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MATHEMATICS

Quarter 1 - Module 8:
Polynomial Equations

AIRs - LM

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MATHEMATICS 10
Quarter 1 - Module 8: Polynomial Equations
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MATHEMATICS

Quarter 1 - Module 8:
Polynomial Equations

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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

What comes to your mind when you hear the word polynomial equation? Have you ever wondered If you actually use it in a real- life situation? Every activity in this module is designed to help show you where and when polynomial equation is used in the real world. As you go through this lesson, think of this important question: “How are polynomials and polynomial equations used in solving real-life problems and in making decisions?” To find the answer, perform the different activities. Steps are presented for you to follow in finding the solutions of the different problems. You must bear in mind that every problem has a solution.

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

Learning Competency:

1. Illustrates polynomial equations(**M10AL-Ii-1)**
2. Solves problems involving polynomials and polynomial equations(**M10AL-Ij-2)**

Subtasks:

1. Identify the types of polynomial equation
2. Recall how to translate verbal phrase to mathematical expression and write equations on the given real-life situations; and
3. Create polynomial equation given the roots

Before going on, find out how much you already know about the topic in this module. Answer the pre-assessment below.

Pre – Assessment

Directions: Read and understand the questions below. Select the best answer to each item then write the letter of your choice on your answer sheet.

1. Which of the following does **NOT** represents a polynomial equation?
   A. $x^2 - 4 = 0$ B. $x^{-2} - 2 = 0$
   C. $3x^5 + 5x + 2 = 0$ D. $x + 4 = 0$
2. From the equation $4x^2 - 2x^3 + 6x - 3 = 0$, what is the degree of the polynomial?
   A. 0 B. 1 C. 2 D. 3
3. Which of the following is the leading coefficient of $2x\,(x^2 - 8) = 0$?
   A. 2 B. 3 C. 4 D. 8
4. What is the constant term of the polynomial $2x^3 + 6x^2 - 5x = 0$?
   A. 0 B. 2 C. 5 D. 6
5. In the polynomial equation $3x^2 + 4x^3 - x - 3 = 0$, what is the leading term?
   A. 4 B. 3 C. $4x^3$ D. x^3
6. Which of the following polynomial equations is written in standard form?
   A. $2x^2 + 5x + 6 = 0$ B. $5x - 2x^2 + 6 = 0$
   C. $2x^2 - 6 + 5x = 0$ D. $6 + 5x + 2x^2 = 0$
7. How many roots does $x(x-2)(x+1)(x^2+x+3) = 0$?
   A. 3 B. 4 C. 5 D. 6
8. Which of the following is the polynomial equation with integral coefficients that has roots -2, -1 and 1?
   A. $x^3 - 2x^2 - x - 2 = 0$ B. $x^3 + 2x^2 - x - 2 = 0$
   C. $x^3 - 2x^2 + x + 2 = 0$ D. $x^3 + 2x^2 + x - 2 = 0$

For items 9 – 13, refer to the problem below.

The length of the box is five meters less than twice the width. The height is 4 meters more than three times the width. The box has a volume of 475 cubic meters.

9. Which of the following expressions represents the length of the box?
   A. 2x + 5 B. 2x - 5 C. 5x + 2 D. 5x - 2
10. What is the formula to be used to find the dimension?
   A. $V = \pi r^2 h$ B. $V = \frac{1}{3}lwh$ C. $V = \frac{1}{2}lwh$ D. $V = lwh$
11. Which of the following equations can be used to find the dimensions of the box?
   A. $475 = x(2x-5)(3x+4)$ B. $475 = x(2x+5)(3x+4)$
   C. $475 = x(2x-5)(3x-4))$ D. $475 = x(2x+5)(3x-4)$
12. What is the width of the box?
   A. 3m B. 4m C. 5m D. 6m
13. Which of the following is the height of the floor?
   A. 20 m B. `19 m C. 18m D. 17m
14. A box is (x +2) cm by (x – 3) cm by (x + 4) cm. Find the volume of the box.
   A. $x^3 + 3x^2 - 10x - 24$ B. $x^3 - 3x^2 - 10x - 24$
   C. $x^3 + 3x^2 + 10x - 24$ D. $x^3 - 3x^2 - 10x + 24$
15. If a car covers ($15x^2 + 7x - 2$) km in (3x + 2) hours, what is the average speed in km/hr?
   A. x + 5 B. x - 5 C. 5x – 1 D. 5x + 1

Lesson 1	Illustrating Polynomial Equations

Jumpstart

Let us begin this lesson by remembering the different concepts on equations previously studied from your mathematics classes. The knowledge and mathematical skill mentioned will help you to illustrate polynomial equations. Furthermore, these will also guide you to identify the different types of polynomial equations and create polynomial equation given its roots.

Activity 1: Complete Me!

Direction: Complete the table below by identifying the degree and the number of real roots for the given polynomial equations. The first one is done for you.

Polynomial Equation	Degree	No. of Real Roots
1. $(x+1)^2\,(x-5)=0$	3	3
2. $x-8=0$		
3. $(x+2)(x-2)=0$		
4. $(x-3)(x+1)(x-1)=0$		
5. $x(x-4)(x+5)(x-1)=0$		
6. $(x-1)(x-3)^3=0$		
7. $(x^2-4x+13)(x-5)^3=0$		
8. $(x+1)^5(x-1)^2=0$		
9. $(x^2+4)(x-3)^3=0$		
10. $\left(x-\sqrt{6}\right)^6\left(x+\sqrt{6}\right)^6=0$		

This activity shows the relationship between the number of roots and the degree of a polynomial equation.

Discover

Below are some important matters that we need to discuss in order for you to understand polynomial equations. Read carefully and understand all main points written in this part of the module.

Before we proceed with polynomial equation, let us recall first the definition of a polynomial.

POLYNOMIAL

A polynomial consists of one term or the sum or difference of two or more terms. It is an expression that can be written in the form

$$a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_1 x + a_0.$$

Moreover, a polynomial must NOT have the following:

a. Negative exponent
b. Variable in the denominator
c. Fractional exponent

Some examples are shown in the table below.

Examples	Polynomial /NOT Polynomial	Reasons
1. $x + 2 = 0$	Polynomial	Linear Equation
2. $x^2 + \frac{5}{x} = 0$	NOT Polynomial	It has a variable in the denominator
3. $y^{-3} + y + 2 = 0$	NOT Polynomial	It has a negative exponent.
4. $\sqrt{x} - 5 = 0$	NOT Polynomial	The exponent of x is ½
5. $\frac{1}{2}x^2 - 1 = 0$	Polynomial	Quadratic Equation

TYPES OF POLYNOMIALS

1. **Monomials** – Monomials are the algebraic expressions with one term. It is an expression that contains any count of like terms.

   Examples:
   $5x^2$ $8x$ $6xy$ $-3y$ 8

2. **Binomials** – Binomials are the algebraic expressions with two unlike terms separated by addition or subtraction.

   Examples:
   $2x^2 + 3$ $x + y$ $x^3 - 2x$ $x - 5$ $4ab + 2ac$

3. **Trinomials** – Trinomials are the algebraic expressions with three unlike terms.

   Examples:
   $2x^2 + 5x - 3$ $2x^2 + 4xy + 2y^2$ $-3x^3 - 7x^2 + 8$

POLYNOMIAL EQUATION

A polynomial equation is an equation that has multiple terms made up of numbers and variables. Usually, it is expressed in the form $a_n(x^n)$, where a is the coefficient, x is the variable, and n is the exponent. The value of the exponent should always be a positive integer.

If we expand the polynomial equation, we will get the general expression, and this is the **standard form**.

$$a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_1 x + a_0 = 0$$

TYPES OF POLYNOMIAL EQUATION

1. **Linear Equation.** This type of equation is in the form $ax + b = 0$, where $a \neq 0$. This is always in the first degree or let's just say the highest exponent is 1.

   Examples:
   $5x + 2 = 0$ $\quad -2y - 4 = 0$ $\quad 3x = 0$ $\quad 4a - 2 = 6$

2. **Quadratic equation.** This type of equation has a general form of $ax^2 + bx + c = 0$, where a , b and c are real numbers and $a \neq 0$.

   Examples:
   $2x^2 + 5x - 4 = 0$ $\quad y^2 + 2y - 3 = 0$

3. **Cubic equation.** This type of equation has the general form of $ax^3 + bx^2 + cx + d = 0$ where a, b, c and d are real numbers and $a \neq 0$. The way to identify these types of equations is to look for x^3.

   Examples:
   $x^3 + 4x^2 - 3x + 2 = 0$ $\quad y^3 - 5y^2 + 6y - 8 = 0$

Let us define some terms related to polynomial equations.

$$\boldsymbol{a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_1 x + a_0 = 0}$$

1. Degree of the Polynomial – the highest among the degrees (exponents) on the equation. The variable $\boldsymbol{n}$ indicates the degree of the polynomial from the $\boldsymbol{x^n}$.
2. Leading term - the term in a polynomial which contains the highest degree of the variable. $\boldsymbol{a_n x^n}$ is the leading term of the polynomial equation.
3. Leading coefficient – the number written in front/before the variable of the leading term; it is the coefficient of the leading term. In general, $\boldsymbol{a_n}$ shows the leading coefficient of the polynomial equation.
4. Constant term – a term which does not have a variable and the degree is zero. The symbol that represents the constant term of a polynomial equation is $\boldsymbol{a_0}$**.**

Polynomial Equation	Degree	Leading Coefficient	Constant Term
1. $2x + 6 = 0$	1	2	6
2. $3x^2 + 2x + 2 = 0$	2	3	2
3. $x^3 + 5x^2 + x + 5 = 0$	3	1	5
4. $-5x^2 - 2x = 0$	2	-5	0

WRITING POLYNOMIAL EQUATIONS IN STANDARD FORM

To transform polynomial equation into a standard form, identify the number of terms and arrange the terms with degrees in decreasing order.

Examples:

1. $\mathbf{2x+6=0}$ → In this example, it has two terms, which is already in standard form.
2. $\mathbf{3x^4-4+\ 2x^2=0}$ → In this second example, it has three terms and the highest degree is 4. Since you are going to arrange the terms with degrees in decreasing order, therefore, the standard form is $\mathbf{3x^4+\ 2x^2-4=0}$.
3. $\mathbf{-2x+5-\ 4x^2+\ x^3=0}$ → This equation has four terms and the degree is 3. Arrange the terms with degrees in decreasing order. The standard form is $\mathbf{x^3-\ 4x^2-2x+5=0.}$

FUNDAMENTAL THEOREM OF ALGEBRA

This theorem was first proven by a mathematician, Karl Friedrich Gauss. It states the relationship between the number of roots and the degree of a polynomial equation. The fundamental theorem of algebra states the following:

A polynomial function $f(x)$ of degree n (where $n>0$) has n complex solutions for the equation $f(x)=0$. This theorem forms the foundation for solving polynomial equations.

Please note that the terms 'zeros' and 'roots' are synonymous with solutions as used in the context of this module.

To show the difference between zeros and roots, let’s take a look at these examples.

1. $\mathbf{x^3+\ 4x^2-x-7=0}$. You identify this an example of a polynomial equation. Therefore, it has three (3) complex roots since the degree is 3.

2. $\mathbf{f(x)=3x^2+2x+2.}$ This an example of a polynomial function. Hence, it has two (2) complex zeros because the degree is 2.

Now, we should already know that polynomials can be described by their degree. For example, the polynomial equation , $\mathbf{x^3+\ 3x^2-6x-8=0}$ has a degree of 3 because its highest exponent is 3 and has 3 complex solutions.

The degree of a polynomial equation is important because it tells us the number of solutions of a polynomial equation.

The theorem does not tell us what the solutions are. It only tells us how many solutions exist for a given polynomial equation.

WRITING POLYNOMIAL EQUATION GIVEN THE ROOTS

The roots of an equation are the values that make it equal zero. If this is a regular polynomial, then it means that there are as many factors (at least) as there are roots. If the equation is the product of three factors, then there are three roots. Each root corresponds to one of the factors equal to zero, so you can deal with them individually and think of each of the roots as a separate function.

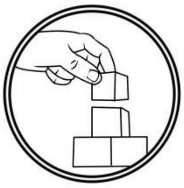
$$f(x)g(x)h(x)=0,\text{ so } f(x)=0 \text{ or } g(x)=0 \text{ or } h(x)=0$$

If you start with the equation $x^3 - 4x^2 - 7x + 10 = 0$, you can factor it and get $(x-1)(x+2)(x-5) = 0$ and thus the roots are $x = 1, x = -2$ and $x = 5$. To solve for the polynomial equation, you apply this process backwards.

Examples:

Find a polynomial equation with integer coefficients that has the following roots.

1. -1, 2, 3	Start with the roots, $x = -1, x = 2$ and $x = 3$. The factors of a polynomial are those terms that can be multiplied together to make up the polynomial. The factors have the opposite signs of the roots. Next, we write the factors of the polynomial together and multiply: $(x+1)(x-2)(x-3) = 0$. Expand this expression and you will get $\boldsymbol{x^3 - 4x^2 + x + 6 = 0}$.
2. 0, -2, 1	First, we take the roots, $x = 0$, $x = -2$ and $x = 1$. We can re-write this equation so that it equals 0, which gives us the factors of the polynomial. Then, we write the factors of the polynomial together and multiply: $x(x+2)(x-1) = 0$. Expand and you will get $\boldsymbol{x^3 + x^2 - 2x = 0}$.
3. 2, -5	Following the steps from the previous examples, the factored form of the polynomial is $(x-2)(x+5) = 0$. Multiplying the two expressions, it becomes $\boldsymbol{x^2 + 3x - 10 = 0}$.



Explore

Work on the following enrichment activities for you to apply your understanding on this lesson.

Activity 2: Find Me!

Directions: Using what you have learned earlier about polynomial equation, complete the table below. The rational roots are already given, answer only what is missing.

Polynomial Equation	Leading Coefficient	Constant Term	Roots
$11x - 6 = 0$	(1)	(2)	1, 2, 3
$x^3 - x^2 - 10x - 8 = 0$	(3)	(4)	-2, -1, 4
$x^3 + 2x^2 - 23x - 60 = 0$	(5)	(6)	-4, -3, 5
$2x^4 - 7x^3 + 6x^2 + x - 2 = 0$	(7)	(8)	$-\frac{1}{2}$, 1, 1, 2
$3x^4 - 16x^3 + 21x^2 + 4x - 12 = 0$	(9)	(10)	$-\frac{2}{3}$, 1, 2, 3

How did you find the activity? What mathematical concepts did you use? Now, here is another activity that lets you apply what you have learned about types of polynomials.

Activity 3: Follow My Destiny!

Directions: Name each polynomial equation by its degree and number of terms. If necessary, write the polynomial equation in standard form. The first one is done for you.

Polynomial Equation	Name of the Polynomial		Standard Form
	Degree	Number of Terms	
1. $x - 2 = 0$	linear	binomial	$x - 2 = 0$
2. $2x + 8 + 3x^2 = 0$			
3. $17a^2 - 7 + 2a = 0$			
4. $10a + 12 = 0$			
5. $8x - 16x^2 + 52 = 0$			
6. $-6 - 5x = 0$			

If you have described the polynomial function, then you have already understand the concepts of illustrating polynomial equations into different forms.
Answer the next activity to deepen your understanding in the concepts of illustrating polynomial equations into different forms.

Deepen

Activity 4: Create Me!

Direction: For each item below, create a polynomial equation with integral coefficients and has the following roots.

1. -1, 2, -6
2. 2, -7
3. 0, -4, -5, 1
4. -2, 3, 5
5. -2, 3, 2, -3

Now that you have created a polynomial equation given the roots, then you have already understood the concepts of illustrating polynomial equations into different forms.

Lesson 2 Problems Involving Polynomials and Polynomial Equations

Jumpstart

This lesson focuses on the application of learned concepts on polynomials and polynomial equations. You are going to solve problems involving polynomials and polynomial equations. Recall how verbal phrases are translated into mathematical expressions. Answer the activity below.

Activity 1: Translate Me!
Directions: Translate each mathematical phrase into algebraic expression in column A then select your answers in column B. Write the letters of your choice only.

Column A	Column B
1. ten more than a number x	A. $3(6x)^3$
2. four subtracted from twice a number x	B. $2x - 4$
3. half of a number y decreased by one – third of another number x	C. $4y > 2 + x$
	D. $x + 10$
4. thrice the cube of the product of six times x	E. $(11x)^2$
5. twice a number y diminished by another number x	F. $3x + 9 = 18$
6. 9 increased by 3 times x is equal to 18	G. $x + 4 \geq 3 - 7x$
7. the product of 4 and y is greater than the sum of 2 and x	I. $2y - x$
8. seven times the product of -8 and x is equal to or greater than 10	J. $7(-8x) \geq 10$
	K. $\frac{1}{2}y - \frac{1}{3}x$
9. four plus x is greater than or equal to 3 minus seven x	
10. the square of the product of eleven and a number x	

Your skill in translating verbal phrases to mathematical phrases will help you work on problems involving polynomials.

Discover

Now consider the situation below:

The owner of the *rice cake bibingka* offers special rice cake for Christmas and other special occasions. The owner wants the volume of the rectangular solid shaped rice cake to be 24 cubic inches; the length is 5 inches greater than the width and the height is 2 inches less than the width. Find the dimensions of the rice cake pan to be used? If you are the owner of the *rice cake bibingka* how would you determine the size of the pan to be used for baking the cake?

For you to understand the lesson better, study the following examples.
1. Here is the step by step solution of the problem in the above situation.

Steps	**Expression/Equation**	**Discussion**
1.Identify what is/are given in the problem	Let $x = width$ $x + 5 = length$ $x - 2 = height$ Volume = 24 cubic inches	You translate the verbal phrases into mathematical expressions
2.Identify the formula to be used	$V = lwh$	This is the formula for the volume of a rectangular prism.
3. Form the equation	$24 = x(x-2)(x+5)$	Substitute the values of the width, height, length, and volume which are: $x, x-2, x+5$ and 24 respectively to the formula.
4.Perform the operation	$24 = x(x^2 + 3x - 10)$ $24 = x^3 + 3x^2 - 10x$ $0 = x^3 + 3x^2 - 10x - 24$	Multiply $(x-2)$ and $(x+5)$, then multiply the product by x and equate to zero.
5.Solve for the roots/ solutions	-2] 1 3 -10 -24 -2 -2 24 1 1 -12 0	From the list of possible roots, try -2. Use synthetic division to find out if -2 is a root or a solution.
6. Solve for the other solutions	$x^2 + x - 12 = 0$ $(x+4)(x-3) = 0$ $x + 4 = 0, x - 3 = 0$ $x = -4,\ x = 3$	Form the depressed equation using the last row in step 5 as its coefficients. Using factoring, the other solutions are -4 and 3.

7. Choose which of the roots is the measure of the width	$x = -2, x = -4, \ x = 3$	Since there is no measurement that is negative, so we choose $x = 3$ as the width.
8. find the measure of the length and height	height = x-2 = 3-2 =1 length = x +5 = 3 + 5 = 8	Substitute $x = 3$ to the expressions for the length and height.

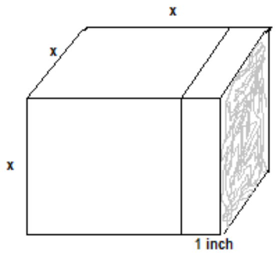
2. One dimension of a cube is increased by 1 inch to form a rectangular block. Suppose that the volume of the new block is 150 cubic inches. Find the length of an edge of the original cube.

Solution:

Step 1. Let x = side of a cube

x + 1 = length of the new rectangular block

Step 2. Illustrate and label the figure



Step 3. Translate the problem

$V = s^3$ or $V = lwh$

$150 = x(x)(x+1)$

Step 4. Solve the problem

$150 = x(x)(x+1)$

$x^3 + x^2 = 150$

$x^3 + x^2 - 150 = 0$

Using synthetic division

5]	1	1	0	-150
		5	30	150
	1	6	30	0

$x^2 + 6x + 30 = 0$ (*depressed equation*)

$x = \frac{-6 \pm \sqrt{6^2 - 4(1)(30)}}{2(1)}$ (*using quadratic formula*)

$x = \frac{-6 \pm \sqrt{36-120}}{2}$ (*the roots are not real*)

Note: Recall that the nature of the roots can be determined using the discriminant.
The **only real root** of the working equation $x^3 + x^2 - 150 = 0$ is **5**.

Step 5. Hence, **the length of an edge of the original cube is 5 inches.**

3. The area of the parallelogram is given by the polynomial expression $(x^3 - 2x^2 - 6x + 12)$ units and its height is $(x - 2)$ units. Find the base of the parallelogram.

Solution:
Area of parallelogram = base x height
$x^3 - 2x^2 - 6x + 12 = base(x - 2)$

using synthetic division

2]	1	-2	-6	12
		2	0	-12
	1	0	-6	0

The base of the parallelogram is $x^2 - 6$.

Now that you have learned to solve real-life problem involving polynomial and polynomial equations you may now try the next activity.

Explore

Activity 2: Apply Your Skills!
Direction: Read and analyze the problems below to answer the questions that follow.

A. The length of a rectangular garden is two feet less than 3 times the width. If the area of the garden is 65 ft^2, find its dimensions.

1. What expression represents the width of the garden? How about the expression represents its length?
2. Formulate an equation relating the width, length and the area of the garden. Explain how you arrived at the mathematical sentence.
3. Using the equation, how will you determine the length and the width of the garden?
4. What is the width of the garden? How about its length?
5. How did you find the length and the width of the garden?

B. The dimensions of a rectangular metal box are 3cm, 5cm, and 8 cm. If the first two dimensions are increased by the same number of centimeters, while the third dimension remains the same, the new volume is 34 cm^3 more than the original volume. What is the new dimension of the enlarged rectangular metal box?

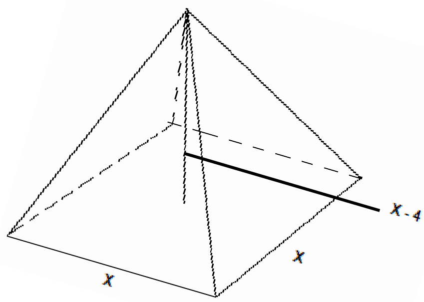
1. Let ______ = the amount of increment
2. ______ = height of the new box

3.   ______ = width of the new box
4. If the volume of the rectangular box is V = lwh, then the equation that will lead to the solution is _______________ = (3)(5)(8) + 34
5. The possible roots of the equation are ______________
6. Which of the roots is the measure of the amount of increment? ______
7. What is the new dimension of the enlarged rectangular metal box?
height = ______   width = _______ length = _______

Here is another activity that lets you apply what you have learned about polynomial and polynomial equations.

Deepen

Activity 3: Solve and Decide!
Direction: Solve the following problems completely and fill in the blanks with the correct answer.
A. Packaging is one important feature in producing quality products. A box designer needs to produce a package for a product in the shape of a pyramid with a square base having a total volume of 200 cubic inches. The height of the package must be 4 inches less than the length of the base. Find the dimensions of the product.



Solution:

1. Let ________________ = area of the base
2.   ________________ = height of the pyramid
3. If the volume of the pyramid is V = 1/3 (base)(height), then the equation that will lead to the solution is 200 = _______________
4. Using synthetic division, the roots are _____________
5. Therefore, the length of the base of the package is ________________
6. and its height is _______________

B. How many reams of bond paper can you buy for $(6x^4 - 17x^3 + 24x^2 - 34x + 24)$ pesos if one ream costs $(3x - 4)$?

C. Mr. Aquino wants to paint the ceiling of a room that has a length of $(c^2 + 2cd + d^2)$ meters and a width of $(c + d)$ meters. If one can of paint will cover $(c + d)^2$ square meters, what is the minimum number of paint of cans of paint needed? Express you answer as a polynomial.

Gauge

Post-Assessment

Directions: Read and understand the questions below. Select the best answer to each item then write the letter of your choice on your answer sheet.

1. Which of the following represents a polynomial equation?
   A. $x^2 - 4 = 0$ B. $y^{-2} - 2 = 0$
   C. $\sqrt{x} + 5 = 0$ D. $\frac{1}{x} + 4 = 0$
2. From the equation $x^3 - 4x^2 + 5x + 3 = 0$, what is the degree of the polynomial?
   A. 0 B. 1 C. 2 D. 3
3. Which of the following is the leading coefficient of $3x\,(x^2 - 36) = 0$?
   A. 2 B. 3 C. 4 D. 36
4. What is the constant term of the polynomial $4x^3 + 4x^2 - 5x + 4 = 0$?
   A. 3 B. 4 C. 5 D. 6
5. In a polynomial equation $4x^3 + 3x^2 - 2x + 3 = 0$, what is the leading term?
   A. $4x^3$ B. x^3 C. 4 D. 3
6. Which of the following polynomial equations is written in standard form?
   A. $x^2 + 3x + 2 = 0$ B. $3x - x^2 + 2 = 0$
   C. $x^2 - 2 + 3x = 0$ D. $2 - 3x + x^2 = 0$
7. How many roots does $x(x-4)(x+5)(x^2+2x+1) = 0$?
   A. 3 B. 4 C. 5 D. 6
8. Which of the following is the polynomial equation with integral coefficients that has roots -1, 0 and 1?
   A. $x^3 - 1$ B. $x^3 - 2x$
   C. $x^3 - 2$ D. $x^3 - x$

   For items 9-13, refer to this problem. The length of the rectangular floor is 3m more than twice the width. If the area of the floor is $65m^2$, find its dimensions.
9. Which of the following expressions represents the length of the rectangular floor? (let x = width)
   A. 2x + 3 B. 3x + 2 C. 2x – 3 D. 3x - 2
10. What is the formula to be used to find the dimension?
   A. $A = s^2$ B. $A = \frac{1}{2}bh$ C. $A = lw$ D. $A = lwh$
11. Which of the following equations represents the area of the rectangular floor?
   A. $65 = x(2x+3)$ B. $65 = x(3x+2)$
   C. $65 = x(2x-3)$ D. $65 = x(3x-2)$
12. What is the width of the rectangular floor?
   A. 2m B. 3m C. 5m D. 7m
13. How about the length of the floor?
   A. 13m B. `12m C. 8m D. 5m
14. The length of the rectangle is $(x^2 + 3)$cm and its width is (x +2) cm. Find the area of the rectangle?
   A. $x^3 + 2x^2 + 3x + 6$ cm^2 B. $x^3 + 3x + 6$ cm^2
   C. $x^3 + 2x^2 + 6$ cm^2 D. $x^3 - 2x^2 + 3x + 6$ cm^2
15. If one dozen of eggs costs (x – 2)pesos, how many dozens can you buy for $(x^5 - 5x^4 - 3x^3 + 15x^2 - 4x + 20)$ pesos?
   A. $x^4 - 3x^3 - 9x^2 - 3x - 10$ B. $x^4 - x^3 - 9x^2 + 3x - 10$
   C $x^4 + 3x^3 - 9x^2 - 3x + 10$ D. $x^4 - 3x^3 + x^2 - x - 10$

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