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Mathematics

Quarter 1 - Module 3

Solving Equations Transformable to Quadratic Equations and Rational Algebraic Equations

AIRs - LM

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Mathematics 9
Alternative Delivery Mode
Quarter 1 - Module 3: Solving Equations Transformable to Quadratic Equations and Rational Algebraic Equations
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Jumpstart

Activity 1: You Complete Me

In his iconic speech at the Lincoln Memorial for the 1963 March on Washington for Jobs and Freedom, Martin Luther King Jr. urged America to "make real the promises of democracy." More than 200,000 people, black and white came to listen and demanded equal rights for black people.

Find out the title of his speech by solving the quadratic equations below. Choose the right answer from the table and write the appropriate letter on the corresponding number.

TITLE OF THE SPEECH:

I HAVE A ____ ____ ____ ____ ____
1 2 3 4 5

1. $x^2 - 9x + 18 = 0$
2. $3k^2 - 18k - 21 = 0$
3. $x^2 + 14x - 15 = 0$
4. $5k^2 = 60 - 20k$
5. $4b^2 + 8b + 7 = 4$

E	**D**	**I**	**S**
(1, -15)	(3, 6)	(-5, 3)	(-2 , 7)
A	**Y**	**R**	**M**
(2, -6)	(3, 6)	(7, -1)	$(-\frac{1}{2}, -\frac{3}{2})$

Were you able to evaluate the activity with ease? Quadratic Equations are easier to work on when they are written in standard form and with your mastery of the various methods of finding solutions of quadratic

Activity 2:

A. Quadratic or Not Quadratic?

Identify which of the following equations are quadratic and which are not. Put a check mark (✓) if quadratic, otherwise, put a wrong mark (✗).

_____1. $x^2 - 4x + 12 = 0$
_____2. 15 – 3x = 0
_____3. $2x^2 + 6x = -4$
_____4. 3x (x – 2) = -7
_____5. $x^2 = 100$

B. Perform the indicated operation and express your answer in simplest form. You can have an extra sheet of paper to solve and simplify.

Given	*Your Answer*
1. $\frac{1}{x} + \frac{3x}{2}$	
2. $\frac{4}{y} - \frac{2y-1}{2}$	
3. $\frac{3m}{2} + \frac{m+1}{m}$	
4. $\frac{k+1}{2k} - \frac{k+2}{3k}$	
5. $\frac{x-5}{2x} + \frac{x+1}{x-2}$	

Are you still familiar with those expressions? Recall your learnings in your previous grade level mathematics. Certainly, this is one of the types of expressions you are fond to work with.

Discover

In some instances, there are equations that are transformable into quadratic equations. These equations may be given in different forms. Hence, transforming these into quadratic equations requires varied procedures and processes.

Once the equations are transformed into quadratic equations, then they can be solved using the techniques you have learned in the previous module. These methods of solving quadratic equations may be in the form of extracting square roots, factoring, completing the squares and through quadratic formula, all leading to the solution/s of the transformed equations.

Case 1: Solving Quadratic Equations That Are Not Written In Standard Form

Example 1: Solve $x\,(x - 7) = 18$

This is a quadratic equation but it is not yet written in standard form.

To transform the quadratic equation in standard form, follow these steps:

a. *Write the given equation* $\longrightarrow$ $x\,(x - 7) = 18$

b. *Use distributive property of multiplication over subtraction* $\longrightarrow$ $x^2 - 7x = 18$

c. *Rewrite quadratic equation in standard form* $\longrightarrow$ $x^2 - 7x - 18 = 0$

Use any of the four methods in finding the solutions of the quadratic equation

$$x^2 - 7x - 18 = 0.$$

In this case we use factoring in finding the roots of the equation.

d. Factor the left side of the equation $\longrightarrow$ $(x - 9)(x + 2) = 0$

e. equate each factor to zero $\longrightarrow$ $x - 9 = 0$ and $x + 2 = 0$

f. solve each resulting equation $\longrightarrow$ $x = 9$ or $x = -2$

Check whether the obtained values of x make the equation $x\,(x - 7) = 18$ true. If the obtained values of x make the equation $x\,(x - 7) = 18$ true, then the solutions of the equation are: $x = 9$ or $x = -2$.

Example 2: Find the roots of the equation $(x + 1)^2 - 9 = 0$

Expand the term $(x + 1)^2$: $(x + 1)(x + 1)$ =0 $\longrightarrow$ $x^2 + 2x + 1$

Combine like terms: $x^2 + 2x + 1\ - 9 = 0$ $\longrightarrow$ $x^2 + 2x - 8 = 0$

Factor the equation: $x^2 + 2x - 8 = 0$ $\longrightarrow$ $(x + 4)(x - 2) = 0$

Equate each factor to zero: $x - 4 = 0$ or $x + 2 = 0$

Check whether the obtained values of x make the equation $(x + 1)^2 - 9 = 0$ true.

Alternately, you can also do extracting square roots: $(x+1)^2 - 9 = 0$

That is: $\longrightarrow$ $(x+1)^2 = 9$

Extract square roots of both sides: $\longrightarrow$ $\sqrt{(x+1)^2} = \sqrt{9}$

Simplify the terms: $\longrightarrow$ $x + 1 = \pm 3$

Solve for the values of x: $x = 3 - 1 \ or\ 2$ and $x = -3 - 1 \ or - 4$

Case 2: Solving Rational Algebraic Equations Transformable Into Quadratic Equations

***Example 1**: Solve the rational algebraic equation* $\frac{6}{x} + \frac{x-3}{4} = 2$

Solution:

The equation can be transformed into quadratic equation. There are few steps to consider to solve for its solutions.

Find the Least Common Multiple (LCM) of all denominators	4x
Multiply both sides of the equation by the LCM to get rid of the denominator	$4x\left(\frac{6}{x} + \frac{x-3}{4}\right) = 2(4x)$ $24 + x^2 - 3x = 8x$
Rewrite the resulting equation in standard form	$x^2 - 11x + 24 = 0$
Find the solutions using any of the methods in solving quadratic equation	$(x-3)(x-8) = 0$ x = 3 and x = 8

***Example 2**: Find the solutions of* $x + \frac{8}{x-2} = 1 + \frac{4x}{x-2}$

Find the Least Common Multiple (LCM) of all denominators	$x - 2$
Multiply both sides of the equation by the LCM to get rid of the denominator	$(x-2)\left(x + \frac{8}{x-2}\right) = (x-2)\left(1 + \frac{4x}{x-2}\right)$ $x^2 - 2x + 8 = x - 2 + 4x$
Rewrite the resulting equation in standard form	$x^2 - 7x + 10 = 0$
Find the solutions using any of the methods in solving quadratic equation	$(x-5)(x-2) = 0$ x = 5 and x = 2

✓ *Check whether the solutions make the equation true.*

For x = 5

$$x + \frac{8}{x-2} = 1 + \frac{4x}{x-2}$$

$$5 + \frac{8}{5-2} = 1 + \frac{4(5)}{5-2}$$

$$5 + \frac{8}{3} \stackrel{?}{=} 1 + \frac{20}{3}$$

$$\frac{15+8}{3} \stackrel{?}{=} \frac{3+20}{3}$$

$$\frac{23}{3} = \frac{23}{3}$$

For x = 2

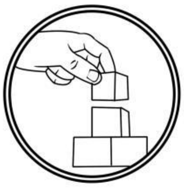
$$x + \frac{8}{x-2} = 1 + \frac{4x}{x-2}$$

Observe that at x = 2 , the value of $\frac{8}{x-2}$ and $\frac{4x}{x-2}$ are undefined or does not exist.

Why? (Zero denominators)

*Here, x = 2 is an **extraneous root** or **solution** of the equation.*

***An extraneous root or solution** is a solution of an equation derived from the original equation . However, it is **not** a solution of the original equation.*



Explore

Strengthen your understanding and establish mastery in the basic concepts you've learned through the evaluation of these exercises.

Activity 3: Change my view!

Transform each of the following equations into a standard quadratic equation and answer briefly the questions below. You have **20 minutes** to work on this.

1. $x\,(x + 4) = 5$
2. $(x + 3)^2 = 36$
3. $(t + 2)^2 + (t - 3)^2 = 9$
4. $\frac{3}{x} + \frac{4}{2x} = x - 1$
5. $\frac{3}{m-2} + \frac{4}{m+5} = 1$

Questions:

1. How did you transform each equation into a quadratic equation? What concepts or principles did you employ?

2. Did you encounter any difficulty transforming each equation into a quadratic equation? Which item/s? Briefly explain why.

Deepen

Activity 4: Trace my roots!

A. Solve for the solution set of the following. Use extra sheet of paper if needed.

1. $3s\,(s - 2) = 12s$
2. $(t + 1)^2 - 2t - 1 = 9$
3. $\frac{1}{k} - \frac{k}{6} = \frac{2}{3}$
4. $\frac{1}{x} + \frac{x+2}{3} = 2$
5. $\frac{4}{t-3} + \frac{t}{2} = -2$

Activity 5: Set me in your world!

Linda and Lando are frontliners in a public hospital doing a very critical job of collecting swab samples from suspected patients of Covid-19. Working together, they can finish the job in 6 days. If Linda works alone, she will take 5 days less than Lando to complete. How many days required for Linda and Lando to complete their heroic gestures of doing their job alone?

Source: https://www.istockphoto.com/illustrations/covid-testing-kit

Questions:

1. What type of equation can you formulate for this given word problem?
2. Can you set the required mathematical equation for this? State your equation.
3. What mathematical concepts or principles can you employ to evaluate this problem?
4. Is there any extraneous root you got for this situation? Identify
5. How many days do each of these individuals work alone?

You did a very exceptional job of completing these activities.
Keep that intensity resounds as you finally accomplish this last activity.