I Can Do

Directions: Read, analyze, and solve the following problem.

1. Mr. Edgardo Cruz bought two round wall clocks. The blue wall clock has a circumference of 53.38 cm while the brown wall clock has a circumference of 65.94 cm. How much longer is the diameter of one wall clock than the other?

Assessment

A. Directions: Find the circumference of each circular object. Write your answer on a separate sheet of paper.

1. A table top with a diameter of 90 cm
2. A mirror with a diameter of 18 cm
3. A picture frame with a diameter of 15 cm
4. A wall clock with a radius of 22 cm
5. A circular pond with a radius of 5.5 m

B. Directions: Read and solve the following word problems. Write your answer on a separate sheet of paper.

6. The circle has a circumference of 40.82 cm. What is its diameter?
   A. 12cm   B. 13 cm   C. 14cm   D. 15 cm

7. A circular fishpond has a 6.4 m diameter. How many meters of fence is needed to enclose the fishpond?
   A. 20.066 m   B. 20.096 m   C. 21.066m   D. 21.096 m

8. The distance around a circular fountain is 25.12 m. What is its radius?
   A.   2 m   B. 3 m   C. 4 m   D. 5 m

For items 9 – 10: Jessica has a square paper whose edge measures 30 cm.

9. What is the diameter of the largest circle that she can cut out from the square paper?
   A. 60 cm   B. 50 cm   C. 40 cm   D. 30 cm

10. What is the circumference of the largest circle that she can cut out from the square paper?
    A. 94.2 cm   B. 86.9c m   C. 64.2 cm   D. 56.8 cm

CONGRATULATIONS! *If you got a score of 9 or 10, you have understood the lesson.*

If you got a score of 8 or below, you may need to restudy the lesson more carefully and do all the given activities.
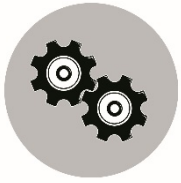
Additional Activities

Directions: Read each problem and solve for the answer using the four-step plan.

1. A wheel has a diameter of 40 centimeters. How far does it roll after 5 complete revolutions?

2. A circle is drawn around a square. If the circumference of the circle is 50.24 cm, what is the length of the diagonal of the square?

Answer Key

Assessment

1. 282.6 cm
2. 56.52 cm
3. 47.1 cm
4. 138.16 cm
5. 34.54 m
6. B
7. B
8. C
9. D
10. A

Additional Activities

1. 628 cm
2. 16 cm

What I Have Learned

1. Circumference
2. C = π d
3. C = 2π r
4. Asked
5. facts

What's More
Activity 2

1. Formula: C = π d
   Answer: 37.68 dm
2. Formula: C = π d
   Answer: 389.36 cm
3. Formula: r = $\frac{c}{2\pi}$
   Answer: 30 cm

What's More
Activity 3

1. The circumference of the largest circle that can be drawn on the square paper.
2. 50 cm perimeter of square
3. Use the formulas:
   C = π d, for circumference of the circle
   P = 4s, for the perimeter of a square
4. Solve:
   4s = 50 cm
   s = 50 ÷ 4
   s = 12.5 cm
   The side of the square is 12.5 cm. This is also the diameter of the circle.
   Thus,
   C = π d
   C = π x 12.5 cm
   C = 39.25
5. Check: Recheck your solution.
   C = π d
   39.25 = π x 12.5
   39.25 = 39.25 cm = 39.25 cm

What's More
Activity 1

1. C
2. D
3. E
4. B
5. A

What's In

1. 25.12 cm
2. 15.7 m
3. 31.4 cm
4. 21.98 cm
5. 37.68 cm

What I Know

1. B
2. A
3. A
4. C
5. B
6. D
7. C
8. B
9. B
10. D

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