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MATHEMATICS

Quarter 1 - Module 7:
Factoring Polynomials

AIRs - LM

MATHEMATICS 10
Quarter 1 - Module 7: Factoring Polynomials
Second Edition, 2021

Development Team of the Module

Author: Elmundo C. Taberdo
Editor: SDO La Union, Learning Resource Quality Assurance Team
Illustrator: Ernesto F. Ramos, Jr.
Christian R. Bumatay
Content Reviewer: Richie C. Noveloso
Language Reviewer: Richie R. Noveloso
Design and Layout: Mark Jesus M. Mulato

Management Team:

ATTY. Donato D. Balderas, Jr.
Schools Division Superintendent
Vivian Luz S. Pagatpatan, Ph.D
Assistant Schools Division Superintendent
German E. Flora, Ph.D, *CID Chief*
Virgilio C. Boado, Ph.D, *EPS in Charge of LRMS*
Erlinda M. Dela Peña, Ph.D, *EPS in Charge of Mathematics*
Michael Jason D. Morales, *PDO 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

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MATHEMATICS

Quarter 1 - Module 7:
Factoring Polynomials

DEPARTMENT OF EDUCATION

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

Target

This module is about finding the factors of polynomials with the nth terms. Your knowledge and skills in factoring quadratic and linear equations that you have learned from the lower grade levels and the application of synthetic division with some theorems you learned from the previous modules will help you in factoring higher form of polynomials. As you go over the discussion and exercises, you will learn another technique in finding the factors of polynomials. Enjoy learning about factoring, and do not hesitate to go back if you think you are at a loss.

After through this module, you are expected to attain the following objectives.

Learning Competency

- factors polynomials (M10AL– h–1)

Subtasks

1. Determine the factors of polynomials using Synthetic Division and Factor Theorem.
2. Apply the Rational Root Theorem to find the factors of polynomials.

Before going on, let's check how much you know about this module. Answer the pre-assessment on the next page in a separate sheet of paper.

Pre – Test

Directions: Find out how much you already know about this module. Write the letter that you think best answers the question in a separate sheet of paper. Please answer all items. Take note of the items that you were not able to answer correctly and find the right answer as you go through this module.

1. Which of the following are the factors of the mathematical expression $2x + 10$?
   A. $2(x + 2)$ B. $2(x + 3)$
   C. $2(x + 4)$ D. $2(x + 5)$
2. Which of the following are the factors of the quadratic equation $x^2 + 5x – 24 = 0$?
   A. $(x + 3)(x + 8) = 0$ B. $(x + 3)(x – 8) = 0$
   C. $(x – 3)(x + 8) = 0$ D. $(x – 3)(x – 8) = 0$
3. What are the factors of $7x + 2x^2 + 6$?
   A. $(2x + 3) (x + 2)$ B. $(2x + 3) (x - 2)$
   C. $(2x - 3) (x - 2)$ D. $(2x - 3) (x + 2)$
4. One of the factors of $x^2 – 36$ is $(x + 6)$, what is the other factor ?
   A. $(x – 4)$ B. $(x – 6)$ C. $(x – 9)$ D. $(x – 12)$
5. Which of the following is the factored form of $x^3 + 3x^2 – 10x - 24$?
   A. $(x + 4) (x -3) (x + 2)$ B. $(x - 4) (x -3) (x + 2)$
   C. $(x - 4) (x -3) (x - 2)$ D. $(x + 4) (x + 3) (x - 2)$
6. Factor $P(x) = x^4 + x^3 + x^2 + x$.
   A. $x (x +1)(x^2 +1)$ B. $x (x - 1)(x^2 +1)$
   C. $x (1)(x^2 +1)$ D. $x (-1)(x^2 +1)$
7. The factored form of the polynomial equation is $(x + 2)(x – 2)(x – 4) = 0$. Which of the following is its standard form?
   A. $x^3 + 4x^2 – 4x + 16 =0$ B. $10x^3 - x^2 – x + 16 =0$
   C. $x^3 - 4x^2 – x + 16 =0$ D. $x^3 - 4x^2 – 4x + 16 =0$
8. One of the factors of $2x^3 + 11x^2 - 23x - 14 = 0$ is $(x -2)$. Find the other factors.
   A. $(2x – 1) (x-7)$ B. $(2x – 1) (x+7)$
   C. $(2x + 1) (x-7)$ D. $(2x + 1) (x+7)$
9. Which of the following statement is correct?
   A. $6m^2 + 5mn + n^2 = (2m – n)(3m – n)$
   B. $16m^2 – 40m – 25 = (4m – 5)(4m – 5)$
   C. $6m^2 – 13m – 28 = (3m – 4)(2m + 7)$
   D. $4m^2 + 20m + 25 = (2m + 5)(2m + 5)$
10. The area of a square is $4h^2 + 12h + 9$ square units. Which of the following expression represents the length of its sides?
    A. $(3h + 2)$ units B. $(2h + 3)$ units
    C. $(4h + 9)$ units D. $(4x + 3)$ units
11. Which of the following polynomials is exactly divisible by $(2x – 1)$?
    A. $2x^2 – 5x + 2$ B. $2x^2 + 9x + 1$ C. $4x^2 – 16$ D. all of the above
12. Which of the following is equal to $25y^2 – x^2$?
    A. $(5y + x)(5y + x)$ B. $(5y + x)(5y – x)$
    C. $(5y – x)(5y – x)$ D. $(5y + x)(–5y – x)$
13. Factor $2m^2 + 3m - 9$ completely.
    A. $2(m + 3)(m – 3)$ B. $(m + 3)(2m – 3)$
    C. $(2m – 3)(2m – 3)$ D. $(2m + 3)(m – 3)$

14. Which of the following are the factors of the polynomial $2x^3 + 9x^2 - 33x + 14$?

A. $(x - 2)(2x + 1)(x - 7)$ B. $(x - 2)(2x - 1)(x + 7)$

C. $(x - 2)(2x + 1)(x - 7)$ D. $(x + 2)(2x - 1)(x - 7)$

15. The volume (lwh) of each rectangular prism is expressed as a polynomial $P(x) = x^3 + 10x^2 + 16x$. Find three factors to represent the length, width, and height of the prism.

A. $x(x + 1)(x + 16)$ B. $x(x + 2)(x + 8)$

C. $x(x + 4)(x + 4)$ D. $x(x + 5)(x + 3)$

Well, how was it? Do you think you fared well? Did you get a good score? If all your answers are correct, very good! You may still study the module to review what you already know. Who knows, you might learn more new things as well.

Lesson 1

Factoring Polynomials Using Synthetic Division, Factor Theorem, and Rational Root Theorem

Before you start learning on how to factor polynomials, let's see what you have learned so far when you were in lower grade level and from the previous modules. The activities will help you understand the lesson.

Jumpstart

Activity 1: Match Me With My Factors!

Direction: Match the factors in column B to their corresponding quadratic and linear equations in column A.

Column A(Equations)	**Column B**(Factors)
1. $x^2 - 25 = 0$	A. $4(x - 9) = 0$
2. $x^2 + 5x - 36 = 0$	B. $(x - 5)(x - 5) = 0$
3. $4x - 36 = 0$	C. $(x + 5)(x - 2) = 0$
4. $6x - 9 = 0$	D. $10(x + 1) = 0$
5. $x^2 - 10x + 25$	E. $(x + 12)(x - 7) = 0$
6. $x^2 + 3x - 10 = 0$	F. $(x + 5)(x - 5) = 0$
7. $x^2 - 16 = 0$	G. $(2x + 4)(2x + 4) = 0$
8. $x^2 + 5x - 84 = 0$	H. $(x + 4)(x - 4) = 0$
9. $4x^2 + 16x + 16 = 0$	I. $(x + 9)(x - 4) = 0$
10. $10x + 10 = 0$	J. $3(2x - 3)$

Activity 2: Do You Remember Me?

Direction: Find the quotient and remainder if the first polynomial is divided by the second polynomial using synthetic division.

1. $(5x^2 - 2x + 1) \div (x + 2)$ Quotient:________________ Remainder: ____
2. $(x^3 + x^2 + 2x - 12) \div (x - 3)$ Quotient:________________ Remainder: ____
3. $(x^3 - x - 2) \div (x - 1)$ Quotient:________________ Remainder: ____
4. $(2a^3 + 5a^2 - 3) \div (a + 1)$ Quotient:________________ Remainder: ____
5. $(x^4 - x^3 - 11x^2 + 9x + 18) \div (x + 1)$ Quotient:________________ Remainder: ____

What can you say about the exercises? If you got all the correct answers, very good! If not, review your lesson. Then you are ready for lesson.

Discover

In dividing polynomials, we came up with a generalization,

$$P(x) = D(x) \cdot Q(x) + R$$

$$\text{Polynomial} = (\text{Divisor}) \times (\text{Quotient}) + \text{Remainder}$$

If D(x) has the form x – c, the equation above becomes $P(x) = (x - c) \cdot Q(x) + R$. If x = c, then;

$$P(c) = (c - c) \cdot Q(x) + R$$
$$P(c) = (0) \cdot Q(x) + R$$
$$P(c) = 0 + R$$
$$P(c) = R$$

This leads us to the **Remainder Theorem** which you learned from the previous modules. The theorem states that, "***If the polynomial P(x) is divided by x – c, then the remainder is P(c)".***

If the remainder is 0 like in this example,

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

Therefore x + 1 is an **exact** divisor of $x^3 + 2x^2 - x - 2$. And if it is an exact divisor of $x^3 + 2x^2 - x - 2$, then, x + 1 is a ***factor*** of $x^3 + 2x^2 - x - 2$.

We now have another theorem as a result of Remainder Theorem when the remainder is 0. We call this the **Factor Theorem.** It states that, ***"x – c is a factor of P(x) if and only if P(c) is 0."***

Let us now apply the **Synthetic Division** and **Factor Theorem** to find the factors of polynomials P(x).

Illustrative Examples

Example 1. Find the factors of $P(x) = x^3 - 6x^2 + 3x + 10$.

Step 1

By substitution, let us find one factor of the polynomial. The possible numbers that we can try as value of x in P(x) are the factors of the constant term, 10. Factors of 10 are ±1, ±2, ±5, and ±10.

(*Like the factors of $x^2 + 5x + 6$, the constant term 6 will determine the second terms of the binomial factors. For $x^3 - 6x^2 + 3x + 10$, the constant term will also determine its factors*.)

So, going back to $P(x) = x^3 - 6x^2 + 3x + 10$, let us try x – 1 or x = 1. By Remainder Theorem;

$$P(1) = (1)^3 - 6(1)^2 + 3(1) + 10$$
$$P(1) = 1 - 6 + 3 + 10 = 14 - 6 = 8,$$

x – 1 is NOT a factor of $x^3 - 6x^2 + 3x + 10$ because $P(1) \neq 0$

Let us try the other possible factor of 10 which is x + 1 or x = -1. By Remainder Theorem;

$$P(-1) = (-1)^3 - 6(-1)^2 + 3(-1) + 10$$
$$P(-1) = -1 - 6 - 3 + 10 = -10 + 10 = 0$$

Therefore x + 1 is a factor of $x^3 - 6x^2 + 3x + 10$ because P(-1) = 0

Step 2

Knowing one factor of the polynomial, we can now find the other factor/factors by using Synthetic Division. (Since x + 1 is a factor, then the divisor in the synthetic division will be -1.)

-1	1	-6	3	10
		-1	7	-10
	1	-7	10	0

Step 3

Write the quotient in the synthetic division as a polynomial in terms of x. If this is factorable, factor it. If not, try the other factors of 10 until the polynomial is factored completely.

1, -7 and 10 are the coefficients of the quotient whose degree is one less than that the given/original polynomial.

Therefore the quotient is $x^2 - 7x + 10$ and the remainder is 0. Now, write the given polynomial as the product of two factors.

$$x^3 - 6x^2 + 3x + 10 = (x + 1)(x^2 - 7x + 10)$$

Since $x^2 - 7x + 10$ is factorable, the factors are (x – 2) and (x – 5)

Therefore the complete factors of $x^3 - 6x^2 + 3x + 10$ are (x + 1), (x – 2) and (x – 5).

$$\mathbf{x^3 - 6x^2 + 3x + 10 = (x + 1)(x - 2)(x - 5)}$$

Example 2. Solve for the other factors of P(x) = $x^4 - x^3 - 11x^2 + 9x + 18$, given that one factor is (x + 3).

Solution:

Given one factor of the polynomial, we can now find the other factor/factors by using Synthetic Division. (Since x + 3 is a factor, then the divisor in the synthetic division will be -3.)

-3	1	-1	-11	9	18
		-3	12	-3	-18
	1	-4	1	6	0

The quotient in the synthetic division is $x^3 - 4x^2 + x + 6$

Since the quotient is still in the third degree, continue finding the other factor/factors of the polynomial by synthetic division using the factors of the constant term of $x^3 - 4x^2 + x + 6$. The factors of the constant term 6 are $\{\pm 1,\ \pm 2,\ \pm 3,\ \pm 6\}$. Let us try the factor x + 1 or x = -1. So the divisor in the synthetic division is -1.

-1	1	-4	1	6
		-1	5	-6
	1	-5	6	0

Since the remainder is zero, by the Factor Theorem, x + 1 is factor of $x^3 - 4x^2 + x + 6$. This implies that,

$$x^3 - 4x^2 + x + 6 = (x + 1)(x^2 - 5x + 6)$$

The polynomial $x^2 - 5x + 6$ is factorable, by inspection the two factors are, (x + 3) and (x + 1).

Therefore the factors of $P(x) = x^4 - x^3 - 11x^2 + 9x + 18$ are **$(x + 3)(x + 1)\ (x - 2)(x - 3)$**.

Example 3. Solve for the other factors of $P(x) = x^3 - 2x^2 - 3x + 10$, given that (x + 2) is one of its factors.

Solution:

Given one factor of the polynomial, we can now find the other factor/factors by using Synthetic Division. (Since x + 2 is a factor, then the divisor in the synthetic division will be -2.)

-2	1	-2	-3	10
		-2	8	-10
	1	-4	5	0

The quotient is $x^2 - 4x + 5$

Since $x^2 - 4x + 5$ is not factorable, therefore the factors of $x^3 - 2x^2 - 3x + 10$ are **$(x + 2)(x^2 - 4x + 5)$**.

Another way of finding the factors of a polynomial is applying the **Rational Roots Theorem.**

Rational Roots Theorem: *The set composed of every factor of the constant term of a polynomial P(x) divided by every factor of its leading coefficient is the set of all possible rational roots of P(x).*

Definitions

- The leading term of a polynomial is the term with the highest exponent of x. The term that determines the degree of the polynomial.
- The leading coefficient of a polynomial is the coefficient of the leading term.
- The constant term of a polynomial is the term with no variable. The degree is zero.

Steps

1. Use the Rational Roots Theorem to make the list of all possible rational roots.
2. Test possible roots using synthetic division. Once you find a root, rewrite the original polynomial with the root you just found factored out using the resulting coefficients from the successful synthetic division.
3. Keep testing roots using the new, reduced coefficients and continue to factor the polynomial until it is factored entirely into linear factors.

Example 4: Find the factors of the polynomial $P(x) = x^3 + 4x^2 + x - 6$.

- First we compile the list of all possible rational roots using the Rational Roots Theorem.
  The factors of the constant term, -6, are ±1, ±2, ± 3, ±6.
  The factors of the leading coefficient 1, are ±1.
  If the leading coefficient is 1 the possible rational roots are the factors of the constant term: {±1, ±2, ± 3, ±6}
- Now we start testing values until we find a root. We have no choice but to choose at random.

We start at 1.

1	1	4	1	-6
		1	5	6
	1	5	6	0

So we found a root. So that means we can factor

$x^3 + 4x^2 + x – 6 = (x – 1)(x^2 + 5x + 6)$

Since $x^2 + 5x + 6$ is factorable, by inspection the factors are $(x + 2)(x + 3)$.
Therefore, our entire polynomial P(x) factors the following way:

$x^3 + 4x^2 + x – 6 =$ $\mathbf{(x – 1)\ (x + 2)(x + 3)}$

Example 5: Find the factors of the polynomial $P(x) = 4x^4 - 8x^3 - 3x^2 + 7x - 2$.

- First we compile the list of all possible rational roots using the Rational Root Theorem.
  The factors of the constant term, 2, are ±1 and ±2.
  The factors of the leading coefficient 4, are ±1, ±2, and ±4.
  Since the leading coefficient is NOT 1, we divide all the factors of 2 by all factors of 4 to get the following list of possible rational roots:
  $\left\{\pm 1, \pm 2, \pm\frac{1}{2}, \pm\frac{1}{4}\right\}$.
- Now we start testing values until we find a root. We have no choice but to choose at random.

We start at 1.

1	4	-8	-3	7	-2
		4	-4	-7	0
	4	-4	-7	0	-2

This is not a root of the polynomial because the remainder is not a zero. So we try another. We try ***-1***.

-1	4	-8	-3	7	-2
		-4	12	-9	2
	4	-12	9	-2	0

This time we found a root. This division tells us that we can factor P(x) as follows. $P(x) = (x + 1)(4x^3 - 12x^2 + 9x - 2)$

Now we continue testing numbers with synthetic division to find more roots. However, now we try to divide $4x^3 - 12x^2 + 9x - 2$. At this time we try ***-2***.

-2	4	-12	9	-2
		-8	40	-98
	4	-20	49	-100

-2 is not a root so we try another.

We try ***2***.

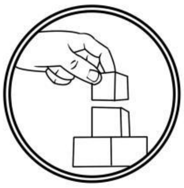
2	4	-12	9	-2
		8	-8	2
	4	-4	1	0

We found another root! So that means we can factor

$4x^3 - 12x^2 + 9x - 2$ into $(x - 2)(4x^2 - 4x + 1)$

We can factor $4x^2 - 4x + 1$ by inspection into $(2x - 1)(2x - 1)$. So our entire polynomial P(x) factors the following way:

$$4x^4 - 8x^3 - 3x^2 + 7x - 2 = (x + 1)(4x^3 - 12x^2 + 9x - 2)$$
$$= (x + 1)(x - 2)(4x^2 - 4x + 1)$$
$$\mathbf{4x^4 - 8x^3 - 3x^2 + 7x - 2 = (x + 1)(x - 2)(2x - 1)(2x - 1)}$$



Explore

Activity 3: What did the Binomials Say to P(x)?

Directions: Find the other factor or factors in each polynomial P(x) and place the letter in the corresponding box to solve the puzzle.

O	R	A
$P(x) = x^3 + 2x^2 - x - 2$ $= (x + 2)(x - 1)(\_\_\_\_\_)$	$P(x) = x^2 - x - 56$ $= (x + 7)(\_\_\_\_\_)$	$P(x) = x^3 - 10x^2 - x + 10$ $= (x + 1)(\_\_\_\_\_)(\_\_\_\_\_)$
M	**U**	**I**
$P(x) = 2x^3 + x^2 - 13x + 6$ $= (x + 3)(x - 2)(\_\_\_\_\_)$	$P(x) = x^2 + 2x - 48$ $= (x - 6)(\_\_\_\_\_)$	$P(x) = x^3 - 7x + 6$ $= (x - 2)(\_\_\_\_\_)(\_\_\_\_\_)$
F	**Y**	**C**
$P(x) = 2x^3 - 3x^2 - 3x + 2$ $= (x + 1)(2x - 1)(\_\_\_\_\_)$	$P(x) = x^2 - 12x + 35$ $= (x - 5)(\_\_\_\_\_)$	$P(x) = x^3 - 3x^2 - 10x + 24$ $= (x - 2)(\_\_\_\_\_)(\_\_\_\_\_)$

T
$P(x) = x^4 - 13x^2 + 36$ $= (x + 3)(x - 3)(\_\_\_\_\_)(\_\_\_\_\_)$

(x+3)(x-1)

(x-10)(x-1)	(2x – 1)

(x – 7)	(x + 1)	(x + 8)	(x – 8)

(x – 2)	(x-10)(x-1)	(x+3)(x–4)	(x+2)(x–2)	(x + 1)	(x – 8)

Deepen

Activity 4: Find My Parts!

Directions: Find the factors of the following polynomials. With complete solution showing your synthetic division.

1. $P(x) = x^3 – 5x^2 + 2x + 8$
2. $P(x) = x^3 + 2x^2 - 23x – 60$
3. $P(x) = x^3 + x^2 – 14x – 24$
4. $P(x) = -7x + 3 + 4x^3$
5. $P(x) = x^4 – x^3 – 19x^2 + 49x – 30$

Gauge

Directions: Find out how much you have learned from the lessons. Write the letter that you think best answers the question. Please answer all items.

1. What are the factors of the polynomial $x^3 + x^2 + x$?
   A. $(x)(x)(x + 1)$ B. $x(x + 1)(x – 1)$
   C. $x(x + 1)(x + 1)$ D. $x(x^2 + x + 1)$

2. Which of the following are the factors of $y^2 – 12y – 64$?
   A. $(y + 16)(y + 4)$ B. $(y + 16)(y – 4)$
   C. $(y – 16)(y + 4)$ D. $(y – 16)(y – 4)$

3. What are the factors of $2x^2 – 2$?
   A. $2(x + 1) (x – 1)$ B. $2(x + 1) (x + 1)$
   C. $2(x + 2) (x - 1)$ D. $2(x – 2) (x + 1)$

4. One of the factors of $-7x + 3 + 4x^3$ is $(2x + 3)$, what are the other factors?
   A. $(x – 1)(2x – 1)$ B. $(x – 1)(2x + 1)$
   C. $(x + 1)(2x – 1)$ D. $(x + 1)(2x + 1)$

5. Which of the following is the factored form of $x^3 + 4x^2 + x – 6$?
   A. $(x + 3) (x – 2) (x + 1)$ B. $(x + 3) (x + 2) (x – 1)$
   C. $(x – 3) (x – 1) (x + 2)$ D. $(x – 3) (x + 2) (x – 1)$

6. Which of the following are the factors of $15y^2 + 10y – 25$?
   A. $5(y + 1)(3y + 5)$ B. $5(y – 1)(3y + 5)$
   C. $5(y + 1)(3y – 5)$ D. $5(y – 1)(3y – 5)$

7. Find the polynomial with factors $(x + 2)(x – 2)(x – 4)$.
A. $P(x) = x^3 + 4x^2 – 4x + 16$
B. $P(x) = x^3 – 4x^2 + 4x + 16$
C. $P(x) = x^3 + 4x^2 + 4x + 16$
D. $P(x) = x^3 – 4x^2 – 4x + 16$

8. One of the factors of $5x^3 + 2x^2 + 15x + 6 = 0$ is $(5x + 2)$. Find the other factors.
A. $(x^2 + 3)$ B. $(x^2 – 3)$ C. $(x^2 + 2)$ D. $(x^2 – 2)$

9. Which of the following mathematical statement is NOT correct?
A. $2x^3 – 2x^2 + 3x – 3 = (x – 1) (2x^2 + 3)$
B. $r3 – r^2 – 3r + 3 = (r – 1) (r^2 – 3)$
C. $x^3 + 2x^2 – 4x – 8 =(x + 2) (x^2 + 4)$
D. $2x^3 + 2x^2 – 3x – 3 = (x + 1) (2x^2 – 3)$

10. If $9x^2 + 30x + 25$ represent the area of a square, find the binomial that represents the length of its side.
A. $(3x + 5)$ B. $(3x – 5)$ C. $(9x + 5)$ D. $(x + 5)$

11. The area of a rectangular garden is $x^2 + 7x + 12$ square units, find the length and width of the garden in terms of polynomial factors.
A. $(x + 4)$units and $(x + 3)$units
B. $(x + 3)$ units and $(x + 2)$units
C. $(x + 6)$units and $(x + 2)$units
D. $(x + 12)$ units and $(x + 1)$ units

12. Which of the following is equal to $36x^2 – 49y^2$?
A. $(6x + 7y)(6x + 7y)$
B. $(6x + 7y)(6x – 7y)$
C. $(6x – 7y)(6x – 7y)$
D. $(6x + 7y)(–6x – 7y)$

13. Find the factors of $P(x) = x^4 – x^3 – 11x^2 + 9x +18$.
A. $(x + 3)(x + 1)(x – 2)(x – 3)$
B. $(x – 3)(x – 1)(x + 2)(x + 3)$
C. $(x + 3)(x – 1)(x + 2)(x – 3)$
D. $(x – 3)(x + 1)(x + 2)(x – 3)$

14. The polynomial $2x^3 + 9x^2 – 33x + 14$ has three different factors. The two factors are $(x – 2)$and $(x + 7)$. What is the third factor?
A. $(x + 1)$ B. $(x – 1)$ C. $(2x + 1)$ D. $(2x – 1)$

15. Which of the following are the factors of $P(x) = x^4 – 5x^2 + 4$?
A. $(x + 1)(x – 1)(x + 2)(x – 2)$
B. $(x + 1)(x – 1)(x – 2)(x – 2)$
C. $(x – 1)(x – 1)(x + 2)(x – 2)$
D. $(x + 1)(x + 1)(x + 2)(x + 2)$

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For inquiries or feedback, please write or call:

Department of Education – SDO La Union
Curriclum Implementation Division
Learning Resource Management Section
Flores St. Catbangen, San Fernando City La Union 2500
Telephone: (072) 607 - 8127
Telefax: (072) 205 - 0046
Email Address:
launion@deped.gov.ph
lrm.launion@deped.gov.ph