

9

# Mathematics

## Quarter 1-Module 3

### Solving Quadratic Equation By Factoring

Week 1

Learning Code - M9AL-Ia-2.1



***Learning Module for Junior High School Mathematics***Quarter 1 – Module 3 – **New Normal Math for G9**

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MODULE  
3

SOLVING QUADRATIC EQUATION BY FACTORING

You already acquired how to solve quadratic equation by extracting square roots. In this topic, you will learn another approach in solving quadratic equation by factoring.

LEARNING COMPETENCY

The learners will be able to:

- solve quadratic equations by: (b) factoring; **M9AL-Ia-2.1**

WHAT I KNOW

Find out how much you already know about solving quadratic equations by factoring. Write the letter that you think is the best answer to each question on your answer sheet. Answer all items. After taking and checking this short test, take note of the items that you were not able to answer correctly and look for the right answer as you go through this module.

- If  $ab = 0$ , then  $a = 0$  or  $b = \underline{\hspace{2cm}}$ .  
 A. 0  
 B. 1  
 C. -1  
 D. 2
- The factored form of  $x^2 - 25$  is \_\_\_\_\_.  
 A.  $(x - 5)(x - 5)$   
 B.  $(x - 5)(x + 5)$   
 C.  $(x + 5)(x + 5)$   
 D.  $(x + 1)(x - 5)$
- Which of the following is the GCF of  $4x^2$  and  $12x$ ?  
 A.  $3x$   
 B.  $2x$   
 C.  $4x$   
 D.  $5x$
- If  $xy = 0$ , then  $x = 0$  or  $y = 0$  where both  $x$  and  $y$  are real numbers is called \_\_\_\_\_.  
 A. Square Root Property  
 B. Addition Property  
 C. Zero Product Property  
 D. Multiplication Property
- Solve for  $y$  in the equation  $y^2 - 3y = 0$   
 A.  $y = 1, 2$   
 B.  $y = 0, 3$   
 C.  $y = 2, 3$   
 D.  $y = 1, 3$
- Which of the following quadratic equations cannot be factored?  
 A.  $x^2 + 3x + 2 = 0$   
 B.  $x^2 - 4x + 4 = 0$   
 C.  $x^2 + 3x - 18 = 0$   
 D.  $x^2 + 2x - 1 = 0$
- What are the solutions of  $x^2 + 5x + 4 = 0$ ?  
 A. -4, -1  
 B. 4, -1  
 C. -4, 1  
 D. 5, 4

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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  $x$

**\*\*\* If you got an honest 10 points (perfect score), you may skip this module.**

**WHAT'S IN**

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.

**FACTORIZING QUADRATIC EXPRESSIONS**

**A. FACTORING BY GCF**

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

$$\begin{array}{l} 2x^2 = \boxed{2} \cdot \boxed{x} \cdot x \\ 4x = \boxed{2} \cdot 2 \cdot \boxed{x} \end{array} \quad \text{Find the GCF.}$$

$x(2x) - 2(2x)$  The GCF of  $2x^2$  and  $4x$  is  $2x$ .  
 Write terms as products using the GCF as factor.

$2x(x - 2)$  Use the Distributive property to factor

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

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



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

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

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

Guess and Check

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

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

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

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

The factors needed are -2 and 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	$1(-1) + 2(2) = 3$ ✓

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

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

When checking, remember these when multiplying binomials;  
**F**irst Terms  
**O**uter Terms  
**I**nnner Terms  
**L**ast Terms



**Let's Try!!**

- A. 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.) $2x^2 + 11x + 5$	

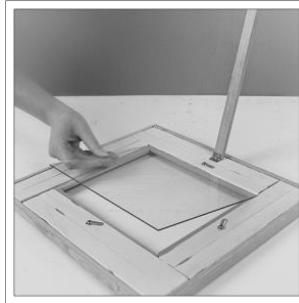
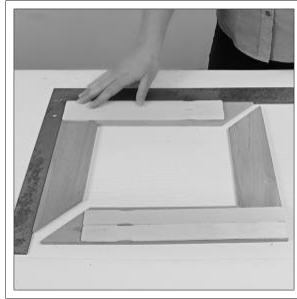
**WHAT'S NEW**

Collaboration, Creativity and Critical Thinking



**PICTURE FRAME**

Directions: Use the situation below to answer the questions that follow.



A rectangular glass with an area of  $168\text{in}^2$  is placed on a picture frame. The length of the glass should be 2 inches longer than its width.

**IT'S YOUR TURN!**

Draw a diagram that represents this situation.



How will you represent the length, width and area of the glass?

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What expression would represent the area of the glass?

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If the picture frame is enlarged and the glass needed should have an area of  $960\text{in}^2$ , what equation would describe its area?

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How will you solve for the length and width of the glass?

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**WHAT IS IT**

In order to find the length and width of the problem above, the property and examples may help you.

**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 <b><math>mn = 0</math></b> , then <b><math>m = 0</math> or <math>n=0</math></b>

**Example 1:**

Solve using factoring.

**A.**  $4x^2 = 6x$

*Solution:*

$$\begin{aligned}
 4x^2 &= 6x \\
 4x^2 - 6x &= 6x - 6x && \text{Subtract } 6x \text{ from both sides} \\
 4x^2 - 6x &= 0 \\
 2x(2x - 3) &= 0 && \text{Factor by GCF (GCF: } 2x) \\
 2x = 0 &\text{ or } 2x - 3 = 0 && \text{Use the Zero Product Property} \\
 x = 0 &\text{ or } x = \frac{3}{2} && \text{Solve each equation}
 \end{aligned}$$

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

**Example 2:**

**A.**  $x^2 - 3x = 18$

*Solution:*

$$\begin{aligned}
 x^2 - 3x &= 18 \\
 x^2 - 3x - 18 &= 18 - 18 && \text{Subtract } 18 \text{ from both sides} \\
 x^2 - 3x - 18 &= 0 \\
 (x + 3)(x - 6) &= 0 && \text{Factor the trinomial} \\
 x + 3 = 0 &\text{ or } x - 6 = 0 && \text{Use the Zero Product Property} \\
 x = -3 &\text{ or } x = 6 && \text{Solve each equation}
 \end{aligned}$$

The solutions are -3 and 6.

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**Example 3:**

A.  $2x^2 - 3 = -x$

*Solution:*

$$\begin{array}{ll}
 2x^2 - 3 = -x & \\
 2x^2 - 3 + x = -x + x & \text{Add } x \text{ to both sides} \\
 2x^2 + x - 3 = 0 & \\
 (2x + 3)(x - 1) = 0 & \text{Factor the trinomial} \\
 2x + 3 = 0 \text{ or } x - 1 = 0 & \text{Use the Zero Product Property} \\
 x = -\frac{3}{2} \text{ or } x = 1 & \text{Solve each equation} \\
 \text{The solutions are } -\frac{3}{2} \text{ and } 1. & 
 \end{array}$$

**WHAT'S MORE**

Solve the following quadratic equations by factoring: (SHOW YOUR SOLUTION)

1.  $x^2 - 4x = 0$
2.  $x^2 + 2x = 15$
3.  $x^2 - 8x + 16 = 0$
4.  $x^2 - 5x = 2x^2 - 5x$
5.  $20x^2 - 9x = 20$

**WHAT I HAVE LEARNED**

**Steps on how to solve a quadratic equation by factoring:**

1. Move all the terms of the equation in the left side if necessary. In this case, the other side must be zero.
2. Combine the similar terms in the left side.
3. Factor the left side of the equation.
4. Equate each factor that holds the unknown variable to zero.
5. Solve the equated form.
6. Check the answers by evaluating it to the original equation.



**WHAT I CAN DO**

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

1) $x^2 + 5x = 0$	6) $x^2 + 4x - 21 = 0$
2) $7x^2 + 21x = 0$	7) $x^2 - 14x = -24$
3) $16x^2 = 12x$	8) $2x^2 - 12 = 2x$
4) $-4x^2 = 6x$	9) $2x^2 + 5x + 2 = 0$
5) $x^2 + 8x + 12 = 0$	10) $3x^2 - 5x = 12$

**ASSESSMENT**

Write the letter of the correct answer on your answer sheet. If your answer is not among the choices, write E together with your final answer.

- For any real number **a** and **b**, if  $ab = 0$ , then either  $a = 0$  or  $b = 0$  is called \_\_\_\_\_.  
 A. Zero Product Property  
 B. Square Root Property  
 C. Addition Property  
 D. Subtraction Property
- The  $(x + 3)(x - 3)$  is a factored form of equation \_\_\_\_\_.  
 A.  $x^2 - 3 = 0$   
 B.  $2x^2 = 9$   
 C.  $x^2 - 9 = 0$   
 D.  $x^2 + 32 = 0$
- What is the factored form of  $x^2 + 10x + 25 = 0$ ?  
 A.  $(x - 5)^2$   
 B.  $(x + 5)^2$   
 C.  $(x + 2)(x + 5)$   
 D.  $(x - 2)(x + 5)$
- Solve for the value of x in equation  $4x^2 + 8x = 0$ .  
 A.  $x = 0, -2$   
 B.  $x = 2, -2$   
 C.  $x = 1, 2$   
 D.  $x = -1, -2$
- In question number 4, find the GCF of  $4x^2$  and  $8x$ .  
 A.  $2x$   
 B.  $x$   
 C.  $3x$   
 D.  $4x$
- What is the solution set of  $6x^2 - 30x = -36$ ?  
 A.  $\{1, 2\}$   
 B.  $\{2, 3\}$   
 C.  $\{3, 4\}$   
 D.  $\{4, 5\}$

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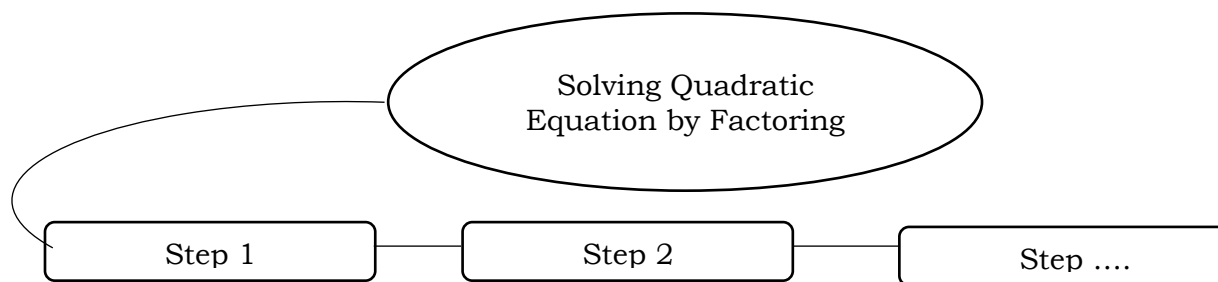
7. Find the roots of  $3x^2 - 4x = 0$ .
- A.  $0, \frac{4}{3}$  D.  $\frac{1}{2}, \frac{2}{3}$   
 B.  $4, 1$   
 C.  $3, 4$
8. Which of the following are factors of  $4 - 8x + 3x^2$ ?
- A.  $(2 - x)(2 + 4x)$  C.  $(1 - x)(4 - 4x)$   
 B.  $(2 - x)(2 - 3x)$  D.  $(4 + x)(1 - 3x)$
9. What are the roots in question number 7?
- A.  $x = -2, -\frac{2}{3}$  C.  $x = \frac{2}{3}, 1$   
 B.  $x = -3, \frac{1}{3}$  D.  $x = \frac{3}{4}, -\frac{3}{2}$
10. A rectangle has a length of five inches more than its width. Its area is 24 square inches. Find the dimensions of the rectangle.
- A. width= 3 in., length= 4 in  
 B. width =3 in, length = 8 in.  
 C. width = 4 in, length = 5 in  
 D. width = 8 in, length = 2 in.

**ADDITIONAL ACTIVITIES**

Communication, Collaboration, and  
Character Building



- A. Copy and complete the graphic organizer. In each box, write a step used in solving quadratic equation by factoring.



**B. REFLECT**

Solving quadratic equation through factoring requires the factors of the given quadratic equation before breaking them down into two linear equations. This is helpful in solving for the values of the unknown.

Do you think the problems within your community also have factors? Do you think it's easier to solve for these factors first before solving the main problem? Why?

### **E-Search**

You may also check the following link for your reference and further learnings about this module:

- <https://www.youtube.com/watch?v=sLlaI7lQ7AM>
- <https://www.youtube.com/watch?v=6PTt9BoIfHg&t=94s>

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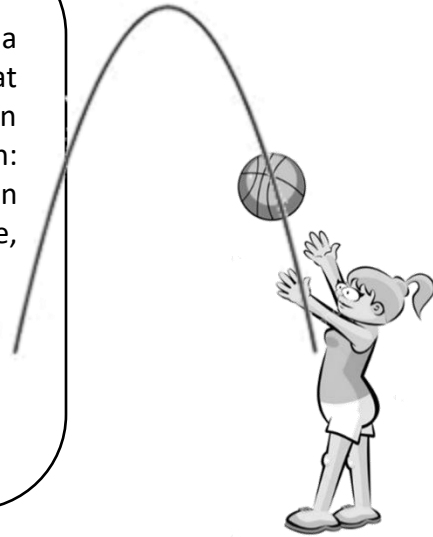
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**PROBLEM – BASED WORKSHEET**

**Throwing of Ball**

Any ball thrown into the air is a projectile. The general function that approximates the height in feet of a projectile on Earth after  $t$  seconds is given by the function:  $h(t) = -16t^2 + v_0t + h_0$ . This model has a limitation because it does not account for air resistance, wind, and other factors.

Suppose Linda throws a ball into the air to a height of 5 ft with an initial velocity of 16ft/s.



1. Write an equation that can be used to model the height of the ball in feet seconds after the ball is thrown.  
\_\_\_\_\_
2. Write an equation of the model when it reaches the ground.  
\_\_\_\_\_
3. Solve the equation by factoring.  
\_\_\_\_\_
4. How long does Linda have to catch the ball before it hits the ground?  
\_\_\_\_\_

ANSWER KEY

WHAT'S IN

WHAT I CAN DO

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

1. -5 and 0
2. -3 and 0
3. 0 and  $\frac{4}{3}$
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

WHAT'S MORE

1. 0, 4
2. -5, 3
3. 4
4. 0
5.  $\frac{4}{5}, -\frac{4}{5}$

WHAT I KNOW

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

PROBLEM - BASED WORKSHEET

1.  $h(t) = -16t^2 + 16t + 5$
2.  $-16t^2 + 16t + 5 = 0$
3.  $(-4t + 5)(4t + 1) = 0$
4. 1.25 seconds

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

ASSESSMENT