9

Mathematics

Quarter 2 - Module 8: Solving Problems Involving Radicals

AIRs - LM

Mathematics 9
Quarter 2 - Module 8: Solving Problems Involving Radicals
Second Edition, 2021

Development Team of the Module

Author: Edel Jayne E. Villanueva
Editor: SDO La Union, Learning Resource Quality Assurance Team
Content Reviewers: Philip R. Navarette and Jocelyn G. Lopez
Language Reviewers: Teresa A. Villanueva and Cleofe M. Lacbao
Illustrators: Ernesto F. Ramos, Jr. and Christian Bautista
Design and Layout: Dana Kate J. Pulido

Management Team:

Atty. Donato D. Balderas Jr.
Schools Division Superintendent
Vivian Luz S. Pagatpatan, PhD
Assistant Schools Division Superintendent
German E. Flora, PhD, *CID Chief*
Virgilio C. Boado, PhD, *EPS in Charge of LRMS*
Erlinda M. dela Peña, EdD, *EPS in Charge of Mathematics*
Michael Jason D. Morales, *PDO II*
Claire P. Toluyen, *Librarian II*

Printed in the Philippines by: _____

Department of Education – SDO La Union
Office Address: Flores St. Catbangen, San Fernando City, La Union
Telefax: 072 – 205 – 0046
Email Address: launion@deped.gov.ph

Jumpstart

This activity will enable you to assess your prior knowledge on solving problems involving radical equations.

ACTIVITY 1: Review

A: Arrange the following steps in solving radical equations. Write A for first step, B for step 2 and so on. Write your answers on separate sheet of paper.

_____1. Arrange the terms of the question so that one term with radical is by itself on one side of the equation.
_____2. Check apparent solutions in the original equation.
_____3. If a radical still remains, repeat steps 1 to 3.
_____4. Square both sides of the radical equation.
_____5. Solve for the variable.
_____6. Combine like terms.

B. Solve and find the value of x on the given radical equations below. Write your answers on separate sheet of paper.

1. $-5\sqrt{x} = -50$
2. $\sqrt{x} - 2 = 10$
3. $3\sqrt[3]{x+1} = 2$
4. $\sqrt[3]{2x+1} = \sqrt[3]{x+8}$

Activity 2: The Reason Behind My Actions

Directions: Solve the radical equation. Write your solution and the property, definition or theorem that you used with respect to your solution.

RADICAL EQUATION	SOLUTION	REASON
$6\sqrt{8x^2 - 72} = 5$		

Discover

To solve problems involving radicals, you must answer the question asked. Well-labeled diagrams and pictures will help you understand better the problem.

Five-step problem solving procedure:
1. Understand the Problem
   - Identify the quantity or quantities you are being asked to find.
2. Translate the problem into mathematical language (express the problem as an equation).
   - Choose a variable to represent one quantity, write down exactly what it represents.
   - Using this information, write the equation that represents the application.
3. Carry out the mathematical calculations (solve the equation).
4. Check the answer (using the original application).
5. Answer the question asked.

Example 1.

A certain number is the same as the cube root of 16 times the number. What is the number?

Representation: Let m be the number
Mathematical equation: $m = \sqrt[3]{16m}$
Solution:

$$m = \sqrt[3]{16m}$$
$$m = (16m)^{\frac{1}{3}}$$
$$(m)^3 = \left[(16m)^{\frac{1}{3}}\right]^3$$
$$m^3 = (16m)^{\frac{3}{3}}$$
$$m^3 = 16m$$
$$m^3 - 16m = 0$$
$$m(m^2 - 16) = 0$$
$$m^2 - 16 = (m+4)(m-4)$$
$$m = 0, m = -4, m = 4$$

Answer:

The numbers are 0, -4 and 4.

The key to word problems is in the translation. Let's walk through the second problem below and solve it.

Example 2.

Lori recently purchased a square painting with an area of 780 cm^2. How much wood does Lori need to make the frame? Don't worry about the width and height of the wood, just find the length.

First, find out the *essential* information in the problem.

A square painting has area 780cm^2**, what is its side length?**

What is the relationship between side length and area of a square?

Area=side length × side length

Denote side length as x for simplicity, plug in the numbers we have:

$780\text{cm}^2 = x.x$

Solve for x:

$780 = x^2$

$x = \sqrt{78}$

$x \approx 27.93$

Lastly, note that the question is asking how much wood Lori needs to build the frame.

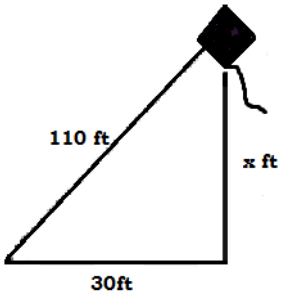
A square has 4 sides so we have to multiply 27.93cm by 4.

In total, Lori needs at least 27.93cm×4=111.72cm of wood.

Example 3:

A kite is secured to a rope that is tied to the ground. A breeze blows the kite so that the rope is taught while the kite is directly above a flagpole that is 30 ft from where the rope is staked down. Find the altitude of the kite if the rope is 110 ft long.

The first step is to draw a diagram.



The Pythagorean Theorem states:

The length of the hypotenuse (diagonal line) is equal to the square root of the square of the sides added.

As an equation:

$c = \sqrt{a^2 + b^2}$; where c is the hypotenuse and a and b are the other sides.

Start by plugging in all the information we know.

$110 = \sqrt{30^2 + x^2}$

To solve this, we want to take the square of both sides.

$(110)^2 = \left(\sqrt{30^2 + x^2}\right)^2$

$12100 = 30^2 + x^2$

$12100 - 30^2 = x^2$

$12100 - 900 = x^2$

$11200 = x^2$

$\sqrt{11200} = \sqrt{x^2}$

$\mathbf{105.83 \approx x}$

Now that you have learned how to solve real – life problems that involves radicals, you can proceed to the next activities

Explore

Here are some enrichment activities for you to work on to master and strengthen the basic concepts you have learned from this lesson.

Activity 3: Try to Answer My Question!

Directions: Read carefully the given problem then answer the questions that follow. Use separate sheet of paper to answer.

A. *If each side of a square garden is increased by 4m, its area becomes 144m^2.*

1. What is the measure of its side after increasing it?
2. What is the length of the side of the original square garden?
3. Supposing the area of a square garden is 192m^2, find the length of its side.

B. *A square stock room is extended at the back in order to accommodate exactly the cartons of canned goods with a total volume of 588 m^3. If the extension can exactly accommodate 245 m^3 stocks, then find the original length of the stock room.*

1. What are the dimensions of the new stock room?
2. Assuming that the floor area of a square stock room is 588 m^2, determine the length of its side.
3. Between which consecutive whole numbers can we find this length?

C. *A farmer is tilling a square field with an area of 900 m^2. After 3 hrs, he tiled 2/3 of the given area.*

1. Find the side of the square field.
2. What are the dimensions of the tiled portion?
3. if the area of the square field measures 180 m^2, find the length of its side?
4. Between which consecutive whole numbers can we find this length?

Activity 4: Problem – Solved!

Directions: Solve the problems by analyzing the given statements and answering the questions that follow. Use separate sheet of paper to answer.

A. Number Problems

1. Five times the square root of less than a number is equal to 3 more than the number. Find the number.
2. What number or numbers are equal to their own square roots?
3. The sum of a number and its square root is equal to 0. Find the number.

B. Approximately, the distance d in miles that a person can see to the horizon is represented by the equation $d = \sqrt{\frac{3h}{2}}$, where h is the height where the person is. (1 mile = 1609.3)

1. How far can you see to the horizon through an airplane window at a height of 8000 m?
2. How far can a sailor see to the horizon from the top of 20 m mast?
3. How far can you see to the horizon through an airplane window at a height of 9800 m?
4. How far can a sailor see from a top of a 24 m mast?

C. The formula $r = 2\sqrt{5L}$ can be used to approximate the speed r, in miles per hour, of a car that has left a skid mark of L, in feet.

1. How far will a car skid at 50 mph? at 70 mph?
2. How far will a car skid at 60 mph? at 100 mph?

D. Carpenters stabilize wall frames with a diagonal brace. The length of the brace is given by $L = \sqrt{H^2 + W^2}$.

1. If the bottom of the brace is attached 9 m from the corner and the brace is 12 m long, ho far up the corner post should it be nailed?

Source (Modified): EASE Modules, Year 2 – Module 6 Radical Expressions, pages 14 – 17

How did find the problems above? Where you able to solve for the required solutions easily or you encountered difficulty in solving it? Which part of the problem solving process is challenging? What did you do to cope with these challenges?

In the previous activity you were able to apply your understanding of solving radical equations to solving real – life problems that involve radicals.

Let us put that understanding to the test by answering the next activity

Deepen

Activity 5: More Problems Here!

Directions: Read, understand and solve each problems then answer the questions that follow. Answer it on a separate sheet of paper.

Situation 1:

Juan is going to Nene's house to do a school project. Instead of walking two perpendicular streets to his classmate's house, Juan will cut a diagonal path through the city plaza. Juan is 13 meters away from Nene's street. The distance from the intersection of the two streets to Nene's house is 8 meters.

Questions:

1. How would you illustrate the problem?
2. How far will Juan travel along the shortcut?
3. How many meters will hemay save by taking the shortcut rather than walking along the sidewalks?
4. If one of the distance increases/ decreases, what might happen to the distance of the shortcut? Justify your answer.
5. What mathematical concepts did you use?

Situation 2:

A wire is anchored on a 9 – meter pole. One part is attached to th top of the pole and the other is 2 meters away from the base.

Questions:

1. How long is the wire?
2. What will happen if the wire id farther/ nearer to the base? Justify your answer.
3. What mathematical concepts did you use?

Situation 3:

If a 36 – storey building is 110 meter high, using the formula $d = \sqrt{\frac{3h}{2}}$ *for sight distance where d is the diastance in miles and h is the height where the person is, how far can you see the building on a clear day? (1 mile = 1609.3 m)*