

9

Mathematics

**Quarter 1 - Module 4:
Word Problems Involving
Quadratic and Rational
Equations**





About the Module

This module was designed and written with you in mind. It is here to help you master about Word Problems Involving Quadratic and Rational Equations. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

This module is divided into four lessons, namely:

- Lesson 1 – Age Problems
- Lesson 2 – Number Problems
- Lesson 3 – Geometry Problems
- Lesson 4 – Rational Equations

After working through this module, you are expected to:

- translates real-life problems into mathematical equations;
- solves real-life problems with the use of the skills in solving quadratic and rational equations; and
- appreciate the importance of quadratic and rational equations in carrying out mathematical and real-life problems.



What I Know (Pre-Test)

DIRECTIONS: Read the following questions carefully. Some items need to be solved, solve it in a separate sheet of paper. Choose the correct answer and write it in your answer sheets. If the answer is not found in the given choices, kindly write the correct answer.

- ____ 1.) Thomas is 2 years more than twice the age of Peter, and the product of their ages is 24. Which of the following equations represents the given situation?
- A. $x^2 + 2x = 24$ C. $2x^2 + 2x = 24$
B. $2x^2 + x = 24$ D. $2 + x = 24$
- ____ 2.) Using the word problem given in number 1, how old is Peter?
A. 8 years old B. 5 years old C. 4 years old D. 3 years old

For items 3 – 6, refer to the problem inside the box and answer the questions that follow.

The length of a wall is 7 meters longer than its width, and its area is $30m^2$.

- ____ 3.) Which of the following expressions represents the length of the wall?
A. x B. 7 C. $7 - x$ D. $x + 7$
- ____ 4.) Which of the following represents the width of the wall?
A. x B. $x + 7$ C. $7 - x$ D. $x + 7$
- ____ 5.) Which of the equations represents the given situation?
A. $x(x + 7) = 30$ C. $7x + x = 30$
B. $x(7 - x) = 30$ D. $x + 7 = 30$
- ____ 6.) What is the length of the wall?
A. 3 meters B. 10 meters C. 30 meters D. 40 meters
- ____ 7.) One positive integer is 5 more than the second positive integer, and the product of these two integers is 14. What is the first positive integer?
A. 2 B. 5 C. 7 D. 9
- ____ 8.) A motorcycle travels 2 kilometers per hour faster than a car. The motorcycle traveled 480km in two hours less than the time it took the car to travel the same distance. How fast does the motorcycle travel?
A. 20.93kph B. 22.93kph C. 40kph D. 80kph
- ____ 9.) The sum of two positive integers is 16, and their product is 60. What are the integers?
A. -6 and 10 B. 6 and -10 C. -6 and -10 D. 6 and 10
- ____ 10.) The sum of a number and its reciprocal is 2, what equation represents the condition?
A. $x + x = 2$ B. $x + \frac{1}{x} = 2$ C. $x - x = 2$ D. $x - \frac{1}{x} = 2$

- ____ 11.) Using the situation in number 10, what is the number?
A. 3 B. 2 C. 1 D. -1
- ____ 12.) The rent of a van to be used in going to one of the resorts in Cebu City is ₱800.00, to be shared equally by a group of friends. At the last minute, the group decided that they will pay for the share of their other two members, resulting in a rise of their share for ₱200.00 each. How many of them paid the rent of the van?
A. 8 B. 6 C. 4 D. 2
- ____ 13.) Using the situation in number 12, how much is the equal share of the people who paid for the rent?
A. ₱100.00 B. ₱200.00 C. ₱400.00 D. ₱800.00

For items 14 – 15. Refer to the problem inside the box.

The area of a triangular frame is 52 in^2 . If the height of the frame is three inches less than twice the length of a base.

- ____ 14.) What equation represents the problem?
A. $2x^2 - 3x - 104 = 0$ C. $2x^2 + 3x - 104 = 0$
B. $2x^2 - 3x + 104 = 0$ D. $2x^2 + 3x + 104 = 0$
- ____ 15.) What is the height of the triangular frame?
A. 21 inches B. 16 inches C. 13 inches D. 8 inches

Lesson 1

Age Problems



What I Need To Know

At the end of this lesson, you are expected to:

- o solve age problems involving quadratic equations



What's In

❖ Flashback 1.1

SOLVING QUADRATIC EQUATIONS

In module 1, you have learned on how to solve for the roots of a quadratic equations using the four methods, namely:

- **by extracting roots**
- **by factoring**
- **by completing the square**
- **by using the quadratic formula**

Now, let us have a short review on how to use the methods above in solving for the roots of the quadratic equation. Use the equation inside the box in solving for the roots using the different methods.

$$x^2 - 9 = 0$$

SOLVING BY EXTRACTING ROOTS

$$x^2 - 9 = 0$$

$$x^2 = 9$$

$$\sqrt{x^2} = \pm\sqrt{9}$$

$$x = \pm 3$$

SOLVING BY FACTORING

$$x^2 - 9 = 0$$

$$(x + 3)(x - 3) = 0$$

$$(x + 3) = 0 \quad | \quad (x - 3) = 0$$

$$x = -3 \quad | \quad x = 3$$

SOLVING BY THE FORMULA

$$x^2 - 9 = 0$$

$$a = 1, b = 0, c = -9$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(0) \pm \sqrt{(0)^2 - 4(1)(-9)}}{2(1)}$$

$$= \frac{\pm\sqrt{36}}{2}$$

$$= \frac{\pm 6}{2}$$

$$x = \pm 3$$

❖ **Activity 1.1: Find my roots!**

DIRECTIONS: Answer the Riddle inside the box below, and to help you, find the roots of the quadratic equation by using whatever method that is convenient for you. Write the letter of the correct answer in the decoder at the bottom of this exercise. Write your answer on a separate sheet of paper.

RIDDLE:

I have three feet, but I cannot walk. What am I?

- | | |
|-------------------------|--------------------------|
| 1.) $x^2 - 49 = 0$ | R $x = -\frac{3}{4} - 1$ |
| 2.) $35x - 5x^2 = 0$ | Y $x = -6 \text{ & } 3$ |
| 3.) $x^2 + 3x = 18$ | A $x = -7 \text{ & } 7$ |
| 4.) $4x^2 + 7x + 3 = 0$ | D $x = 0 \text{ & } 7$ |
| | S $x = 3 \text{ & } 6$ |

DECODER

1		3	1	4	2

❖ **Flashback 1.2**

TRANSLATING VERBAL PHRASES TO ALGEBRAIC EXPRESSION

Algebra has so many uses, and one of it is to give a shorthand for mathematics. It enables us to write long English phrases into symbols.

It translating English phrases into mathematical expressions, it is important to remember the words that are used to indicate mathematical operations. Some of these words are shown in the table below.

Addition (+)	Subtraction (-)	Multiplication (•)	Division (÷)
<ul style="list-style-type: none"> • more than • more • plus • increased by • the sum of • the total of • added to 	<ul style="list-style-type: none"> • less • less than • minus • decreased by • the difference of • subtracted from 	<ul style="list-style-type: none"> • times • the product of • multiplied by 	<ul style="list-style-type: none"> • the quotient of • divided by • the ratio of

Let us try translating the following phrases:

- 1.) the sum of b and y

Translation: $b + y$

- 2.) thrice x

Translation: $3x$

- 3.) the sum of twice a number and 8

Translation:

If x represents a number, then

“twice a number” = $2x$

“the sum of twice a number and 8” = $2x + 8$

- 4.) 3 less than 5 times a number

Translation:

If x represents a number, then

“5 times a number” = $5x$

“3 less than 5 times a number” = $5x - 3$

- 5.) The sum of three consecutive integers is 9

Translation:

If x represents a number, then

“first number” = x

“second number” = $x + 1$

“third number” = $x + 1 + 1$ Or $x + 2$

“the sum of three consecutive integers is 9” = $x + x + 1 + x + 2 = 9$

❖ **Activity 1.2: Translate Me!**

INSTRUCTIONS: Read the English phrases below and translate them into a mathematical statement. To represent the unknown quantity, use a variable.

English Phrase

Mathematical Phrase

1. A number added to seven

2. twice the number more than 9 is 27

3. thrice the number added to two

4. a number multiplied by 8 is 72

5. six less than a number is 7

6. thrice m divided by the difference
of 1 and y

7. the difference of 7 and the reciprocal of y

8. thrice the sum of a number and 10

9. the product of d and 26

10. n increased by e is 33



What's New

You are now ready to apply the skills in solving quadratic equations in solving real-life problems and situations.

❖ Can You Guess Our Age?

Read the situation below and try to guess the ages of Sheila and Ruby.



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Sheila and Ruby are sisters. If Sheila is twice as old as Ruby, and the product of their ages is 98, how old are they now?



What Is It

Sometimes in solving word problems, we use a formula that describes the relationship between the quantities present in the problem. There are formulas for perimeter, area, circumference, volume, and a lot more. But, more often, formulas are not given in the word problems. So, before we can find the solution to the problems, we first need to translate the statements into mathematical expressions.

To help you organize your solution to any kind of word problem, the following steps can help you.

STEPS IN SOLVING WORD PROBLEMS by POLYA

1. Analyze the problem
 - a. Read and understand the problem carefully.
 - b. Determine what is being asked in the problem. A sketch may help you.
 - c. Make a representation on one unknown number by a variable/letter, then represent the other unknown number using the same variable/letter.
2. Formulate the equation.
 - a. Translate the statement into mathematical expressions
3. Solve the problem and interpret
4. Check
 - a. Verify whether your answer satisfies the conditions in the problem



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Now, let us discuss how to solve problems involving quadratic equations. Let us try solving the presented problem in *Can You Guess Our Age?*, using the steps in solving word problems.

Example 1: Sheila and Ruby are sisters. If Sheila is twice as old as Ruby, and the product of their ages is 98, how old are they now?

Solution:

1. *Analyze the problem*

Sheila is twice as old as Ruby

Let x = be the age of Ruby

$2x$ = be the age of Sheila

Now, let us translate the conditions given in the problem into symbols to form an equation

2. *Formulate the equation*

The product of their ages is 98.

In words:	Ruby's Age	times	Sheila's Age	is 98
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In symbols:

$$x \cdot 2x = 98$$

Equation: $x(2x) = 98$

3. *Solve the equation and state the answer.*

Solving for x ,

$$\begin{aligned} x(2x) &= 98 \\ \frac{x^2}{2} &= \frac{98}{2} \\ x^2 &= 49 \\ \sqrt{x^2} &= \pm\sqrt{49} \\ x &= \pm 7 \end{aligned} \quad \left. \begin{array}{l} \text{Translate the equation into standard form} \\ \text{Solve the equation by extracting roots} \\ \text{NOTE: You may use whatever method} \\ \text{that is convenient for you.} \end{array} \right\}$$

We will use $x = 7$ as the age of Ruby because we cannot have a negative number as age, so we disregard $x = -7$. **So, Ruby is 7 years old.**

Solve for the age of Sheila.

$$\begin{aligned} \text{Sheila's age} &= 2x \\ &= 2(7) \\ &= 14 \end{aligned}$$

Therefore, Ruby is 7 years old, while Sheila is 14 years old.

4. *Checking*

Let us check using the conditions given in the problem.

Is Sheila twice as old as Ruby?

$$\begin{aligned} \text{Sheila's age} &= 2(\text{Ruby's age}) \\ &= 2(7) \\ &= 14 \end{aligned} \quad \text{YES}$$

Is the product of the ages 98?

$$\begin{aligned} (\text{Ruby's age})(\text{Sheila's age}) &= 98 \\ (7)(14) &= 98 \\ 98 &= 98 \end{aligned} \quad \text{YES}$$

Example 2: Zeke is five years older than his friend Kirsten. If the product of their ages is 50. How old are they now?

Solution:

1. *Analyze the problem*

Zeke is five years older than his friend Kirsten.

Let x = be the age of Kirsten

$x + 5$ = be the age of Zeke

2. *Formulate the equation*

The product of their ages is 50.

In words:

Kirsten's age	times	Zeke's age	= 50
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In symbols

$$\begin{array}{cccc} x & \cdot & x + 5 & = 50 \\ \text{Equation: } x(x + 5) = 50 \end{array}$$

3. *Solve the equation and state the answer.*

Solving for x ,

$$\begin{array}{l} x(x + 5) = 50 \\ x^2 + 5x = 50 \\ x^2 + 5x - 50 = 0 \\ (x - 5)(x + 10) = 0 \\ x = 5 \quad | \quad x = -10 \end{array} \quad \left. \begin{array}{l} \text{Rewrite the equation into standard form} \\ \text{Solve the equation by Factoring} \end{array} \right\}$$

We will use **$x = 5$** as the age of Kirsten because we cannot have a negative number as age, so we disregard $x = -10$. So, **Kirsten's age is 5**.

Solve for the age of Zeke.

$$\begin{aligned} \text{Zeke's age} &= x + 5 \\ &= 5 + 5 = 10 \end{aligned}$$

Therefore, Zeke is 10 years old while Kirsten is 5 years old.

4. *Checking*

Is Zeke 5 years older than Kirsten?

$$\begin{aligned} \text{Zeke's age} &= x + 5 \\ &= 5 + 5 \\ &= 10 \text{ years old} \end{aligned} \quad \text{YES}$$

Is the product of their ages 50?

$$(10)(5) = 50 \quad \text{YES}$$



What's More

Activity 1.3: NOW, IT'S YOUR TURN!

INSTRUCTIONS: Solve the following word problems below by following the steps presented. Answer in a separate sheet of paper.

- Ana is 2 years more than twice Shayne's age. If the product of their ages is 220, how old is Ana?
- How old is Eric and his father now, if Eric is 33 years younger than his father, and the product of their ages is 70?



What I Need To Remember

- Translate word problems into mathematical symbols before finding its answer.
- Follow the following steps before solving any given word problem.
 - ✓ Analyze the problems
 - ✓ Formulate the equation
 - ✓ Solve the equation and state the answer
 - ✓ Checking
- In age problem, a negative or imaginary number cannot be a solution.

Lesson 2

Number Problems



What I Need To Know

At the end of this lesson, you are expected to:

- solve integer problems involving quadratic equations



What's In

Just like what we have done in the Age Problems, we will still be using the following steps in solving Integer problems.

STEPS IN SOLVING WORD PROBLEMS by POLYA

1. Analyze the problem
 - a. Read and understand the problem carefully.
 - b. Determine what is being asked in the problem. A sketch may help you.
 - c. Make a representation on one unknown number by a variable/letter, then represent the other unknown number using the same variable/letter.
2. Formulate the equation.
 - a. Translate the statement into mathematical expressions
3. Solve the problem and interpret
4. Check
 - a. Verify whether your answer satisfies the conditions in the problem



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What's New

❖ Can You Guess My Number?



I have a positive integer. If it is added to its square, the result is 42. What is my positive integer?

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What is It

Solving Integer Problems are just like solving any other word problem; we will follow the steps presented in Lesson 1: Age Problem in solving. Let us try solving the situation in *Can You Guess My Number?*

Example 1: I have a positive integer. If it is added to its square, the result is 42.
What is my positive integer?

Solution:

1. *Analyze the problem*

A number added to its square is 42.

Let x = be the number

2. *Formulate the equation*

Now, let us translate the conditions given in the problem into symbols to form an equation.

In words:

A positive integer	is added to	its square	the result is	42
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In symbols:

$$x + x^2 = 42$$

3. *Solve the equation and state the answer.*

Solving for x ,

$$x + x^2 = 42$$

$$x^2 + x - 42 = 0 \longrightarrow \text{Rewrite the equation into standard form}$$

$$(x + 7)(x - 6) = 0$$

$$x + 7 = 0 \quad | \quad x - 6 = 0$$

$$x = -7 \quad | \quad x = 6$$

Solve the equation by Factoring

Note: You may use whatever method that is convenient for you

We found two values of x , but we are only asked to give its positive integer, so **the positive integer is 6**.

4. *Check*

Is the sum of the number and its square 42?

$$6 + 6^2 = 42$$

$$6 + 36 = 42$$

YES

Example 2: The sum of two numbers is 20. Their product is 64. Find the numbers.

Solution:

1. *Analyze the problem*

The sum of two numbers is 20.

Let x = the first number
 $20 - x$ = the second number

2. *Formulate the equation*

In words:

Their product is 64.

$$(\text{first number}) (\text{second number}) = 64$$

In Symbols:

$$x \quad \bullet \quad 20 - x \quad = 64$$

Equation: $(x)(20 - x) = 64$

3. *Solve the equation and state the answer.*

Solving for x ,

$$\begin{aligned} (x)(20 - x) &= 64 \\ 20x - x^2 &= 64 \\ -x^2 + 20x - 64 &= 0 \\ x^2 - 20x + 64 &= 0 \\ (x - 16)(x - 4) &= 0 \\ x - 16 &= 0 \quad | \quad x - 4 = 0 \\ x &= 16 \quad | \quad x = 4 \end{aligned} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Rewrite the equation into its standard form} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Solve the equation by Factoring}$$

The two numbers are 16 and 4.

4. *Checking*

The sum of two numbers is 20

$$16 + 4 = 20 \quad \text{YES}$$

The product of two numbers is 64.

$$(16)(4) = 64 \quad \text{YES}$$



What's More

Activity 1.4: NOW, IT'S YOUR TURN!

INSTRUCTIONS: Solve the following word problems below by following the steps presented. Answer in a separate sheet of paper.

1. One positive number is four less than the second number. If the product of the two numbers is 32, what are the numbers?
2. The sum of the two numbers is five, and the sum of their squares is 37. Find the numbers.
3. The sum of the two numbers is 56. Their product is 108. Find the larger number?



What I Need To Remember

- Translating word problem into mathematical sentence can help you solve word problems easily.
- All roots are possible solutions.

**Lesson
3**

Geometry Problems



What I Need To Know

At the end of this lesson, you are expected to:

- solve geometry problems involving quadratic equations



What's In

Let us recall some geometric formulas for plane figures that are useful in solving geometry problems.

Remember!

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Perimeter	Area
$P_{square}=4s$	$A_{square}=s^2$
$P_{rectangle}=2l+2w$	$A_{rectangle}=lw$
$P_{triangle}=a+b+c$	$A_{triangle}=\frac{bh}{2}$



What's New

- Dimensions of a geometric figure can be solved by a quadratic equation.
- Drawing the figure can help you visualize the problem.

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What is It

Let us work on the example below.

Example 1: Find the dimensions of the rectangular field whose length is 15 meters more than twice its width. If the total area of the rectangular field is $125m^2$.

Solution:

1. Analyze the problem

Let x = be the width of the field
 $2x + 15$ = be the length of the field

$$\text{length} = 2x + 15$$

$$\boxed{\text{Area} = 125m^2}$$

$$\text{width} = x$$

2. Formulate the equation

In words: The area of the field is $125m^2$.
Area = (length) (width)

In symbols:

$$125 = (2x + 15) \cdot x$$

$$\text{Equation: } 125 = (2x + 15)(x)$$

3. Solve the equation and state the answer.

Solving for x ,

$$\begin{aligned} 125 &= (2x + 15)(x) \\ x(2x + 15) &= 125 \\ 2x^2 + 15x - 125 &= 0 \\ (2x + 25)(x - 5) &= 0 \\ 2x + 25 &= 0 & x - 5 &= 0 \\ \frac{2x}{2} &= -\frac{25}{2} & x &= 5 \\ x &= -\frac{25}{2} \end{aligned} \quad \left. \begin{array}{l} \text{Rewrite into its standard form} \\ \text{Solve by Factoring} \end{array} \right\}$$

Since the length of the side cannot be negative, we conclude that the **width of the rectangle is 5 meters**.

Solve for the length if $x = 5$

$$\begin{aligned} \text{length} &= 2x + 15 \\ &= 2(5) + 15 \\ &= 10 + 15 \\ &= 25 \end{aligned}$$

The length of the rectangle is 25 meters.

Therefore, the dimensions of the rectangular field are 5 meters and 25 meters.

4. Checking

Is the area $125m^2$?

$$A = (\text{length})(\text{width})$$

$$= (25m)(5m)$$

$$= 125m^2$$

YES



What's More

Activity 1.5: NOW, IT'S YOUR TURN!

INSTRUCTIONS: Solve the following word problems below by following the steps presented. Answer in a separate sheet of paper.

1. A square garden is to be surrounded by a 3-foot brick border. If the total is 256 sq. ft . What are the dimensions of the square garden?
2. The length of the base of the triangle is 3 inches less than twice the length of its height. The area is 52 sq.in . Find the height and the length of the base of the triangle.
3. The length of a tarpaulin is 4 meters more than twice its width. What is the length of the tarpaulin if its area is $16m^2$?



What I Need To Remember

- The formulas of plane figures are useful in solving Geometry Problems
- In integer problem, a negative or imaginary number cannot be a solution.
- Formula for a perimeter does not represent a quadratic equation. It is an example of linear equation.

$$P_{\text{square}} = 4s$$

$$P_{\text{rectangle}} = 2l + 2w$$

$$P_{\text{triangle}} = a + b + c$$

- Formula for an area of a polygon represents a quadratic equation.

$$A_{\text{square}} = s^2$$

$$A_{\text{rectangle}} = lw$$

$$A_{\text{triangle}} = \frac{bh}{2}$$

Lesson 4

Rational Equations



What I Need To Know

At the end of this lesson, you are expected to:

- o solve problems involving rational equations



What's In

❖ Flashback 1.3

In module 4, you have learned about rational equation. Rational Equation is an equation that contains atleast one rational expression. Rational expressions contain a variable in the denominator.

Example: Transform the rational equation into quadratic equation.

$$\frac{3}{x} + \frac{1}{x+1} = 2$$

Solution:

$$x(x+1) \left[\frac{3}{x} + \frac{1}{x+1} = 2 \right] \quad \text{LCD: } x(x+1)$$

$$\begin{aligned} 3(x+1) + x &= 2x(x+1) \\ 3x + 3 + x &= 2x^2 + 2x \\ -2x^2 + 3x - 2x + x + 3 &= 0 \\ -2x^2 + 2x + 3 &= 0 \end{aligned}$$

Quadratic Equation

❖ Activity 1.6: Transform Me!

DIRECTION: Evaluate the following rational equations below, and identify which rational equation is transformable to a quadratic equation. Cross-out the rational equation transformable to a quadratic equation.

$$\frac{m+7}{9} = \frac{18}{4m}$$

$$\frac{y^2-1}{5} - \frac{y}{6} = \frac{y+1}{3y}$$

$$\frac{x}{5} - \frac{x+1}{x} = \frac{1}{2}$$



What's New

❖ What's My Share?



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A group of students are to divide 8 slices of cassava cake equally. If there is one less person in the group who does not like cassava, then each student will get one more slice. How many students will be dividing the whole cassava?



What is It

A rational equation is useful in representing real-life problems, particularly for describing relationships between distance-time-speed and for modeling work or motion problems that involve more than one person or things.

And for you to organize your solution, follow the steps used in solving word problems involving quadratic equation.

The following are some basic applications of rational equations.

✓ Problems from the Multiplication – Division Operations

All the multiplicative formulas in the form $A = BC$, can be written in the form $B = \frac{A}{C}$

Example: $distance = (rate)(time)$, it can be written in the form

$$rate = \frac{distance}{time}$$

✓ Cost Per Unit

$$Per\ Unit\ Cost = \frac{Total\ Cost}{Number\ of\ Units}$$

Example 1: Nicole walks 3 kilometers in going to school and returns home on a motorcycle. When riding a motorcycle, she averages 4 kilometers per hour faster than when walking, and the total of both journeys is two hours. Compute for her speed when walking. ($speed = \frac{distance}{time}$)

Solution:

1. Analyze the problem

Let x = the speed when Nicole walks

	Distance	Time	Speed
Walking	3	2	x
Motorcycling	3	2	$x + 4$

2. *Formulate the equation*

The total time traveled by Nicole is 2.

In words:

Speed in walking plus Speed in motorcycling is 2

In Symbols: $\frac{3}{x} + \frac{3}{x+4} = 2$

Equation:

$$\frac{3}{x} + \frac{3}{x+4} = 2$$

3. *Solve the equation and state the answer.*

Solving for x ,

$$\begin{aligned} & \frac{3}{x} + \frac{3}{x+4} = 2 && \text{LCM: } x(x+4) \\ & x(x+4) \left[\frac{3}{x} + \frac{3}{x+4} = 2 \right] \\ & 3x + 12 + 3x = 2x^2 + 8x \\ & -2x^2 - 2x + 12 = 0 \\ & -2(x^2 + x - 6) = 0 \\ & -2(x - 2)(x + 3) = 0 \\ & x = 2 \quad | \quad x = -3 \end{aligned}$$

Since x represents the speed of Nicole, we will disregard -3 as the value of the speed. So, **Nicole's speed in walking is 2 kilometers per hour.**

Example 2: There are 40 apples that will be given as a gift to a group of students attending a summer class in a barangay. But at the end of the class, 1 student decided to go home and not take the apples, thus making each student to get 2 more apples each. How many students attended the class?

1. *Analyze the problem*

Let x = be the number of students who attended the class

$x - 1$ = the number of students who divided the 40 apples

Total no. of apples	No. of students	$Share \text{ per student} = \frac{\text{Total no. of apples}}{\text{No. of people}}$
40	x	$\frac{40}{x}$
40	$x - 1$	$\frac{40}{x - 1}$

2. *Formulate the equation*

In words: Share more minus share less = plus 2 more apples

In symbols: $\frac{40}{x-1} - \frac{40}{x} = 2$

Equation: $\frac{40}{x-1} - \frac{40}{x} = 2$

3. Solve the equation and state the answer.

Solving for x,

$$\frac{40}{x-1} - \frac{40}{x} = 2 \quad LCD: x(x-1)$$

$$\left. \begin{aligned} &x(x-1) \left[\frac{40}{x-1} - \frac{40}{x} = 2 \right] \\ &40x - 40x + 40 = 2x(x-1) \\ &40 = 2x^2 - 2x \\ &-2x^2 + 2x + 40 = 0 \\ &-2(x^2 - x - 20) = 0 \\ &x^2 - x - 20 = 0 \\ &(x+4)(x-5) = 0 \\ &x = -4 \quad | \quad x = 5 \end{aligned} \right\}$$

Transform the rational equation
to quadratic equation

Solve by Factoring

We disregard $x = -4$, because we cannot have a negative number as a number of people. Therefore, **there are 5 students who attended the class.**



What's More

Activity 1.7: NOW, IT'S YOUR TURN!

INSTRUCTIONS: Solve the following word problems below by following the steps presented. Answer in a separate sheet of paper.

- The rent of a condo unit was ₱1,200.00 for one night, to be shared equally by a group of female friends, who will be having their get together in the condo unit. At the last minute, four people decided not to go to the party, thus raising the cost to each girl by ₱400.00. How many girls attended the get-together?
- Joy went to her province with her van, driving 300 km at a certain average speed. Had she traveled 10 kilometers per hour, the trip would have taken 1 hour less. Compute for Joy's average rate.



What I Need To Remember

- Motion and work problems can be solved using the concept of solving rational equation.
- In distance and work-related problems, no solution should be negative or imaginary.

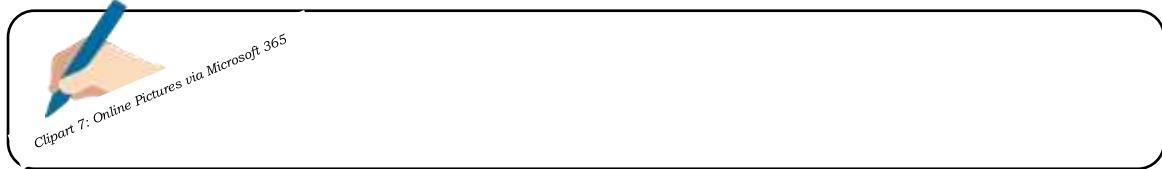
$$rate = \frac{distance}{time}$$

$$Per\ Unit\ Cost = \frac{Total\ Cost}{Number\ of\ Units}$$



What I Can Do

INSTRUCTIONS: What new learnings do you have about the real-life applications of quadratic and rational equations? How would you relate this to your daily life? How would you use this in making decisions? Write your answer on a piece of paper.



Your reflection or output will be graded using the rubric.

Skills	5	4	3	2
Depth of Reflection	The response demonstrates an in-depth reflection on and personalization of the theories, concepts, and strategies presented in the module.	The response demonstrates a general reflection on, personalization of the theories, concepts, and strategies presented in the module.	The response demonstrates a minimal reflection on, personalization of the theories, concepts, and strategies presented in the module.	The response demonstrates a lack of reflection on the topic, with no details provided.
Required Components	The response surpasses the required components of the selected topic.	The response includes the required components of the selected topic.	The response includes only few components of the selected topic.	The response does not include the required components of the selected topic.
Quality of Information	The response clearly relates to the main topic. It includes all the necessary supporting examples.	The response clearly relates to the main topic. It includes 1-2 necessary supporting examples.	The response clearly relates to the main topic. No examples are given.	The response has little to do or no relations to the main topic.
Conventions	The response is stated clearly, concisely, and properly. Reasons are expressed logically.	The response is stated clearly, concisely, and properly. Reasons are expressed logically.	The response is unclear and not organized. Thoughts are not expressed logically.	The response is unclear and disorganized. Thoughts make little to no sense.



Assessment (Post Test)

DIRECTIONS: Read the following questions carefully. There are some items that need to be solved. Solve it on a separate sheet of paper. Choose the correct answer and write it in your answer sheets. If the answer is not found in the given choices, kindly write the correct answer.

- _____ 1.) Thomas is 2 years more than twice the age of Peter, and the product of their ages is 24. Which of the following expressions represents Thomas' age?
- A. $x + 2x$ C. $2x^2 + 2$
B. $2x + 2$ D. x
- _____ 2.) Using the word problem given in number 1, how old is Thomas?
- A. 8 years old C. 12 years old
B. 9 years old D. 20 years old

Items 3 – 6, refer to the problem inside the box.

The length of a wall is 3 meters more than twice its width and its area is $14m^2$.

- _____ 3.) Which of the following expressions represents the length of the wall?
- A. $3 - x$ B. $x + 3$ C. x D. $2x + 3$
- _____ 4.) Which of the following represents the width of the wall?
- A. x B. $2x$ C. $3 - x$ D. $2x + 3$
- _____ 5.) Which of the equations represents the given situation?
- A. $x(x + 3) = 14$ C. $2x + x = 14$
B. $x(3x + 2) = 14$ D. $x(2x + 3) = 14$
- _____ 6.) What is the length of the wall?
- A. 6 meters B. 7 meters C. 8 meters D. 9 meters
- _____ 7.) A positive integer is 5 more than the second positive integer, and the product of these two integers is 14. What is the second positive integer?
- A. 2 B. 5 C. 7 D. 9
- _____ 8.) A motorcycle travels 2 kilometers per hour faster than a car. The motorcycle traveled 480km in two hours less than the time it took the car to travel the same distance. How fast does the motorcycle travel?
- A. 20.93kph B. 22.93kph C. 40kph D. 80kph
- _____ 9.) The sum of two positive integers is 120, and their product is 3500. What are the integers?
- A. -50 and 70 C. -50 and -70
B. 50 and -70 D. 50 and 70

_____ 10.) The sum of a number and its reciprocal is 2, what equation represents the condition?

A. $x + x = 2$ B. $x + \frac{1}{x} = 2$ C. $x - x = 2$ D. $x - \frac{1}{x} = 2$

_____ 11.) Using the situation in number 10, what is the number?

A. 3 B. 2 C. 1 D. -1

_____ 12.) The rent of a van to be used in going to one of the resorts in Cebu City is ₱800.00, to be shared equally by a group of friends. At the last minute, the group decided that they will pay for the share of their other two members, resulting in a rise of their share for ₱200.00 each. How many went to the outing?

A. 8 B. 6 C. 4 D. 2

_____ 13.) Using the situation in number 12, how much is the equal share of the people who paid for the rent?

A. ₱100.00 B. ₱200.00 C. ₱400.00 D. ₱800.00

For items 14 – 15, refer to the problem inside the box.

The area of a triangular frame is 52 in^2 . If the height of the frame is three inches less than twice the length of a base.

_____ 14.) What equation represents the problem?

A. $2x^2 - 3x - 104 = 0$ C. $2x^2 + 3x - 104 = 0$
B. $2x^2 - 3x + 104 = 0$ D. $2x^2 + 3x + 104 = 0$

_____ 15.) What is the measurement of the base of the triangular frame?

A. 21 inches B. 16 inches C. 13 inches D. 8 inches



Answer Key (With Explanation)

Remember: This portion of the module contains all the answers. Your **HONESTY** is required.

Activity 1.5

1.) 10 ft.

Sol'n: Let x = dimension of the garden
Use the equation in solving:

$$(x + 6)^2 = 256$$

2.) base = 8 in.
height = 13 in.

Sol'n: Let x = height
 $2x - 3 = \text{base}$

Use the equation in solving:
 $52 = \frac{x(2x-3)}{2}$

3.) 8 meters

Sol'n: Let x = width
 $2x + 4 = \text{length}$
Use the equation in solving:
 $x(2x + 4) = 16$

<div style="text-align: center; margin-bottom: 10px;"> Activity 1.1Find My Roots! </div> <div style="text-align: center; margin-bottom: 10px;"> <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>A</td><td></td><td>Y</td><td>A</td><td>R</td><td>D</td></tr> <tr><td>1</td><td></td><td>3</td><td>1</td><td>4</td><td>2</td></tr> </table> </div> <div style="text-align: center; margin-bottom: 10px;"> Activity 1.3: It's Your Turn </div> <div style="text-align: center; margin-bottom: 10px;"> 1. $x + 7$ 2. $9 + 2x = 27$ 3. $3x + 2$ 4. $8x = 72$ 5. $x - 6 = 7$ 6. $\frac{3m}{7} = \frac{15}{7}$ 7. $\frac{7}{x} = \frac{14}{3}$ 8. $3(x + 10)$ 9. $26d$ 10. $n + e = 33$ </div>	A		Y	A	R	D	1		3	1	4	2	<div style="text-align: center; margin-bottom: 10px;"> Activity 1.2: Transform Me! </div> <div style="text-align: center; margin-bottom: 10px;"> <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>A</td><td></td><td>Y</td><td>A</td><td>R</td><td>D</td></tr> <tr><td>1</td><td></td><td>3</td><td>1</td><td>4</td><td>2</td></tr> </table> </div> <div style="text-align: center; margin-bottom: 10px;"> Activity 1.4: It's Your Turn </div> <div style="text-align: center; margin-bottom: 10px;"> 1. $48x^8$ 2. $68 - 1$ 3. $x(56 - x) = 54$ 4. $5 - x = \text{1st no.}$ 5. $x - 4 = \text{2nd no.}$ 6. $x^2 + (5 - x)^2 = 37$ 7. $56 - x = \text{2nd no.}$ 8. $x(56 - x) = 108$ </div>	A		Y	A	R	D	1		3	1	4	2
A		Y	A	R	D																				
1		3	1	4	2																				
A		Y	A	R	D																				
1		3	1	4	2																				

$$4m^2 + 28m - 162 = 0$$

$$4m^2 + 28m = 162$$

$$36m \left[\frac{9}{m+7} \right] = 18m$$

Sol'n:

$$\frac{9}{m+7} = \frac{4m}{18}$$

$$2x^2 - 15x - 10 = 0$$

$$2x^2 - 10x - 10 = 5x$$

$$10x \left[\frac{x}{x+1} - \frac{x}{5} \right] = 2$$

Sol'n:

$$\frac{5}{x} - \frac{x}{x+1} = \frac{1}{2}$$

Equation

Transformable to Quadratic

Activity 1.6

$$\frac{300}{t} + 10 = \frac{300}{t-1}$$

Use the formula in solving:

Formula: $\text{rate} = \frac{\text{distance}}{\text{time}}$

Distance	Speed	Time
300	x	t
300	x + 10	t - 1

Sol'n: Let $x = \text{the rate for Joy's trip}$

2.) 50kph

$$\frac{x-4}{1200} - \frac{x}{1200} = 400$$

Use the equation on solving:

Rent	# of people	Share of the rent per person	$\frac{x}{1200}$
1200	x	1200	x
1200	$x - 4$	1200	$x - 4$

$x - 4 = \text{no. of people who shared the rent together}$

Sol'n: Let $x = \text{no. of people attended the get-$

1.) 6 people

Activity 1.7

Text Text Text Text Text Text

Text Text Text Text Text Text

What I can Do

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Congratulations!

You are now ready for the next module. Always remember the following:

1. Make sure every answer sheet has your
 - o *Name*
 - o *Grade and Section*
 - o *Title of the Activity or Activity No.*
2. Follow the date of submission as agreed with your teacher.
3. Keep the modules with you.
4. Return them at the end of the school year.