

SELF LEARNING KIT IN MATHEMATICS 9

Solving Quadratic Equations by Factoring



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Mathematics 9

Self-Learning Kit

Solving Quadratic Equations by Factoring

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FOREWORD

This self-learning kit will help our students answer mathematical problems and relate the concepts to real-world situations. In order to help students in Grade 9 have a thorough knowledge of the material, it attempts to walk them through the methodical process of factoring quadratic equations by factoring.

By incorporating it into other activities, such as the arts, the learners will be able to enjoy mathematics while also appreciating the process of solving quadratic equations.

GENERAL MATHEMATICS

SOLVING QUADRATIC EQUATIONS

CONTENT STANDARD

The learner demonstrates understanding of key concepts of quadratic equations, inequalities and functions, and rational algebraic equations.

PERFORMANCE STANDARD

The learner is able to investigate thoroughly mathematical relationships in various situations, formulate real - life problems involving quadratic equations, inequalities and functions, and rational algebraic equations and solve them using a variety of strategies.

MOST ESSENTIAL LEARNING COMPETENCY

The learner solves quadratic equations by factoring (M9AL-Ia-b-1)

SPECIFIC OBJECTIVES

1. Develop skills in solving quadratic equation by factoring.
2. Solve quadratic equations using the different algebraic techniques for simplifying and factoring of expressions; and
3. Appreciate the use of factoring in solving quadratic equation.

PRE-TEST

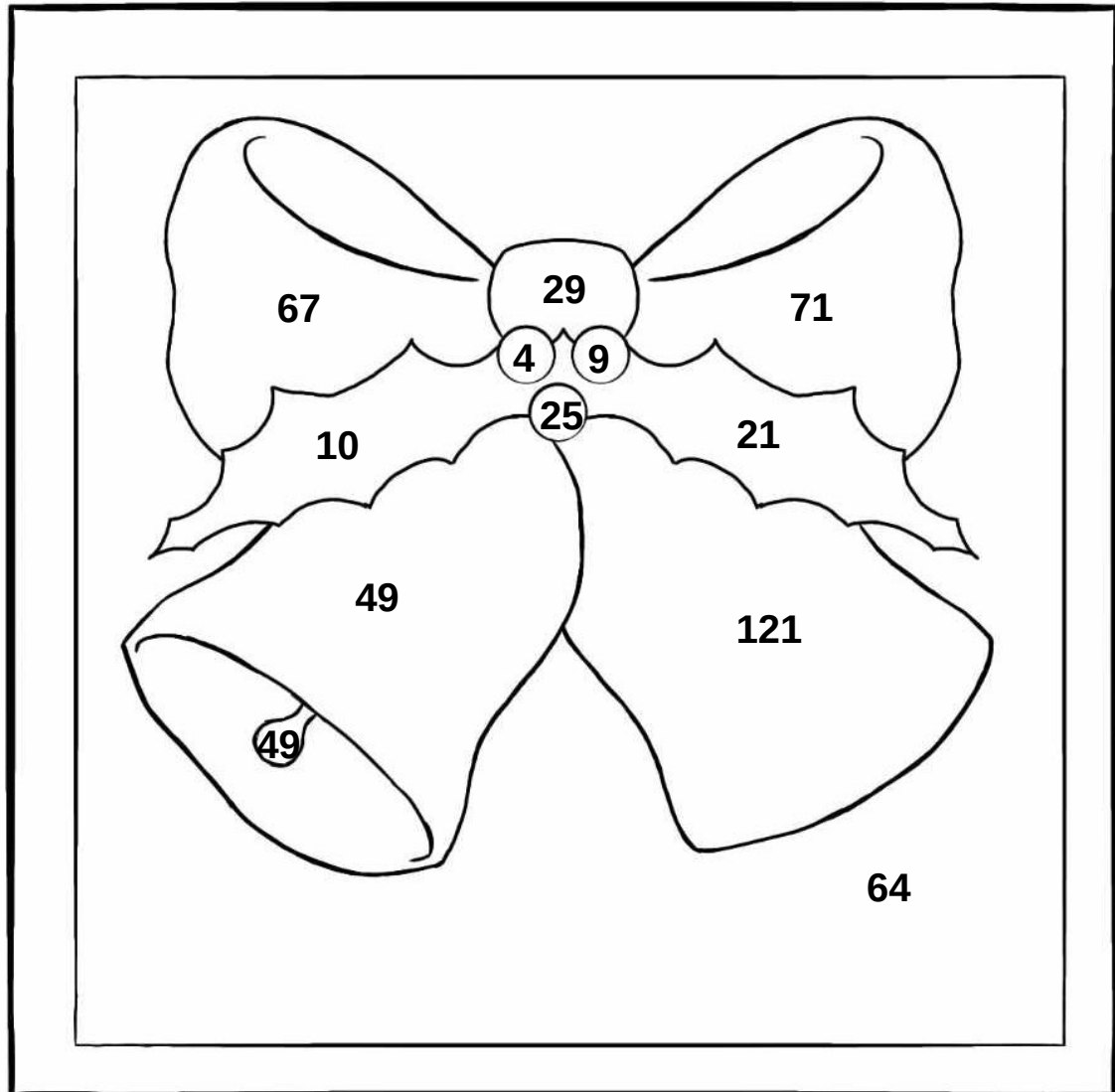
Directions: Choose the letter of the best answer. Write the chosen letter on the space provided.

- ___ 1. If $ab = 0$, then $a = 0$ or $b =$ _____.
a. 0 b. 1 c. -1 d. 2
- ___ 2. The factored form of $x^2 - 25$ is _____.
a. $(x - 5)(x - 5)$ c. $(x + 5)(x + 5)$
b. $(x - 5)(x + 5)$ d. $(x + 1)(x - 5)$
- ___ 3. Which of the following is the GCF of $4x^2$ and $12x$?
a. $3x$ c. $4x$
b. $2x$ d. $5x$
- ___ 4. If $xy = 0$, then $x = 0$ or $y = 0$ where both **x** and **y** are real numbers is called _____.
a. Square Root Property c. Zero Product Property
b. Addition Property d. Multiplication Property
- ___ 5. Solve for y in the equation $y^2 - 3y = 0$
a. $y = 1, 2$ c. $y = 2, 3$
b. $y = 0, 3$ d. $y = 1, 3$
- ___ 6. Which of the following quadratic equations cannot be factored?
a. $x^2 + 3x + 2 = 0$ c. $x^2 + 3x - 18 = 0$
b. $x^2 - 4x + 4 = 0$ d. $x^2 + 2x - 1 = 0$
- ___ 7. What are the solutions of $x^2 + 5x + 4 = 0$?
a. -4, -1 c. -4, 1
b. 4, -1 d. 5, 4
- ___ 8. Find the solution set of $x^2 - 7x = -12$.
a. $\{-2, 4\}$ c. $\{4, -4\}$
b. $\{-4, 1\}$ d. $\{3, 4\}$
- ___ 9. Using factoring, solve for x : $6x^2 + 7x = 3$.
a. $x = -\frac{3}{2}, \frac{1}{3}$ c. $x = -\frac{3}{2}, 1$
b. $x = 3, \frac{1}{3}$ d. $x = -\frac{3}{2}, \frac{2}{3}$
- ___ 10. Which of the following is NOT a factor of $12x^2$?
a. 3 and x c. 4 and x^3
b. 12 and x^2 d. 12 and x

WHAT HAPPENED?

Activity 1: COLOR FACTOR

Directions: Find out the factors of each number in the ribbon. If the number has 2 factors color it with **RED**, if it has 3 factors color it **YELLOW**, if it has 4 factors color it **GREEN**, and **BLUE** if it has 5 or more factors.



TASK No. 2: SHARE YOUR THOUGHTS!

Directions: Share your insights to the following questions based on the techniques and process you used in finding the factors of a number given in Task No.1.

1. What techniques and process did you used in finding the factors of a number?

2. What method did you used in factoring a number?

3. How can you use your prior knowledge in factoring numbers in terms of factoring quadratic expression?

4. Do you have any idea in solving quadratic equation by factoring?

WHAT TO LEARN?

What is a Quadratic Equation?

The polynomial equation whose highest degree is two is called a **quadratic equation** or sometimes just quadratics. It is expressed in the form of:

$$ax^2 + bx + c = 0$$

where x is the unknown variable and a , b and c are the constant terms.

Solving Quadratic Equation by Factoring

The processes in factoring were already tackled when you were in Grade 8. In this part, you will be focusing on factoring quadratic expressions which will be needed in finding the solutions of quadratic equations.

But let's have a review first in factoring quadratic expression.

A. FACTORING BY GCF

Example: Factor this polynomial: $2x^2 - 4x$

Find the GCF.

$$\begin{array}{rcl} 2x^2 & = & \boxed{2} \cdot \boxed{x} \cdot x \\ 4x & = & \boxed{2} \cdot 2 \cdot \boxed{x} \end{array}$$

The GCF of $2x^2$ and $4x$ is $2x$

Note:
Aligning the factor of each term will help you identify the GCF

$$\begin{array}{l} x(2x) - 2(2x) \\ 2(x - 2) \end{array}$$

Write terms as products using the GCF as factor.
Use the Distributive property to factor

Therefore, the factored form is $2(x - 2)$.

B. FACTORING: $x^2 + bx + c$

Example: Factor this polynomial: $x^2 + 4x - 12$

$$(x + \blacksquare)(x + \blacksquare)$$

In this form, $b = 4$ and $c = -12$;
look for the factors of -12 with a sum of 4 .

Guess and Check

Factors of -12	Sum
-1 and 12	11 ×
1 and 12	-11 ×
-2 and 6	4 ✓

The factors needed are -2 and 6

$$(x - 2)(x + 6)$$

The factored form is $(x - 2)(x + 6)$.

C. FACTORING: $ax^2 + bx + c$

Factor this polynomial: $2x^2 + 3x - 2$

$$(\blacksquare x + \blacksquare)(\blacksquare x + \blacksquare)$$

Guess and Check

a = 2	c = -2	b = 3
Factors of 2	Factors of -2	Outer + Inner
1 and 2	1 and -2	$1(-2) + 2(1) = 0$ ×
1 and 2	-1 and 2	$1(2) + 2(-1) = 0$ ×
1 and 2	2 and -1	$1(-1) + 2(2) = 3$ ✓

Note:

When checking, remember these when multiplying binomials;
First Terms
Outer Terms
Innner Terms
Last Terms

$$(x + 2)(2x - 1) = 2x^2 + 3x - 2$$

The factored form is $(x + 2)(2x - 1)$.

Know that we learned the step by step process in solving quadratic expression; let us move to solve some quadratic equations using the *Zero Product Property*.

ZERO PRODUCT PROPERTY

“This states that if $ab=0$, then either $a=0$ or $b=0$ (or both). This property is useful when solving quadratic equations.”

For all real number a and b,

Words	Numbers	Algebra
If the product of two quantities is equal to zero, then either or both two quantities are equal to zero.	$5(0) = 0$ $0(7) = 0$	If $mn = 0$, then $m = 0$ or $n=0$

Example 1: Solve $4x^2 = 6x$ using factoring,

Solution:

$$4x^2 = 6x$$

$$4x^2 - 6x = 6x - 6x \quad \text{Subtract 6x from both sides}$$

$$4x^2 - 6x = 0$$

$$2x(2x - 3) = 0 \quad \text{Factor by GCF (GCF: 2x)}$$

$$2x = 0 \text{ or } 2x - 3 = 0 \quad \text{Use the Zero Product Property}$$

$$x = 0 \text{ or } x = \frac{3}{2} \quad \text{Solve each equation}$$

The solutions are 0 and $\frac{3}{2}$

Example 2: $x^2 - 3x = 18$

Solution:

$$x^2 - 3x = 18$$

$$x^2 - 3x - 18 = 18 - 18 \quad \text{Subtract 18 from both sides}$$

$$x^2 - 3x - 18 = 0$$

$$(x + 3)(x - 6) = 0 \quad \text{Factor the trinomial}$$

$$x + 3 = 0 \text{ or } x - 6 = 0 \quad \text{Use the Zero Product Property}$$

$$x = -3 \text{ or } x = 6 \quad \text{Solve each equation}$$

The solutions are -3 and 6.

Example 3: $2x^2 - 3 = -x$

Solution:

$$2x^2 - 3 = -x$$

$$2x^2 - 3 + x = -x + x \quad \text{Add } x \text{ to both sides}$$

$$2x^2 + x - 3 = 0$$

$$(2x + 3)(x - 1) = 0 \quad \text{Factor the trinomial}$$

$$2x + 3 = 0 \text{ or } x - 1 = 0 \quad \text{Use the Zero Product Property}$$

$$x = -\frac{3}{2} \text{ or } x = 1 \quad \text{Solve each equation}$$

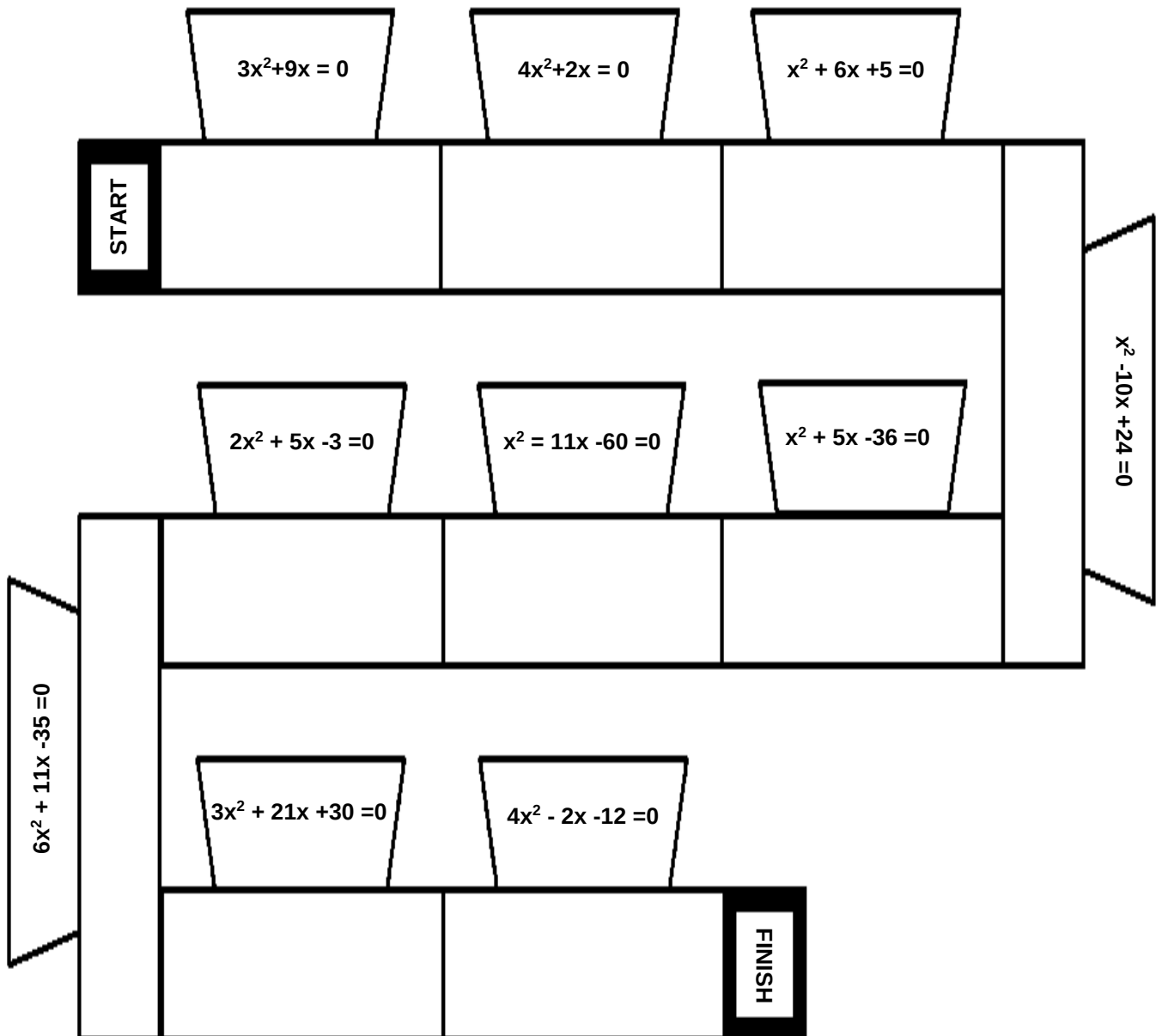
The solutions are $-\frac{3}{2}$ and 1.**WHAT HAVE YOU LEARNED?****Activity 1. FACTOR TO FIND THE ANSWER!**

Directions: Factor each quadratic expression. Show your **COMPLETE SOLUTION** then **ENCIRCLE** your final answer.

1) $3x^2 + 5x$	3) $x^2 + 5x + 6$
2) $4x^2 + 16x$	4) $x^2 - 5x + 4$
5.) $2x^2 + 11x + 5$	

Activity 2. QUADRATIC CHALLENGE

Directions: Fill the rectangular boxes with the answers of the given quadratic equations above. Solve the 1st quadratic equation and so on until you reach the finish line.



Activity 3. ASSESSMENT TIME!

Directions: Solve each quadratic equation by factoring. Show your **COMPLETE SOLUTION** then **ENCIRCLE** your final answer.

1. $x^2 + 5x = 0$

2. $7x^2 + 21x = 0$

3. $16x^2 = 12x$

4. $-4x^2 = 6x$

5. $x^2 + 8x + 12 = 0$

6. $x^2 + 4x - 21 = 0$

7. $x^2 - 14x = -24$

8. $2x^2 - 12 = 2x$

9. $2x^2 + 5x + 2 = 0$

10. $3x^2 - 5x = 12$

POST TEST

Directions: Choose the letter of the best answer. Write the chosen letter on the space provided.

___ 1. If $ab = 0$, then $a = 0$ or $b =$ _____.

a. 0

b. 1

c. -1

d. 2

___ 2. The factored form of $x^2 - 25$ is _____.

a. $(x - 5)(x - 5)$

c. $(x + 5)(x + 5)$

b. $(x - 5)(x + 5)$

d. $(x + 1)(x - 5)$

___ 3. Which of the following is the GCF of $4x^2$ and $12x$?

a. $3x$

c. $4x$

b. $2x$

d. $5x$

___ 4. If $xy = 0$, then $x = 0$ or $y = 0$ where both **x** and **y** are real numbers is called

_____.

a. Square Root Property

c. Zero Product Property

b. Addition Property

d. Multiplication Property

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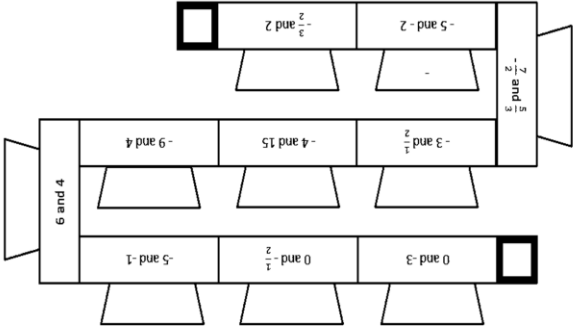
ANSWER KEY

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

POST TEST

1. - 5 and 0
2. - 3 and 0
3. 0 and $\frac{3}{4}$
4. $-\frac{2}{3}$ and 0
5. - 6 and - 2
6. - 7 and 3
7. 2 and 12
8. - 2 and 3
9. - 2 and $-\frac{1}{2}$
10. $-\frac{3}{4}$ and 3

ASSESSMENT



ACTIVITY 2

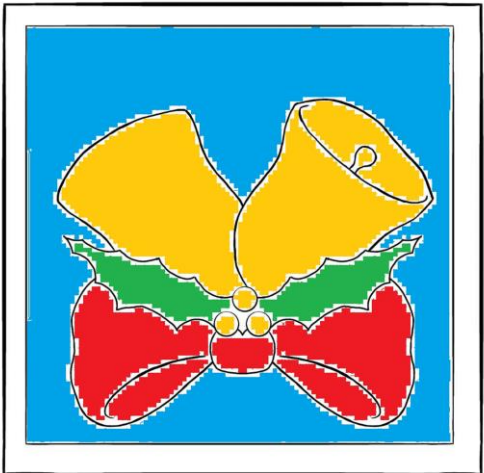
1. $x(3x+5)$
2. $4x(x+4)$
3. $(x+3)(x+2)$
4. $(x-1)(x-4)$
5. $(x+5)(2x+1)$

ACTIVITY 1

WHAT I HAVE LEARNED?

(ANSWERS MAY VARY)

TASK NO.2



TASK NO. 1

WHAT HAPPENED?

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

PRE TEST

SYNOPSIS

The polynomial equation whose highest degree is two is called a quadratic equation or sometimes just quadratics. It is expressed in the form of: $ax^2 + bx + c = 0$ where x is the unknown variable and a , b and c are the constant terms. In solving Quadratic Equation by Factoring you need to follow the following steps to answer it. First is Move all the terms of the equation in the left side if necessary. In this case, the other side must be zero, second is to Combine the similar terms in the left side, third is to Factor the left side of the equation. Fourth is to equate each factor that holds the unknown variable to zero. Fifth is to solve the equated form. And lastly, is check the answers by evaluating it to the original equation.

ABOUT THE AUTHOR



Marinel Joyce Bolima Parchamento is a Teacher II and the Mathematics Coordinator of Sinsayon National High School. She is teaching General Mathematics and Statistics and Probability in Senior High School since 2018 until present and also teaching grade 9 Mathematics this School Year 2023-2024. She is also teaching other subjects in Senior High School like Earth and Life Science, Physical Science, and Entrepreneurship and experienced to teach in Junior High school Teaching Mathematics 7 to 10. She finished her study as Bachelor of Science in Education (BSED) Major in Mathematics at Northeastern College in the year 2018 and recognized as Outstanding Mathematics Major Student and passed the Licensure Examination for Professional Teacher on the same year. Served as a Mathematics Instructor in Private School in the year 2018, Teacher Assistant from 2019-2021, and hired as a Teacher II in the year 2022 at Sinsayon National High School. Her dedication in providing quality education for learners serves as an inspiration to the school and community.