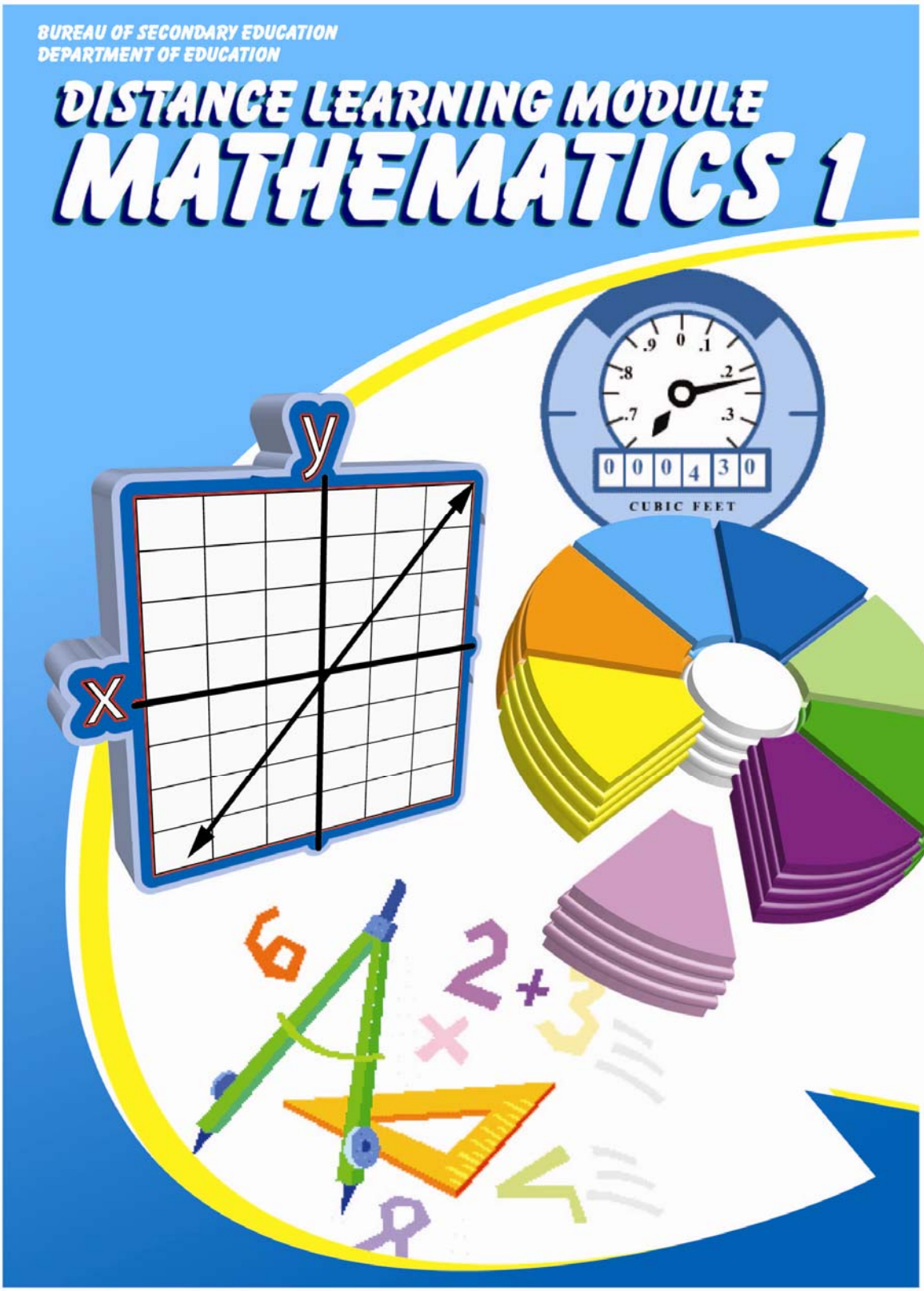

BUREAU OF SECONDARY EDUCATION
DEPARTMENT OF EDUCATION
DISTANCE LEARNING MODULE
MATHEMATICS 1
y
x
CUBIC FEET

FIRST DEGREE EQUATIONS AND INEQUALITIES IN ONE VARIABLE

U N I T V

Planting rice is the usual scenario in the rural areas for the month of June and July.

Mang Mike commissioned the brothers Edgar and Tony to plant rice in his rice field. Edgar can finish the job in 12 hours while Tony can do the same job in 15 hours. The number of hours it will take both of them to complete the whole job can be solved using first degree equations in one variable.

In this unit, you will learn the different concepts involved in first degree equations and inequalities in one variable. As you go over the exercises, you will develop the skills in solving first degree equations and inequalities and apply them in real-life problems.

Painting the wall of a room

Cash register

Mother and daughter

EQUATIONS AND INEQUALITIES

In this lesson, you will be able to distinguish an equation from an inequality by the symbol which relates two expressions.

An equation is a mathematical statement that uses the equality symbol "=", while an inequality uses the symbols, $>$, $<$, $\geq$, $\leq$ or $\neq$.

Examples:

1. $2 + 7 = 9$ is an equation
2. $9 - 3 = 5$ is a false equation and may be written as $9 - 3 \neq 5$
3. $5 - 2 < 6$ is an inequality
4. $4 + 6 > 5$ is an inequality
5. $x + 5 \geq 7$ is an inequality

Activity 1:

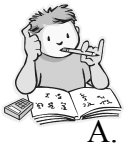
A. Tell whether each statement is an equation or an inequality.

1. $-5 + 7 = 2$
2. $7 + 3 < 15$
3. $25 > 12 + 11$
4. $5 + 7 = 12$
5. $13 - 6 > 4$

B. Write the symbol $=$, $>$, or $<$ in a $\square$ to form a true relation.

1. $8 + 7 \ \square \ 14$
2. $6 + 4 \ \square \ 5$
3. $4 - 3 \ \square \ 7$

4. 12 + 4 ☐ 22
5. 25 – 17 ☐ 12



Test 1:

A. Tell whether each statement is an equation or an inequality.

1. –6 < -5
2. 14 + 2 = 16
3. 9 + 7 > 13
4. –3 + 7 < 6
5. –7 + 3 = - 4

B. Write the symbol =,>,or < in a ☐ to form a true relation.

1. –11 –3 ☐ -14

2. –7 + 4 ☐ 3

3. 15 – 20 ☐ - 5

4. 18 – 12 ☐ 6

5. –26 + 16 ☐ 12

Instructions:

- After answering the test, check your answer with those on the answer key.
- If your score is 3 or higher, you may proceed to the next topic; otherwise, read the lesson once more and do the Test again.

First Degree Equations in one Variable

First degree equations in one variable is an equation that can be written in the form $ax + b = c$, where a and b are constants and $a \neq 0$. Remember the letter x represents a variable of degree 1.

Examples:

1. $2x + 4 = 9$ is a first degree equation in one variable. The variable is x and the exponent is 1.

2. $5y + 7 = 6y + 5$ is a first degree equation in one variable, the variable is y and the exponent is 1.

3. $5x – 7y = 0$ is a first degree equation in two variables because there are two variables, x and y with both variables of degree 1.

4. $x^2 + 5x + 6 = 0$ is not a first degree equation in one variable because the highest exponent of x is 2.

Activity 2:

A. Which of the following is a first degree equation in one variable?

1. $4a + 3b = 8$
2. $5x – y = 0$
3. $\frac{1}{2}x + 4 = 12$
4. $6x + 8 = -2$
5. $3x + 6 = 0$

Test 2:

A. Which of the following is a first degree equation in one variable?

1. $–5x + 3 = 8$
2. $\frac{x+5}{2} = 6$
3. $\frac{3}{x+6} = 16$
4. $x(x - 6) = -7$
5. $a^2 + 5a + 8 = 0$

Instructions:

- After answering the test, check your answer with those on the answer key.
- If your score is 3 or higher, you may proceed to the next topic; otherwise, read the lesson once more and do the Test again.

First Degree Inequalities in one Variable

It would be easy for you to recognize a first-degree inequality. It is similar to a first degree equation in one variable that has a degree of one and uses one variable and any of the symbols >, <, and ≥, instead of the equal (=) sign.

Examples:

1. $3x - 5 > 4$ is a first degree inequality in one variable. The variable is x and the exponent of the variable is 1. The inequality symbol ">" is read as "is greater than".
2. $5x + 4 < \frac{2}{3}x + 6$ is a first degree inequality in one variable. The inequality symbol "< " is read as "is less than."
3. $3a - 2b \geq 12$ is a first degree inequality but in two variables since there are two variables (*a* and *b*) involved. The inequality symbol "≥" is read as "is greater than or equal to".
4. $a^2 - 4b \leq 5$ is a first degree inequality but in two variables because the exponent of the variable is 2. The inequality symbol "≤" is read as "is less than or equal to".
5. $\frac{1}{x} + 7 > 8$ is not a first degree inequality since the variable x is in the denominator the exponent is –1.

Activity 3:

A. Identify the first-degree inequalities in one variable.

1. $a + 3 = -4$
2. $x - 5 - 4 > 8$
3. $- a - 7 = 0$
4. $x^2 - 6 \geq 0$
5. $3n - 2 < 0$

Test 3:

A. Identify the first-degree inequalities in one variable.

1. $x + 7 = 10$
2. $x - 3 \geq -9$
3. $x^4 - 5 = 1$
4. $a + 3x > -4$
5. $9 - b < 6$

Instructions:

- After answering the test, check your answer with those on the answer key.
- If your score is 3 or higher, you may proceed to the next topic; otherwise, read the lesson once more and do the Test again.

Translation of Verbal Statements to Equations and Vice -Versa

Translating verbal statements into mathematical symbols is an essential skill for you to develop in solving word problems. In section you will learn how to identify the key words that would indicate

the operation to be used in forming equations and inequalities in one variable.

A single operation in an algebraic expression can be interpreted in several ways. For examples,

The worded expressions:
x plus 5
the sum of x and 5
x increased by 5
5 more than x
can be translated into a single algebraic expression $x + 5$.

Variables are used to represent numbers that are unknown.

Examples:

Consider the following verbal phrases: and their corresponding algebraic expressions where x = the number.

1. Three times a number
   $3x$
2. A number decreased by 5
   $x - 5$
3. Two times the sum of x and 4
   $2(x + 4)$
4. Six less than twice a number
   $2x - 6$
5. The quotient of a number and 4
   $\frac{x}{4}$

The word expressions such as" x plus 2" can be meaningful by transforming the expressions into a statement such as:

x plus 3 equals 8
or x plus 3 is 8

Using algebraic symbols, this is translated as $x + 3 = 8$.

You will notice that in the two statements the word "is" was used in place of "equals." With the inclusion of "*is"*, the statement gives rise to an equation.

With this knowledge you will be able to translate verbal statements into equations.

Examples: Below are a few verbal statements and their translations.

1. The difference of 15 and n is 10.

   $15 - n = 10$

2. Thrice p is 21.

   $3p = 21$

3. Twice the sum of x and 4 is 20.

   $2(x + 4) = 20$

4. The quotient of $3x - 9$ and 10 is 30.

   $\frac{3x - 9}{10} = 30$

5. Three more than a number is 12.

   $n + 3 = 12$

6. Eight less than the product of p and 4 is 20.

   $4p - 8 = 20$

7. The sum of three consecutive integers is 15.

   $n + (n + 1) + (n + 2) = 15$

   where, n is the 1st integer
   n + 1 is the 2nd integer
   n + 2 is the 3rd integer

8. The sum of three consecutive odd integers is -12.

   $n + (n + 2) + (n + 4) = -12$

where, n is the 1st odd integer
n +2 is the 2nd odd integer
n + 4 is the 3rd odd integer

9. The sum of four even consecutive integers is -300.

$n + (n + 2) + (n + 4) + (n + 6) = -300$

where, n is the 1st even integer
n + 2 is the 2nd even integer
n + 4 is the 3rd even integer
n + 6 is the 4th even integer

Consider 85 which is a two – digit number. Note that 8 is the tens digit and 5 is the units digit. Hence, an expanded form:
85 = 80 +5
= 8(10) + 5(1)

10. The sum of the digits of two digit number is 6.
If we let x = unit digit
6- x = tens digit
Thus, x + (6 – x) = sum

Translation of Verbal Statements to Inequalities and Vice -Versa

Any of the relation symbols such as >, <, ≥, or ≤ may be used to replace in statements indicating inequality. However, the presence of the verb "is" should be noted. The inequality symbol

> means "is greater than"
< means "is less than"
≥ means "is greater than or equal to"
≤ means "is less than or equal to"

With this knowledge you will be able to translate verbal statements into equations or inequalities.

Examples: Below are verbal statements and their translations.

1. The sum of a number n and 4 is greater than 6.

$n + 4 > 6$

2. Two more than n is less than 6 minus n.

$n + 2 < 6 - n$

Activity 4:

A. Translate the following word phrases into algebraic symbols.

1. The sum of a number n and 5
2. Three more than p
3. Subtract 5 from y
4. The product of y and –3
5. Thrice x

B. Translate the equations into verbal statements.

1. $\frac{x}{5} = 8$
2. $y - 9 = 2$
3. $2x + 4 = 10$
4. $x + 7 = 12$
5. $7x = 28$

Test 4:

A. Translate each verbal statement into an equation or inequality. Let x = the number in each case..

1. A number divided by 5 is $\frac{2}{5}$.
2. A number decreased by 6 is –9.
3. Eight times a number is 56.
4. The product of x and 7 is 84.
5. Twelve is equal to eight plus four.

B. Translate the equations and inequalities into verbal statements.

1. $x + 18 = 54$
2. $2n - 10 \geq 16$

3. $\frac{3p}{5} = 21$

4. $\frac{12+t}{3} \leq 8$

5. $3q = 78$

Instructions:

- After answering the test, check your answer with those on the answer key.
- If your score is 3 or higher, you may proceed to the next topic; otherwise, read the lesson once more and do the Test again.

Solution Set of Equations and Inequalities

A sentence which contains a variable such as $3x - 5 = 22$, or any formula is also an equation. Such an equation is neither true or false until you choose numbers to replace the variables. Equations that contain variables are *open sentences*.

When you find all the values for the variable that make a sentence true, you have found the solution set.

For example, when $x = 9$, $3x - 5 = 22$ is a true sentence. Thus, the solution of $3x - 5 = 22$ is 9 and the solution set is $\{9\}$.

Solution of an equation or inequality is a value of a variable that converts an open sentence into a true statement, where a solution set of an equation and inequalities is a set of numbers that makes the statement true. This can be represented on a horizontal number line, taken from a replacement set and solved by inspection or by using the properties of equality.

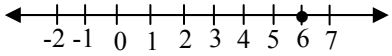
Using a number line.

Equations and inequalities in one variable can be graphed or represented on a number line. The graph of an open sentence is the solution set of the open sentence in the number line. The solution set makes use of a pair of braces { }.

Examples:

1. Graph $x + 5 = 11$

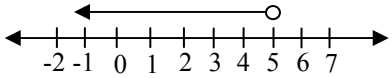
$x = 6$



Notice that the graph of the solution set of $x + 5 = 11$ is the point which corresponds to the real number 6 on the horizontal number line or $\{6\}$.

2. Graph $3x < 15$

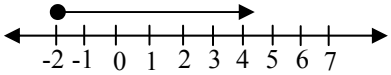
$x < 5$



The graph of the solution set is a ray whose endpoint is hollow which means 5 is not included in the solution. The solution set of the inequality consists of real numbers less than 5, or $\{x / x < 5\}$ which is read as " set of all number x such that x is less than 5."

3. Graph $x - 5 \geq -7$

$x \geq -2$



The graph is a ray whose endpoint is shaded which means -2 is one of the solution. The solution set of the inequality consists of real numbers greater than – 2. In symbols $\{x/x \geq -2\}$ which is read as " the set of all numbers x such that x is greater than and equal to -2..

The Replacement set

Equations and inequalities containing variables are called *open sentences*. An open sentence is a pattern for the different statements, you obtain by replacing the variable by numbers in the replacement set of the variable. Some of these statements may be true. Some may be false.

The statements $x + 4 = 6$ and $x < -5$ are open sentences. The variable in an open sentence must be replaced by a number from a given set of numbers. Verification can be done to see if the replacement makes the equation or inequality a true statement.

Examples:

Find the replacement from
A = {-6, -2, 2, 6} that would give a true statement for:

a. $x + 4 = 6$
b. $x < -5$

Solution:

a) $x + 4 = 6$

Replace x with –6, $-6 + 4 \stackrel{?}{=} 6$ False

Replace x with –2, $-2 + 4 \stackrel{?}{=} 6$ False

Replace x with 2, $2 + 4 \stackrel{?}{=} 6$ True

Replace x with 6, $6 + 4 \stackrel{?}{=} 6$ False

The correct replacement for x is 2
Thus, the solution of $x + 6 = 6$ is 2 and the solution set is { 2 }.

b) $x < -5$
Solution:

Replace x with -6, $-6 < -5$ True
Replace x with -2, $-2 < -5$ False
Replace x with 2, $2 < -5$ False
Replace x with 6, $6 < -5$ False

The correct replacement for x is – 6.
Thus, the solution of $x < -5$ is -6 and the solution set is { -6 }.

Set A is called the replacement set and the replacements which make the open sentence true are the solutions or solution set.

By Inspection

A question such as "what number multiplied by 3 will result 36?" will automatically give you an answer of 12. The solution of an equation or inequality by inspection is similar to an on-the-spot questioning where you can do mental computation or guessing.

Examples:

1. $5 + x = 9$

What number added to 5 will give a sum of 9?

The answer is 4.

2. $4x – 6 = 18$

What number multiplied by 4 and decreased by 6 equals 18?

The answer is 6.

3. $x < 5$

What numbers are less than 5?

Answer: {4, 3, 2, 1, 0…}

4. $5x + 2 > 17$

What number multiplied by 5 and added to 2 is greater than 17?

The answer is {4, 5, 6…}

Activity 5:

A. Represent the solution in the number line.

1. $2x = 6$
2. $\frac{1}{3}x = 2$
3. $x + 3 = 5$
4. $x + 7 > 10$
5. $x - 1 < 4$

B. Find the solution set from the given replacement set {1, 2, 3, 4, 5}

1. $x - 1 = 3$
2. $x - 5 = 0$
3. $3x + 2 = 5$
4. $2x + 5 > 13$
5. $4x - 6 < 10$

C. Find the solution of the following equations by inspection.

1. $3x - 6 = 3$
2. $\frac{x}{3} = 6$
3. $x + 8 = 15$
4. $x + 5 < 9$
5. $3x > 12$

Test 5:

A. Represent the solution in the number line

1. $\frac{1}{2}x = 4$
2. $2x = 6$
3. $x + 7 > 10$
4. $\frac{1}{3}x < 3$
5. $x + 5 > 6$

B. Find the solution set from the given replacement set {1, 2, 3, 4, 5}

1. $x - 1 = 3$
2. $2x - 4 = 2$
3. $x + 2 > 3$
4. $2x + 4 = 12$
5. $8x - 9 > 20$

C. Find the solution of the following equations by inspection.

1. $x - 4 = 2$
2. $2x = 10$
3. $x + 5 < 9$
4. $3x > 12$
5. $2x - 3 < 7$

Instructions:

- After answering the test, check your answer with those on the answer key.
- If your score is 3 or higher, you may proceed to the next topic; otherwise, read the lesson once more and do the Test again.

Properties of Equality

The following properties are necessary for you to find the solution of an equation.

A. Reflexive Property of Equality

The number 3 = 3 tells us that a number is equal to itself.

Thus, *for each real number a,*
$a = a$

B. Symmetric Property of Equality

The statements,

12 + 5 = 17 or 17 = 12 + 5

$7 \cdot 2 = 14$ or $14 = 7 \cdot 2$

have the same values even if they are not expressed in either way.

Thus, *for all real numbers a and b, if a = b, then b = a.*

C. Transitive Property of Equality

The sum or product of two real numbers can be equal to the sum and product of two other real numbers.

If $4 + 6 = 10$ and $10 = 3 + 7$, then
$4 + 6 = 3 + 7$.

If $4 \cdot 3 = 12$ and $12 = 6 \cdot 2$, then
$4 \cdot 3 = 6 \cdot 2$

Thus, *for all real numbers a, b, and c, if a = b and b = c, then a = c.*

D. Substitution Property of Equality

If x is a number in $x + 3 = 7$, and $x = 4$, then $4 + 3 = 7$.

For all real numbers a and b, if a = b, then a may be replaced by b.

E. Addition Property of Equality (APE)

Adding the same number to an equation will give an equivalent equation.

Example:

Given the equation $4 + 1 = 5$

$4 + 1 = 5$	Given
$4 + 1 + (-1) = 5 + (-1)$	Add –1 to
$4 = 4$	both sides of the equation.

The result is an equation that is equivalent to the original equation.

Thus, *for all real numbers a, b, and c, if a = b, then a + c = b + c.*

F. Multiplication Property of Equality (MPE)

Multiplying the same number to an equation will give an equivalent equation.

Example: Given the equation $8 \cdot 2 = 16$

$8 \cdot 2 = 16$	Given
$(8 \cdot 2) \cdot 4 = 16 \cdot 4$	Multiply 4 to
$64 = 64$	both sides of the equation.

The result is an equation that is equivalent to the original equation.

Thus, *for all real numbers a, b and c, if a = b, then ac = bc.*

Activity 6:

A. Tell the property illustrated by the following statements:

1. If $8 \cdot 3 = 24$ and $24 = 12 \cdot 2$.
   then $8 \cdot 3 = 12 \cdot 2$

2. $-6 = -6$

3. If $a + 6 = 10$, then $a = 4$

4. If $10 + 5 = 15$, then
   $15 = 10 + 5$.

5. If $6 + 8 = 14$ and $14 = 10 + 4$,
   then $8 + 6 = 10 + 4$

B. Complete the statements below using the properties of equality.

1. –10 = ____ Reflexive Property

2. If 6 + 7 = 13,
   then 3 = ____ Symmetric Property

3. (12 · 3) · 2
   = 36 · ____ Multiplication Property

4. 5 + 4 = 9 and 9 = 7 + 2, then
   5 + 4 = ____ Transitive Property

5. 3 + 9 + (-9)
   = 12 + ____ Addition Property

Test 6:

A. Name the property illustrated in the following statements:

1. (3 · 5) 2 = 15 · 2
2. 7 = 5 + 2, then 5 + 2 = 7
3. (6 + 2) + (-2) = 8 + (-2)
4. 7 = 7
5. If 8 · 5 = 40, then 40 = 8 · 5

B. Complete the statements below by using the indicated property of equality.

1. 3x = 15, then
   $\frac{1}{3}(3)x =$ _____ Multiplication Property

2. If 2· 5 = 10, then
   10 = _____ Symmetric Property

3. If x + 10 = 15,
   then x = ___ Substitution

4. If 15 + 1 = 16 and
   16 = 10 + 6, then ____ Transitive Property

5. 4 + 3 = 7 and 7 = 10 – 3, then
   4 + 3 = _____ Transitive Property

Instructions:

- After answering the test, check your answer with those on the answer key.
- If your score is 3 or higher, you may proceed to the next topic; otherwise, read the lesson once more and do the Test again.

Finding the Solution Sets of First Degree Equations in One Variable

When you solve equations, find a particular value for the variable that would make both sides of the equations equal. This value of the variable is referred to as the solution of the equation. The set of solutions for a given equation is called the solution set. A first degree equation in one variable has only one solution.

The properties of equality will be applied in the process of finding the solution of first degree equations.

To find the solution of equation, consider the following examples.

Examples:

Find the solution set of the equations:

1. x + 7 = 15
   x + 7 + (-7) = 15 + (-7) APE
   x + 0 = 8 Additive inverse property (AIP)
   x = 8 Identity property of addition (IPA)

   The solution set of the equation x + 7 = 15 is {8}

2. y – 9 = -2
   y – 9 + 9 = -2 + 9 APE

$y + 0 = 7$ AIP

$y = 7$ IPA

The solution set of the equation $y - 9 = -2$ is $\{7\}$.

3. $2x = 42$

$\frac{1}{2}(2x) = \frac{1}{2}(42)$

$\frac{2x}{2} = \frac{42}{2}$

$x = 21$ MPE

The solution set of the equation $2x = 42$ is $\{21\}$.

4. $\frac{x}{3} = 12$

$3(\frac{x}{3}) = 12(3)$

$x = 36$ MPE

The solution set of the equation $\frac{x}{3} = 12$ is $\{36\}$.

5. $5y - 4 = 21$

$5y - 4 + 4 = 21 + 4$

$5y = 25$ APE

$\frac{1}{5}(5y) = \frac{1}{5}(25)$

$y = 5$ MPE

The solution set of the equation $5y - 4 = 21$ is $\{5\}$

6. $2x + 9 = 3 - 4x$

$2x + 9 - 9 = 3 - 4x - 9$

$2x = -4x - 6$ APE

$2x + 4x = -4x - 6 + 4x$

$6x = -6$ APE

$\frac{1}{6}(6x) = \frac{1}{6}(-6)$

$x = -1$ MPE

The solution set of the equation $2x + 9 = 3 - 4x$ is $\{-1\}$

7. $8(3 - 2x) = 56$

$24 - 16x = 56$ Distributive Property

$24 - 24 - 16x = 56 - 24$

$-16x = 32$ APE

$-\frac{1}{16}(-16)x = -\frac{1}{16}(32)$

$x = -2$ MPE

The solution set of the equation $8(3 - 2x) = 56$ is $\{-2\}$

Activity 7:

A. Find the solution sets of the following equations.

1. $a + 3 = 19$
2. $x - 4 = 10$
3. $-20 = b - 28$
4. $x + 1 = 12$
5. $y + 15 = 28$

B. Solve for the value of x.

1. $3x + 7 = 22$
2. $\frac{1}{2}x + 16 = 4$
3. $4x - 13 = 11$
4. $5x + 30 = 40$
5. $\frac{2}{3}x - 12 = -18$

C. Find the solution set of each equation below. State the properties used in each step.

1. $3(13y - 2) = 72$
2. $5x + 7 = 22 + 2x$
3. $7x - 5 = 3x + 4$
4. $5(x+1) + 1 = 1 - (x + 1)$
5. $3(5x + 4) = 12 + 3x$

Test 7:

A. Find the solution set of the following equations.

1. $6x = 42$
2. $\frac{1}{6}y = 3$
3. $\frac{4}{5}x = 16$
4. $2p = 16$
5. $\frac{2}{3}q = 8$

B. Find the solution set of the following: State the properties used in each step.

1. $4y + 5 = 37 - 4y$
2. $5x = 2(30 - x) + 10$
3. $2(2y + 5) = 3(5-3y) + 8$
4. $\frac{2}{3}x = 20 + \frac{x}{2}$
5. $3x - 1 = x + 5$

Instructions:

- After answering the test, check your answer with those on the answer key.
- If your score is 3 or higher, you may proceed to the next topic; otherwise, read the lesson once more and do the Test again.

Finding the Solution Set of First Degree Inequalities in One Variable

The solution set of first degree inequalities in one variable can be found by using similar procedure as in solving equations. Unlike in first degree equations in one variable, a first degree inequality may have more than one solution.

The different properties of inequality that will be used in the process are as follows.

1. Trichotomy property

For any number x and y exactly one of the following is true:

$x < y$, $x = y$, or $y < x$

2. Transitive Property

For any number x and y
If $x < y$ and $y < z$, then $x < z$

3. Addition Property of Inequality (API)

For any number *a, b* and *c*

a) *if $a > b$, then $a + c > b + c$;*
b) if $a < b$, then $a + c < b + c$.

4. Multiplication Property of Inequality (MPI)

For any real numbers *a, b* and *c*
a) if $c > 0$ and $a < b$, then $ac < bc$;
b) if $c > 0$ and $a > b$, then $ac > bc$;
c) if $c < 0$ and $a < b$, then $ac > bc$;
d) if $c < 0$ and $a > b$, then $ac < bc$.

Examples:

Find the solution set of the inequalities

1. $x + 12 > 25$
$x + 12 - 12 > 25 - 12$ API
$x > 13$ AIP

The solution of $x + 12 > 15$ consists of any number greater that 13.

The solution set can be written in the form $\{x/x > 13\}$. This is read as "the set of all numbers x such that x is greater than 13."

Check by substituting numbers that are greater than 13 into the inequality.

2. $-3y > 18$

$$-\frac{1}{3}(-3y) < -\frac{1}{3}(18) \quad \text{MPI}$$

$$y < -6 \quad \text{MIP and MPE}$$

The solution of $-3y > 18$ consists of any number less than -6.

The solution set can be written as $\{y/y < -6\}$. This is read as "the set of all number y such that y is less than $\{-6\}$

By applying multiplication property of inequality states that " if $c < 0$ and $a > b$, then $ac < bc$" was applied in this problem.

This can be checked by assigning values for y that is less than -6.

3. $3x + 5 \geq 12 + 2x$

$3x + 5 - 2x \geq 12 + 2x - 2x$ API

$x + 5 \geq 12$

$x + 5 - 5 \geq 12 - 5$ API

$x \geq 7$

The solution set which is written as $\{x/x \geq 7\}$ is read as "the set of all numbers x such that x is greater than or equal to 7."

Activity 8:

A. Determine the solution set of each of the following inequalities:

1. $x - 3 > 12$
2. $y + 10 \leq -9$
3. $\frac{x}{5} \geq 10$
4. $\frac{3}{4}x < -6$
5. $3(4y + 7) < 21$

Test 8:

A. Determine the solution set of the following inequalities.

1. $x - 15 \leq 19$
2. $9y \leq -27$
3. $\frac{x}{2} > \frac{2}{3}$
4. $12x - 40 \geq 11x - 50$
5. $7y + 8 < 15 + 4y$

Instructions:

- After answering the test, check your answer with those on the answer key.
- If your score is 3 or higher, you may proceed to the next topic; otherwise, read the lesson once more and do the Test again.

Solving Problems Involving First Degree Equations in One Variable

First degree equations and inequalities can be used in solving word problems. Consider the following procedure in solving word problems.

1. Represent the unknown with a variable.
2. Translate the conditions stated in the problem into an equation.
3. Solve the equation.

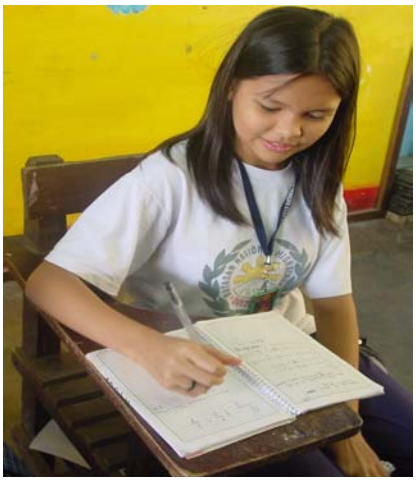
4. Check the solution with the problem and not with the equation.
5. Answer the problem.

Use these steps to solve problems on number relations, motion, age, mixture, work, coins and business.

Examples:

A. Number Relations

1. A number is five more than another number. If the sum of the two numbers is 75, find the numbers.



Representation:

Let x = the 1st number
x + 5 = the 2nd number
x + (x + 5) = the sum of two numbers

Equation:

$$x + (x + 5) = 75$$

Solution:

$$2x + 5 = 75$$
$$2x = 75 - 5$$
$$2x = 70$$
$$x = 35 \text{ one number}$$
$$x + 5 = 35 + 5$$
$$= 40 \text{ the other number}$$

Check: 40 is 5 more than 35

The sum of 40 and 35 is 75. Therefore, the two numbers are 35 and 40.

2. The sum of the digits of a two- digit number is 10. If the number is divided by the units digit, the quotient is 3 and the remainder is 4. Find the number.

Solution:

Let x = the units digit
10 – x = tens digit
x + 10 (10 – x) = the number

$$\frac{100 - 9x}{x} = 3 + \frac{4}{x}$$
$$x\left(\frac{100 - 9x}{x} = 3 + \frac{4}{x}\right)$$

$$100 - 9x = 3x + 4$$
$$-9x - 3x = 4 - 100$$
$$-12x = -96$$
$$x = 8 \text{ the units digit}$$

$$10 - x = 10 - 8 = 2 \text{ the tens digit}$$
$$2(10) + 8 = 28 \text{ the number}$$

Check: The sum of 8 and 2 is 10

$$\frac{28}{8} = 3, \text{ remainder is } 4$$

Therefore, the number is 28.

3. The sum of three consecutive integers is 15. Find the integers?

Solution:

Let x = the 1st integer
x + 1 = 2nd integer
x + 2 = 3rd integer

$$x + (x + 1) + (x + 2 = 15$$
$$3x + 3 = 15$$

$3x = 15 - 3$
$3x = 12$
$x = 4$

Thus, $x = 4$ is the 1^{st} integer
$x + 1 = 4 + 1$
$= 5$ is the 2^{nd} integer
$x + 2 = 4 + 2$
$= 6$ is the 3^{rd} integer
Therefore, $4 + 5 + 6$ are the three integers.

4. Find the three consecutive odd integers whose sum is -12.

Solution:

Let $x = 1^{st}$ odd integer
$x + 2 = 2^{nd}$ odd integer
$x + 4 = 3^{rd}$ odd integer

$x + (x + 2) + (x + 4) = -21$
$3x + 6 = -21$
$3x = -21 - 6$
$3x = -27$
$x = -9$
Thus, $x = -9$ is the 1^{st} odd integer
$x + 2 = -9 + 2$
$= - 7$ is the 2^{nd} odd integer
$x + 4 = -9 + 4$
$= - 5$ is the 3^{rd} odd integer

Therefore, -9 , -7 & -5 are the three Integers.

5. The sum of four even consecutive integers is 300. Find the integers.

Solution:

Let $x = 1^{st}$ even integers
$x + 2 = 2^{nd}$ even integer
$x + 4 = 3^{rd}$ even integer
$x + 6 = 4^{th}$ even integer

$x + (x + 2) + (x + 4) + (x + 6) = 300$
$4x + 12 = 300$
$4x = 300-12$
$4x = 288$
$x = 72$

Thus, $x = 72$ is the 1^{st} even integer

$x + 2 = 72 + 2$
$= 74$ is the 2^{nd} even integer

$x + 4 = 72 + 4$
$= 76$ is the 3^{rd} even integer

$x + 6 = 72 + 6$
$= 78$ is the 4^{th} even integer

Therefore, $72 + 74 + 76 + 78 = 300$

B. Age Problem

To solve age problem, you often have to represent a person's present age, person's age a number of years ago, and the person's age a number of years from now.

	Age now	Age 4 yrs ago	Age 7 yrs. from now
Mae	15	15 – 4, or 11	15 + 7 or 22
Mia	x	x - 4	x + 7

Thus to represent a past age, subtract from the present age. To represent a future age, add to the present age.

Example:

Mrs. Inac is now three times as old as her daughter, Sarah. In 14 years, Mrs. Inac's age will be twice Sarah's age then. How old is each?

Representation:

	Age now	Age 14 yrs. from now
Sarah	x	x + 14
Mrs. Inac	3x	3x + 14

To write an equation:

Mrs. Inac's age in 14 yrs ↓ will be ↓ twice Sarah's in 14 yrs. ↓

$3x + 14 = 2(x + 14)$

Solution:

$$3x + 14 = 2(x + 14)$$
$$3x + 14 = 2x + 18$$
$$(-2x) + 3x + 14 = (-2x) + 2x + 18$$
$$x + 14 = 18$$
$$x + 14 + (-14) = 18 + (-14)$$
$$x = 14$$
$$3x = 42$$

Check:

Does $42 = 3(14)$? Yes

$42 + 14 = 2(14 + 14)$ Yes

Therefore, Sarah is now 14yrs old and Mrs. Inac is 42 yrs. old.

C. Mixture

To save on budget, a housewife mixed first class rice which she bought for ₱30.00 per kilo with third class rice which sells for ₱20.00 per kilo. How many kilos of third class rice must she add to 8 kilos of first class rice to produce a mixture that would cost to ₱22.00 per kilo?

Solution:

₱20	+	₱30	=	₱22
x		8		x + 8

$$20x + 30(8) = 22(x + 8)$$
$$20x + 240 = 22x + 176$$
$$240 - 176 = 22x - 20x$$
$$64 = 2x$$
$$32 = x$$

Therefore, 32 kg of third class rice must be added to 8 kg of first class rice.

D. Motion

Two buses start from the same place at the same time and go in opposite directions, one traveling 12 km/hr faster than the other. Find the rate of each if they are 324 km apart at the end of 3 hrs.

Since the two buses are 324 km apart in 3 hrs, then the rate can be solved using the distance formula d = rt, where

d = distance
r = rate
t = time

Distance traveled by one bus + distance traveled by the other bus = 324 km.

(Rate · time) + (Rate · time) = 324
Bus_1 + Bus_2

Let x = rate of the one bus
x + 12 = rate of the other bus

$3x + 3(x + 12) = 324$
$6x + 36 = 324$
$6x = 288$
$x = 48$ km/hr rate of one bus

$x + 12 = 48 + 12$
$= 60$ km/hr rate of the other bus

Check:

The distance traveled by the two buses must be 324 km.

Distance (D) of two buses from each other

= (48km/hr)(3hrs) + (60 km/hrs)(3hrs)

D = 144 km + 180 km
D = 324 km

Therefore, the rates of the buses are 48km/hr and 60/hr.

E. Work

If Edgar can finish a piece of work in 12 hrs. His brother Tony can do the same job in 15 hrs., how long will it take both of them to complete the work?

Let x = number of hrs. to complete the work

$\frac{x}{12}$ = the part of work Edgar can finish in 1 hour.

$\frac{x}{15}$ = the part of work Tony can finish in 1 hour.

The work that can be finished by both in 1 hour is given by the equation.

$$\frac{x}{12} + \frac{x}{15} = 1$$

$$\frac{4x + 5x}{60} = 1$$

$$9x = 60$$

$$x = \frac{60}{9}$$

$$x = 6\frac{2}{3}$$

The brothers can finish the job in $6\frac{2}{3}$ hrs.

F. Coins

A mini store has 190 coins in a cash register consisting of P5 and 25¢ coins. If all of these coins amounted to ₱285.00, how much of each kind did the cash register has?

Let x = number of ₱5 coins
190 – x = number of 25¢ coins

The total amount:

$$5x + .25(190 - x) = 285$$
$$5x + 47.5 - .25x = 285$$
$$4.75x = 237.5$$
$$x = 50$$

Check: x = 50 the number of P5 coins

190 – x = 140 the number of 25 ¢ coins

$$5(50) + .25(140) = 285$$

Therefore, the number of ₱5 coins is 50 and the number of.25¢ coins is 140.

G. Business

Mrs. Ycoy invested ₱500,000 of her savings at 16% per annum. She found another investment opportunity at 20% per annum where she invested the rest of her savings. If she realized a total yearly income of 19% on her two investments, how much did she invest at 20%? How much was her savings?

Let x = Mrs. Ycoy's savings
500,000 = investment at 16%
x – 500,000 = investment at 20%

$$.16(500{,}000) + .2(x - 500{,}000) = .19x$$
$$80{,}000 + .2x - 100{,}000 = .19x$$
$$.2x - .19x = 20000$$
$$x = 2{,}000{,}000$$

Mrs. Ycoy's savings is ₱2,000,000

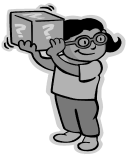
x – 500,000 = 1,500,000 the investment at 20 %

Check:

.16(500,000)+.2(x – 500,000) =.19% income from two investments.

380,000 = .19(2,000,000)

Therefore, the amount of Mrs. Ycoy's saving is ₱2,000,000 and her investment at 20% is P1,500,000.



Activity 9:

A. Solve the following problems.

1. The sum of the digits of a two-digit number is 12. If the number is divided by the unit digit, the quotient is eight and the remainder is 1. Find the number.

2. Mr. Fernando is four times as old as his son. In 10 yrs, he will be 2 yrs more than twice the age of his son. Find their present ages.

3. Wendell's scores on four tests in Algebra were 87, 92, 88, and 86. What score does Wendell need to get the next

test in order to have an average score greater than 90?

4. To save on budget, Mang Tommy the baker mixed sugar which he bought for ₱20.50 per kilogram with third class sugar which sells P16.00 per kilogram. How many kilogram of third class must he add to 10 kilograms of first class sugar to produce a mixture that would cost to P18.50 per kilogram?

5. Two tricycle start from the same place at the same time and go in opposite directions, one traveling 10 km/hr faster than the other. Find the rate of each if they are 480 km apart at the end of 4 hours.

Test 9:

Solve the following problems

1. Find all sets of 3 consecutive positive odd integers such that the sum of the integers in the set is greater than 4 times the least integer in the set. (Ex.of consecutive odd nos. 1 ,3,5,7…)

.

2. Aling Rona and Mang Ryan who were engaged in vending vegetables earned ₱520.00. Aling Rona earned 3 times as much as Mang Ryan. How much did each earn?

3 Mari wants to fence a garden plot using a 44 m wire. If the length of the lot is 2m more than the width, find the dimensions of the garden plot.

4. Jake can paint the wall of the room in 4 hrs., while Jun can do the job in 5 hrs.. How many days will they finish the job if they work together?

5.. Dante is 2 years older than his brother Dino and the sum of their ages is less than 16. Find their possible ages.

Instructions:

- After answering the test, check your answer with those on the answer key.
- If your score is 3 or higher, you may proceed to the next topic; otherwise, read the lesson once more and do the Test again.

Solving Problems Involving Inequalities in One Variable

In this lesson, you will find that there are some problems which would not result in only one answer. The solution of problems involving linear inequalities sometimes give several answers.

Examples:

1. Gina is 7 years older than Anna, and the sum of their ages is less than 23. Calculate their possible ages.

Let x = age of Anna
x + 7 = age of Gina

$x + x + 7 < 23$
$2x < 23 - 7$
$2x < 16$
$x < 8$ age of Anna

Since the age of Anna is less than 8 yrs, then their possible ages are:

{7,14}, {6, 13}, {5, 12} … {1, 8}

2. Find all possible integers such that 4 less than 3 times a given integer is greater than 64. Which is the least integer?

Let x = the least integer

$3x - 4 > 65$
$3x > 65 + 4$
$3x > 69$
$x > 23$

The least integer is 24 and all the positive integers are 25, 26….

Summary:

* An equation is a mathematical statement that uses the equality symbol "=", while an inequality uses the symbols >, <, ≥, ≤ or ≠.

* A first degree equation in one variable is an equation that can be written in the

form $ax + b = 0$, where a and b are constants and $a \neq 0$. The letter x is the variable and its exponent is 1.

* The solution set of the equations and inequalities in one variable can be represented on a horizontal number line, taken from a replacement set and solved by inspection or by using properties of equalities. The solution set makes use of a pair of braces {}.

* Properties of Equality

a. Reflexive Property of Equality

For each real number a, a = a.

b. Transitive Property of Equality

For all real numbers a, b and c
if a = b and b = c, then a = c.

c. Symmetric Property of Equality

For all real number a and b, if a = b, then b = a.

d. Substitution Property of Equality

For all real number a, and b, if a = b, then a may be replaced by b.

e. Addition Property of Equality

For real numbers a, b and c, if a = b, then a + c = b + c.

f. Multiplication Property of Equality

For all real numbers a, b and c, if a = b, then ac = bc.

* Properties of Inequality

1. Addition Property of Inequality

For any numbers a, b, and c,

a. if $a > b$, then $a + c > b + c$
b. if $a < b$, then $a + c < b + c$

2. Multiplication Property of Inequality

For any number a, b, and c,

a. if $c > 0$ and $a < b$, then $ac < bc$
b. if $c > 0$ and $a > b$, then $ac > bc$
c. if $c < 0$ and $a < b$, then $ac > bc$
d. if $c < 0$ and $a > b$, then $ac < bc$

* Procedure in Solving Problems

a. Represent the unknown with a variable.
b. Write an Equation.
c. Solve the Equation.
d. Check the solution with the problem and not with the Equation.
e. Answer the problem

CHAPTER TEST

A. Answer the following:

1. Which of the following is a first degree equation?

a. $x^2 - 3 = 1$ c. $x - 6 < 8$
b. $x + 4 = 7$ d. $x - 3$

2. Which of the following is a first degree inequality?

a. $2x - 3 < 9$ c. $x^2 + 6 = 15$
b. $x - 5 = 4$ d. $6x^2 - 3$

3. What expression represents the phrase "two less than four times a number n"?

a. $2 - 4n$ c. $2n - 4$
b. $4 - 2n$ d. $4n - 2$

4 What represents the statement

"Twice the sum of *a* and 4 is 20?"

a. $2(a + 4) = 20$ c. $a + 4 = 20$
b. $2a + 4 = 20$ d. $2a(4) = 20$

5. Write the correct symbol to form a true relation of $12 - 3 \square 5 - 4$.

a. $>$ c. $<$
b. $\geq$ d. $\leq$

6.What is x in the equation $3x = 15$?

a.. 5 c. 11
b. -5 d. 4

B. Tell the properties used in each of the following .

7. If $2 + 4 = 6$, then $6 = 2 + 4$.
8. $3(\frac{1}{3}) = 1$
9. $(4 + 2) + (-2) = 6 + (-2)$

10. If $8 \cdot 3 = 24$ and $24 = 12 \cdot 2$, then $8 \cdot 3 = 12 \cdot 2$.

C. Find the solution set of the following:

1. $x + 8 = -3$
2. $3x - 6 = 12$
3. $\frac{x}{4} = 5$
4. $\frac{x}{2} + 7 = 10$
5. $5(x - 2) = 3x + 12$
6. $x - 3 > 10$
7. $2x + 7 < 13$
8. $\frac{x}{5} > 3$
9. $\frac{x}{3} - 6 < 4$
10. $4x - 6 < 7x - 12$

D. Solve the problems:

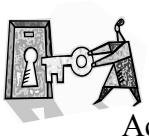
1. A number is 7 more than the 3 times another number. If the sum of the two numbers is 23, find the numbers.

2. In a math class there are three tests. A student must get a total score of 270 for a grade of A. If a student got 91 and 86 in the first two tests what score must bon last test to get a grade of A?

3. Margie is 3 times older then Lilet. In 15 years, the sum of their ages is 38 years. Find their present ages.

4. Two men jog in opposite directions starting from the same place at the same time. The average rate of the westbound men A is 2 km/h more than the rate of the eastbound men B. If they are 15 km apart after 1.5 h, what is the rate of each men?

5.The Parents Teachers Association of St. Andrew's School held a benefit show. If the number of P200.00 tickets is 5 less than twice the number of P150.00 tickets, find the number of tickets sold at each price if the total sales is P20,000.00.



Answer key

Activity 1

A Tell whether each statement is an equation or inequality

1. –5 + 7 = 2 is an equation
2. 7 + 3 < 15 is an inequality
3. 25 > 12 + 11 is an inequality
4. 5 + 7 = 12 is an equation
5. 13 – 6 > 4 is an inequality

B. Write the correct relation symbol for each

1. >
2. >
3. <
4. <
5. <

Test 1:

A. Tell whether each statement is an equation or an inequality

1. -6 < -5 is an inequality
2. 14 + 2 = 16 is an equation
3. 9 + 7 > 13 is an inequality
4. –3 + 7 < 6 is an inequality
5. –7 + 3 = - 4 is an equation

B. Write the correct relation symbol for each

1. =
2. <
3. =
4. =
5. <

Activity 2

A. Which of the following is a first degree equation in one variable

1. not a 1st degree equation in one variable
2. not a 1st degree equation in one variable
3. 1st degree equation in one variable
4. 1st degree equation in one variable
5. 1st degree equation in one variable

Test 2

A. Which of the following is a 1st degree equation in one variable?

1. a 1st degree equation in one variable
2. a 1st degree equation in one variable
3. not 1st degree equation in one variable
4. not 1st degree equation in one variable
5. not 1st degree equation in one variable

Activity 3:

A. Identify which of the following are 1st degree inequalities in one variable.

1. not 1st degree inequalities in one variable
2. a 1st degree inequalities in one variable
3. not 1st degree inequalities in one variable
4. not 1st degree inequalities in one variable
5. a 1st degree inequalities in one variable

Test 3:

A. Identify which of the following are 1st degree inequalities in one variable

1. not 1st degree inequalities
2. a 1st degree inequalities
3. not 1st degree inequalities
4. not 1st degree inequalities
5. a 1st degree inequalities

Activity 4:

A. Translate the following word phrases into algebraic symbols

1. n + 5
2. p + 3
3. y – 5

4. –3y
5. 3x

B. Translate the equations and inequalities into verbal statements.

1. A number divided 5 is 8
2. The difference of y and 9 is 2
3. Four more than the product of x and 2 is 10
4. The sum of x and 7 is 12
5. The product of 7 and x is 28

Test 4:

A. Translate the verbal statements into equation or inequalities

1. $\frac{n}{5} = \frac{2}{5}$
2. n – 6 = -9
3. 8n = 56
4. 7x = 84
5. 12 = 8 + 4

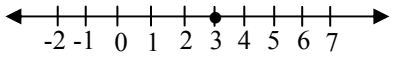
B. Translate the equation and inequalities into verbal statement.

1. Eighteen more than some number x is 54.
   Eighteen added to x is 54.
   The sum of x and eighteen equals 54.
2. Ten less than twice a number is greater than or equal to 16.
   Twice the number minus 10 is greater than or equal to 16.
   The difference of twice a number and 10 is greater than or equal to 16.
3. The quotient of 3 times an unknown number, p, and 5 is 21.
   The quotient of three times p and 5 is 21.
4. Eight is greater than or equal to the sum of 12 and t is divided by 3.
   The sum of 12 and t divided by 3 is less than or equal to 8.
5. The product of 3 and q is 78.
   Three times q equals 78.

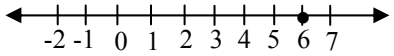
Activity 5

A. Represent the solution in the number line.

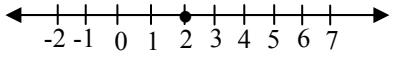
1. 2x = 6



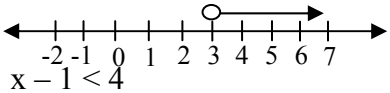
2. $\frac{1}{3}$x = 2



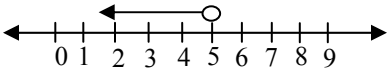
3. x + 3 = 5



4. x + 7 > 10



5. x – 1 < 4



B. Find the solution set from the given replacement set {1,2,3,4,5}

1. x – 1 = 3
   replacement for x is 4

2. x – 5 = 0
   replacement for x is 5

3. 3x + 2 = 5
   replacement for x is 1

4. 2x + 5 > 13
   replacement for x are { 4, 5…}

5. 4x – 6 < 10
   replacement for x are { 3,2,1 …}.

C. Find the solution of the following equation by inspection

1. $3x - 6 = 3$
   $x = 3$

2. $\frac{x}{3} = 6$
   $x = 18$

3. $x + 8 = 15$
   $x = 7$

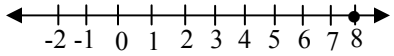
4. $x + 5 < 9$
   $x = \{3,2,1,0\ldots\}$

5. $3x > 12$
   $x = \{5, 6\ldots\}$

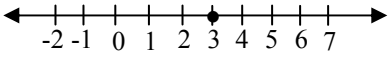
Test 5:

A. Represent the solution in the number line.

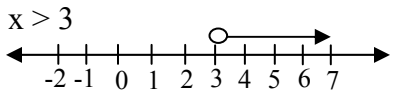
1. $\frac{1}{2}x = 4$
   $x = 8$



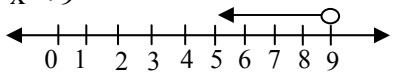
2. $2x = 6$
   $x = 3$



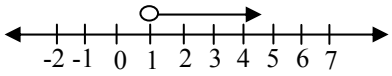
3. $x + 7 > 10$
   $x > 3$



4. $\frac{1}{3}x < 3$
   $x < 9$



5. $x + 5 > 6$
   $x > 1$



B. Find the solution set from the given replacement set {1, 2, 3, 4, 5}

1. $x - 1 = 3$
   replacement for x is 4
2. $2x - 4 = 2$
   replacement for x = 3
3. $x + 2 > 3$
   replacement for x are {2,3,.4,5}
4. $2x + 4 = 12$
   replacement for x is 5.
5. $8x - 4 > 20$
   replacement for x are {4,5 }

C. Find the solution of the following equation by inspection

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

2. $2x = 10$
   $x = 5$

3. $x + 5 < 9$
   $x < 4$

4. $2x > 12$
   $x = \{7,8\ldots\}$

5. $2x - 3 < 7$
   $x = \{4, 3\ldots\}$

Activity 6:

A. Tell the property illustrated by the following statements.

1. Transitive property of equality
2. Reflexive property of equality
3. Substitution property of equality
4. Symmetric property of equality
5. Transitive property of equality

B. Complete the statements below using the properties of equality

1. -10

2. 6 + 7
3. 2
4. 5 + 4 = 7 + 2
5. (–9)

Test 6
A.
1. Multiplication property of equality
2. Symmetric property of equality
3. Addition property of equality
4. Reflexive property of equality
5. Symmetric property

B. Complete the statement below using the properties of equality

1. $15(\frac{1}{3})$
2. $2 \cdot 5$
3. 5
4. 15 + 1 = 10 + 6
5. 10 - 3

Activity 7:

A. Find the solution set of the following:

1. a + 3 = 19
   solution set is {16}

2. x – 4 = 10
   solution set is {14}

3. –20 = b – 28
   solution set is {8}

4. x + 1 = 12
   solution set is {11}

5. y + 15 = 28
   solution set is {13}

B. Solve for the value of x

1. 3x + 7 = 22
   3x + 7 – 7 = 22 – 7
   3x = 15
   x = 5

2. $\frac{1}{2}x + 16 = 4$
   $\frac{1}{2}x + 16 - 16 = 4 - 16$
   $(2)\ \frac{1}{2}x = -12(2)$
   x = -24

3. 4x – 13 = 11
   4x – 13 + 13 = 11 + 13
   4x = 24
   x = 6

4. 5x + 30 = 40
   5x + 30 – 30 = 40 – 30
   5x = 10
   x = 2

5. $\frac{2}{3}x - 12 = -18$
   $\frac{2}{3}x - 12 + 12 = -18 + 12$
   $(3)\ \frac{2}{3}x = -6(3)$
   2 x = -18
   x = - 9

C. Solve the solution set of each equation below. State the properties used in each step. .

1. 3(13y - 2) = 72

39y – 6 = 72	Distributive property
39y – 6 + 6 = 72 + 6	
39y = 78	APE
$\frac{1}{39}(39y) = (78)\ \frac{1}{39}$	MPE
y = 2	

2. 5x + 7 = 22 + 2x

5x + 7 – 7 = 22 +2x – 7	APE
5x = 15 + 2x	

$5x - 2x = 15 + 2x - 2x$ APE
$3x = 15$
$\frac{1}{3}(3x) = (15)\ \frac{1}{3}$ MPE
$x = 5$

3. $7x - 5 = 3x + 4$
$7x - 5 + 5 = 3x + 4 + 5$ APE
$7x = 3x + 9$
$7x - 3x = 3x - 3x + 9$
$4x = 9$
$\frac{1}{4}(4x) = (9)\ \frac{1}{4}$ MPE
$x = \frac{9}{4}$

4. $5(x + 1) + 1 = 1 - (x + 1)$
$5x + 5 + 1 = 1 - x - 1$ DPE
$5x + 6 = -x$
$5x + 6 - 6 = -x - 6$ APE
$5x + x = -6$
$6x = -6$
$\frac{1}{6}(6x) = (-6)\ \frac{1}{6}$ MPE
$x = -1$

5. $3(5x + 4) = 12 + 3x$
$15x + 12 = 12 + 3x$ DPE
$15x + 12 - 12 = 12 + 3x - 12$ APE
$15x = 0 + 3x$
$15x - 3x = 0 + 3x - 3x$ APE
$\frac{1}{12}(12x) = (0)\ \frac{1}{12}$ MPE
$x = 0$

Test 7:

A. Find the solution set of the following Equations

1. $6x = 42$
solution set is {7}

2. $\frac{1}{6}y = 3$
solution set is {18}

3. $\frac{4}{5}x = 16$
solution set is {20}

4. $2p = 16$
solution set is {8}

5. $\frac{2}{3}q = 8$
solution set is {12}

B. Solve the solution set of the following: State the properties involve.

1. $4y + 5 = 37 - 4y$
$4y + 5 - 5 = 37 - 5 - 4y$ APE
$4y = 32 - 4y$
$4y + 4y = 32 - 4y + 4y$ APE
$8y = 32$
$\frac{1}{8}(8y) = (32)\ \frac{1}{8}$ MPE
$y = 4$

2. $5x = 2(30 - x) + 10$
$5x = 60 - 2x + 10$ DPE
$5x + 2x = 60 - 2x + 2x + 10$ APE
$7x = 70$
$\frac{1}{7}(7x) = (70)\ \frac{1}{7}$ MPE
$x = 10$

3. $2(2y + 5) = 3(5 - 3y) + 8$
$4y + 10 = 15 - 9y + 8$ DPE
$4y + 10 - 10 = 15 - 10 - 9y + 8$ APE
$4y = 13 - 9y$
$4y + 9y = 13 - 9y + 9y$ APE
$13y = 13$
$\frac{1}{13}(13y) = (13)\ \frac{1}{13}$ M.E
$y = 1$

4. $\frac{2}{3}x = 20 + \frac{x}{2}$

$\frac{2}{3}x - \frac{x}{2} = 20 + \frac{x}{2} - \frac{x}{2}$ APE

$\frac{4x-3x}{6} = 20$

$6(\frac{x}{6}) = (20)\,6$ MPE

$x = 120$

5. $3x - 1 = x + 5$

$3x - 1 + 1 = x + 5 + 1$ APE

$3x = x + 6$

$3x - x = x - x + 6$ APE

$2x = 6$

$x = 3$

Activity 8:

A. Determine the solution set of the following inequality

1. $x - 3 > 12$

solution set is $\{x/x > 15\}$

2. $y + 10 \leq -9$

solution set is $\{y/y \leq -19\}$

3. $\frac{x}{5} \geq 10$

solution set is $\{x/x \geq 50\}$

4. $\frac{3}{4}x < -6$

solution set is $\{x/x < -8\}$

5. $3(4y + 7) < 21$

solution set is $\{y/y < 0\}$

Test 8 :

1. $x - 15 \leq 19$

solution set $\{x/x \leq 34\}$

2. $9y \leq -27$

solution set $\{y/y \leq -3\}$

3. $\frac{x}{2} > \frac{2}{3}$

solution set $\{x/x > \frac{4}{3}\}$

4. $12x - 40 \geq 11x - 50$

solution set $\{x/x \leq \frac{10}{9}\}$

5. $7y + 8 < 15 + 4y$

solution set $\{y/y < \frac{7}{3}\}$

Activity 9:

Solve the following problems:

1. x = is the unit digit

$12 - x$ = tens digit

$x + 10(12 - x)$ = number

$x + 120 - 10x = 8 + \frac{1}{x}$

$x[\frac{120-9x}{x} = 8 + \frac{1}{x}]$

$120 - 9x = 8x + 1$

$-9x - 8x = -120 + 1$

$-17x = -119$

$x = 7$ unit digit

$12 - x = 12 - 7$

5 = tens digit

$5(10) + 7 = 57$ the no.

Check:

Sum of 7 and 5 is 12

$\frac{57}{7} = 8$ and the remainder is 1

2. let x = the son's age

$4x$ = age of Mr. Fernando

$4x + 10 = 2(x + 10) + 2$

$4x + 10 = 2x + 20 + 2$

$4x - 2x = 22 - 10$

$2x = 12$

$x = 6$ age of the son

4(6) = 24 age of Mr. Fernando

3. Let x = Wendell's score on the next test

$$\frac{87 + 92 + 66 + 86 + x}{5} > 90$$

$$5\left(\frac{87 + 92 + + 88 + 86 + x}{5}\right) > 90(5)$$

$$87 + 92 + 88 + 86 + x > 450$$

$$353 + x > 450$$

$$x > 97$$

Therefore wendell's next score must be greater than 97 as 98, 99 or 100

4.

20.5	16.00	18.50
10	x	x + 10

$$(20.5)10 + 16x = 18.5(x + 10)$$

$$205 + 16x = 18.5x + 185$$

$$205 - 185 = 18.5x - 16x$$

$$20 = 2.5x$$

$$8 = x$$

x = 8 kg of 3rd class sugar must be added to 10 kg of 1st class sugar

5. let x = rate of one tricycle

x + 10 = rate of the other tricycle

d = rt formula for distance

rate · time + rate · time = 480km

$$x(4) + 4(x + 10) = 480$$

$$4x + 4x + 40 = 480$$

$$8x = 480 - 40$$

x = 55km/hr rate one tricycle

$$x + 10 = 55 + 10$$

= 65 km/hr rate of the other tricycle

Test 9:

1. Let x = least integer in the set

x + 2 and x + 4 are the two other integers.

Equation: $x + (x + 2) + (x + 4) > 4x$

$$3x + 6 > 4x$$

$$x > 6$$

set of integers are:

(1,3,5), (3, 5, 7)(5, 7, 9) …

2. 520 – x = amount earned by Mang Ryan

3(520 – x) = amount earned by Aling Rhona

Equation:

$$520 - x + 3(520 - x) = 520$$

$$4x = -1560$$

$$x = 390$$

520 - 390 = 130 amount earned by Mang Ryan

3(130) = 390 amount earned by Aling Rhona

3. Let x = width

x + 2 = length

44 m = Perimeter

$$P = 2l + 2w$$

$$44 = 2(x + 2) + 2(x)$$

$$44 = 2x + 4 + 2x$$

$$40 = 4x$$

10 = x width of the garden plot

x + 2 = 10 + 2 = 12 length of the garden plot

4. let x = number of days to complete the job

$\frac{x}{4}$ = part of job Jake can finish in 1 day

$\frac{x}{5}$ = part of job Jun can finish in 1 day

Equation:

$$\frac{x}{4} + \frac{x}{5} = 1$$

$$20\left(\frac{5x+4x}{20} = 1\right)$$

$$5x + 4x = 20$$

$$9x = 20$$

$$x = 2\frac{2}{9} \text{ days}$$

5. Let x = Dino's age
   x + 2 = Dante's age

Equation:

$$x + x + 2 < 16$$

$$2x < 14$$

$$x < 7$$

since x < 7, Dino's ages can be 6, 5, 4 ..
Dante's age can be : 8, 7, 6 ..

Chapter Test:

A.
1. a
2. a
3. d
4. a
5. c
6. a
7. Symmetric property of equality
8. Multiplicative inverse property
9. Addition property of equality
10. Transitive property of equality

B. Find the solution set:

1. x + 8 = -3
   solution set is {-11}

2. 3x – 6 = 12
   solution set is {6}

3. $\frac{x}{4} = 5$
   solution set is 20

4. $\frac{x}{2} + 7 = 10$
   solution set is {6}

5. 5(x - 2) = 3x + 12
   solution set is {11}

6. x – 3 > 10
   solution set is {x/x > 13}

7. 2x + 7 < 13
   solution set is {x/x < 3}

8. $\frac{x}{5} > 3$
   solution set is {x/x > 15}

9. $\frac{x}{3} - 6 < 4$
   solution set is {x/x < 30}

10. 4x – 6 < 7x – 12
    solution set is {x/x > 2}

C. Solve the problems

1. let x = 1st number
   3x + 7 = 2nd number
   x + 3x + 7 = sum of the nos.
   x + 3x + 7 = 23
   4x + 7 = 23
   4x = 16
   x = 4 1st number.
   3(4) + 7 = 19 2nd number.

2. Let x = score to get in the last test
   91, 86 are the first two sores

Equation:

$$91 + 86 + x \geq 270$$

$$177 + x \geq 270$$

$$x \geq 270 - 177$$

$$x \geq 93$$

since $x \geq 93$, scores can be 93, 94,95…

3. Let x = age of Delia
3x = age of Lina

Equation:
$x + 3x = 48$
$4x = 48$
$x = 12$ age of Delia
$3x = 3(12) = 36$ age of Lina

4. let x = rate (km/h) of the eastbound Jogger
$x + 2$ = rate (km/h) of the westbound Jogger
1.5 h = time

Rate · Time + Rate · Time = Distance

$x(1.5) + x + 2(1.5) = 15$
$x(15) + x + 2(15) = 150$
$5x + 15x + 30 = 150$
$30x = 150 - 30$
$30x = 120$
$x = 4$ rate of east bound jogger

$x + 2 = 4 + 2 = 6$ rate of the west bound Jogger.

5. let x = number of tickets at P150.00
$2x - 5$ = number of tickets at P200.00
Equation:

$x(150) + 200(2x - 5) = 120{,}000$
$150x + 400x - 1000 = 120{,}000$
$550x = 121{,}000$
$x = 220$ number of tickets sold at P150.00

$2x - 5 = 2(220) - 5 = 435$ number of tickets sold at P200.00

Common Errors / Misconceptions in Unit V

1. What expression represents the phrase " two less than four times a number n"?

Student's answer : $2 < 4n$ or $2 - 4n$

Both answers are wrong. To translate verbal phrases to an algebraic expression you have to identify the key words that would indicate the operation to be used like "less than" meaning 2 will be subtracted from four times a number n".
Thus, 4n -2 is the correct answer.

2. The students translation of $n + 4 > 6$ as **n plus 4 greater than 6**, instead of **n plus 4 is greater than 6.**

3.The students failed to write the correct representation for solution set and solution of an equation.