University of Caloocan City
College of Liberal Arts & Sciences

Mathematics Department

COLLEGE ALGEBRA
Learning Module #1

Topic	BASIC CONCEPTS IN ALGEBRA & POLYNOMIALS
Duration	3 hours
Lesson Proper	**I. The Set of Real Numbers** **Fig.1 –The Real Number System** The real number system consists of a set of elements called real numbers. A real number may be positive, negative, or zero and can be classified as either rational or irrational. 2.5 = 5/2 and 0.2 = 1/5 are **terminating decimals** 0.666… = 2/3 and 0.1414… = 14/99 are **non-terminating repeating decimals** Irrational Numbers are called **nonterminating nonrepeating decimals** Ex. $\sqrt{2}$, $\sqrt[3]{5}$, π, e = 2.71828… $\sqrt{2}$ = 1.4142135623… $\pi = 3.14159265358979323\ldots$

Prove that 0.999… = 1

Let x =   0.999…

$$10x = 9.999…$$

$$10x - x = 9$$

$$X = 1 \qquad \textbf{Thus, 0.999… = 1}$$

Exercises: Give the equivalent value in fraction of the following**:**
   a. 0.777…   Ans: 7/9
   b. 0.41444…   Ans: 14,003/9
   c. 0.2156262…

Performing Operations on Series of Numbers

$$4^2 * 3 \div 6 + 2 - \sqrt{9} = \underline{\qquad}$$

➢ **Operations Involved: addition, subtraction, multiplication, division, involution and evolution.**
➢ **In a series of numbers involving the basic operations in Arithmetic, the following give the order of performing the operations**
   • From left to right, perform first involution/evolution
   • Second, perform the operations within the presence of parentheses or grouping symbols
   • Perform multiplication/division whichever comes first
   • Perform addition/subtraction whichever comes first

Examples:

a. $55 - 3 * 8$ g. $-4^2 \div (4 \div 2)$
b. $(6 - 3) + (4 * 9)$ h. $(-4)^2 \div 4 - 3(-2)$
c. $16 \div 2 * 4 + 2^3$ i. $(-5^2 \div 5) * 3^2 - \sqrt{49}$
d. $3^3 + 9 \div 3 * 6 * \sqrt[3]{8}$ j. $[-(-6)^2 - \sqrt[3]{-64} - 2]$
e. $(-4^2 \div 4) \div 2$ $\div [-4^2 - 1^2]$

Properties of Equality
   1. Reflexive   : a = a
   2. Symmetric   **: If a =b, then b = a**
   3. Transitive   **: If a = b and b = c, then a = c**
   4. Addition Property of Equality (APE):
        If a = b, then a + c = b + c
   5. Multiplication Property of Equality
        If a = b, then ac = bc
   6. Substitution**: If a = b,** then a can be replaced by b in any mathematical statement without changing the value of the statement

Properties of Real Numbers

Property Name	Algebraic Representation	Example	Description/Notes
Commutative property of addition	$a + b = b + a$	$5 + 3 = 3 + 5$	The order in which two real numbers are added or multiplied does not affect the result.
Commutative property of multiplication	$a \cdot b = b \cdot a$	$(5)(3) = (3)(5)$	
Associative property of addition	$(a + b) + c$ $= a + (b + c)$	$(2 + 3) + 7$ $= 2 + (3 + 7)$	The manner in which two real numbers are grouped under addition or multiplication does not affect the result.
Associative property of multiplication	$(a \cdot b)c = a(b \cdot c)$	$(2 \cdot 3)7 = 2(3 \cdot 7)$	
Distributive property of multiplication over addition	$a(b + c)$ $= ab + ac$	$3(5 + 2)$ $= 3 \cdot 5 + 3 \cdot 2$	A factor outside the parentheses is multiplied by each term inside the parentheses.
Identity property of addition	0 is the identity element for addition because $a + 0 = 0 + a = a$	$5 + 0 = 0 + 5 = 5$	Any number added to the identity element 0 will remain unchanged.
Identity property of multiplication	1 is the identity element for multiplication because $a \cdot 1 = 1 \cdot a = a$	$5 \cdot 1 = 1 \cdot 5 = 5$	Any number multiplied by the identity element 1 will remain unchanged.
Inverse property of addition	a and $(-a)$ are additive inverses because $a + (-a) = 0$ and $(-a) + a = 0$	$3 + (-3) = 0$	The sum of a number and its additive inverse (opposite) is the identity element 0.
Inverse property of multiplication	a and $\frac{1}{a}$ are multiplicative inverses because $a \cdot \frac{1}{a} = 1$ and $\frac{1}{a} \cdot a = 1$ (provided $a \neq 0$)	$5 \cdot \frac{1}{5} = 1$	The product of a number and its multiplicative inverse (reciprocal) is the identity element 1.