THE BREEDER'S GUIDE

MATHEMATICS

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YEAR 9

Term Cultivate

2023/2024

Scheme of work

Mathematics		
Science & Technology		**September 4 – December 9th**
WEEK	**TOPIC**	**SUB-TOPICS**
1	Whole numbers (Binary number system)	a. Using computer to do simple mathematical calculations b. Addition and subtraction of base 2 multiplication and division of numbers in base 2
2	Expressions involving brackets and fractions	a. Translation of word problems into numerical expressions.
3	Proportion	a. Direct and indirect/inverse proportion
4	Rational and Non-rational numbers	a. Direct variation b. Indirect variation c. Joint variation d. Partial variation
5	Factorization	a. Factorization of expressions in various forms b. Real life problems involving factorization
6	Simple Linear Equation	a. Equations involving fractions b. Word problems on simple equations involving fractions
7	Midterm test and break	
8	Change subject of formulae	
9	Compound interest	a. Revision on simple interest
10	Compound interest (II)	a. Compound interest
11	Revision	
12	Examination	
13	Examination	
WEEK	**TOPIC**	**SUB-TOPICS**

1. WHOLE NUMBERS

Objective: By the end of this class, each student should be able to (i) Apply basic operations in binary system (ii) convert numbers to binary from one base to another.

Duration: 80 mins

Week: 1

Entry Behaviour (*How you plan to start your Class*):

NUMBER BASE CONVERSIONS

People count in twos, fives, twenties etc. Also, the days of the week can be counted in 24 hours. Generally, people count in tens. The digits 0,1,2,3,4,5,6,7,8,9 are used to represent numbers.

The place value of the digits is shown in the number example: 395:- 3 Hundred, 9 Tens and 5 Units. i.e. $3X10^2 + 9X10^1 + 5X10^0$.

Since the above number is based on the powers of tens it is called the base ten number system i.e. 300 + 90 + 5

Also 4075 = 4 Thousand 0 Hundred 7 Tens 5 Units i.e. $4 \times 10^3 + 0 X 10^2 + 7 X 10^1 + 5 X 10^0$

Other Number systems are sometimes used. For instance, the base 8 system is based on the power of 8.

E.g.: Expand 647, 26523, 1011012,

(a) $647_8 = 6 \times 8^2 + 4 \times 8^1 + 7 X 8^0$

$= 6 \times 64 + 4 \times 8 + 7 \times 1 =$

(b) $26523 = 2 \times 7^4 + 6 \times 7^3 + 5 \times 7^2 + 2 \times 7^1 + 3 \times 7^0$

(c) $101101 = 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

Number System		
System	**Base**	**Digits**
Binary	2	0 1
Octal	8	0 1 2 3 4 5 6 7
Decimal	10	0 1 2 3 4 5 6 7 8 9
Hexadecimal	16	0 1 2 3 4 5 6 7 8 9 A B C D E F

CONVERSION TO DENARY SCALE (BASE TEN)

When converting from other bases to base ten the number must be raised to the base and added. Examples: Convert the following to base 10

(a) 17_8

(b) 11011_2

Solutions:

(a) $17_8 = 1 X 8^1 + 7 X 8^0 = 1 X 8 + 7 X 1 = 8 + 7 = 15$

(b) $11011_2 = 1 X 2^4 + 1 X 2^3 + 0 X 2^2 + 1 X 2^1 + 1 X 2^0 = 1 X 16 + 1 X 8 + 0 X 4 + 1 X 2 + 1 X 1$

= 16 + 8 + 0 + 2 + 1 = 27

EVALUATION

Convert The Following To Base Ten: (a) 10100_2 (b) 2120_3

CONVERSION FROM BASE TEN TO OTHER BASES

To change a number from base ten to another base follow the steps listed below

1. Divide the base ten number by the new base number.
2. Continue dividing until zero is reached
3. Write down the remainder each time
4. Start at the last remainder and read upwards to get the answer.

Examples:

1. Convert 68 to base 6
2. Convert 129 to base 2

Solutions:

1. 68_{ten} to base 6

6	68
6	11 r 2
6	1 r 5
	0 r 1

= 152_6

2. 129_{ten} to base 2

2	129
2	64 r 1
2	32 r 0
2	16 r 0
2	8 r 0
2	4 r 0
2	2 r 0

2	1 r 0
	0 r 1

EVALUATION

1. Convert 569_{ten} to base 8.
2. Convert 100_{ten} to base 2.
3. Convert the following numbers to base 7

   a. 405_{ten} b. 876_{ten}

ADDITION IN BASE TWO

We can add binary numbers in the same way as we separate with ordinary base 10 numbers.
The identities to remember are:- 0 + 0 = 0,
0 + 1 = 1,
1 + 0 = 1,
1 + 1 = 10,
1 + 1 + 1 = 11,
1 + 1 + 1 + 1 = 100

Examples

Simplify the following

1. 1110 + 1001
2. 1111 + 1101 + 101

Solutions:

1.
$$\begin{array}{r} 1110_2 \\ +1001_2 \\ \hline 10111_2 \\ \hline \end{array}$$

2.
$$\begin{array}{r} 1111_2 \\ 1101_2 \\ +\ 101_2 \\ \hline 100001_2 \\ \hline \end{array}$$

EVALUATION

Simplify the following

1. 101 + 101 + 111
2. 10101 + 111

ADDITION IN BICIMALS

In bicimals, the binary point is placed underneath each other exactly the same way like ordinary decimals.

Example:

1. 1.1011 + 10.1001 + 10.01
2. 10.001 + 101.111

Solution:

1.
$$\begin{array}{r} 1.1011_2 \\ 10.1001_2 \\ +\ 10.0100_2 \\ \hline 110.1000_2 \\ \hline \end{array}$$

2.
$$\begin{array}{r} 101.111 \\ +\ \ 10.001 \\ \hline 1000.000 \\ \hline \end{array}$$

SUBTRACTION IN BASE TWO

The identities to remember on subtraction are;

0 – 0 = 0,

1 – 0 = 1,

10 – 1 = 1,

11 – 1 = 10,

100 – 1 = 11

Examples

Simplify the following:

(a) 1110 – 1001

Solutions:

-
$$\begin{array}{r} 1110 \\ -\ 1001 \\ \hline 101 \\ \hline \end{array}$$

SUBTRACTION IN BICIMAL

Example

Solve 101.101 – 11.011

$solution$:

$$\begin{array}{r} 101.101 \\ 11.011 \\ \hline 10.010 \\ \hline \end{array}$$

2. Expressions involving brackets and fractions

Objective: By the end of this class, each student should be able to (i) Simplify expressions involving brackets (ii) simplify expressions involving fractions (iii) Translate word problems into numerical expression

Duration: 80 mins

Week: 2

Entry Behaviour (*How you plan to start your Class*):

SOLVING EQUATION EXPRESSIONS WITH FRACTION

Always, clear fractions before beginning to solve an equation: –
To clear fractions, multiply each term in the equation by the LCM of the denominations of the fractions.

Examples:

Solve the following

1) $\frac{x}{9} = 2$
2) $\frac{x+9}{5} + \frac{2+x}{2} = 0$
3) $2x = \frac{5x+1}{7} + \frac{3x-5}{2}$

Solution

1. $\frac{x}{9} = 2$

   Cross multiply

   $X = 9 * 2$

   $X = 18$

2. $\frac{x+9}{5} + \frac{2+x}{2} = 0$

   Find the LCM of the denominators

   LCM of 5 and 2 = 10

   Multiply each fraction with the LCM

   $2(x + 9) + 5(2 + x) = 0$

   $2x + 18 + 10 + 5x = 0$

   Collect like terms

   $2x + 5x + 10 + 18 = 0$

$7x + 28 = 0$

$7x = -28$

$X = -4.$

3. $2x = \frac{5x+1}{7} + \frac{3x-5}{2}$

   Multiply by the LCM = 14

   $14 * 2x = 14\left(\frac{5x+1}{7}\right) + 14\left(\frac{3x-5}{2}\right)$

   $28x = 2(5x + 1) + 7(3x - 5)$

   $28x = 10x + 2 + 21x - 35$

   $28x = 31x - 33$

   $28x - 31x = -33$

   $-3x = 33$

   $X = -33/-3$

   $X = 11$

EVALUATION

Solve the following equations.

1) $\frac{7}{3c} = \frac{21}{2}$ 2) $\frac{6}{y+3} = \frac{11}{y-2}$ 3) $\frac{3}{2b-5} - \frac{4}{b-3} = 0$

3. PROPORTION

<u>Objective:</u> By the end of this class, all the students should be able to (i) State what direct proportion is (ii) State what an indirect or inverse proportion is (iii) Solve problems on direct and inverse proportion (iv) Apply direct and indirect proportions in daily activities

<u>Duration:</u> 80 mins

<u>Week:</u> 3

<u>Entry Behaviour (*How you plan to start your Class*):</u>

<u>Proportions</u>

Proportion can be solved by either unitary method or inverse method. When solving by unitary method, always

- Write in sentence the quantity to be found at the end.
- Decide whether the problem is either an example of direct or inverse method
- Find the rate for one unit before answering the problem.

Examples

1. A worker gets N 900 for 10 days of work, find the amount for (a) 3 days (b) 24 days (c) x days

Solution

For 10 days = ₦ 900
1 day = 900/10 = ₦ 90
a. For 3 days = 3 x 90 = ₦ 270
b. For 24 days = 24×90 = ₦ 2,160
c. For x days =X x 90 = N 90 x

<u>INVERSE PROPORTION</u>

Example

1. Seven workers dig a piece of ground in 10 days. How long will five workers take?

Solution:

For 7 workers = 10 days
For 1 worker = 7 × 10 = 70 days
For 5 workers = 70/5 = 14 days

2. 5 people took 8 days to plant 1,200 trees. How long will it take 10 people to plant the same number of trees

Solution:

For 5 people = 8 days
For 1 person = 8 × 5 = 40 days

For 10 people = 40/10 = 4 days

Note on direct proportion: this is an example of direct proportion .The less time worked (3 days) the less money paid (#270) the more time worked (24 days) the more money paid (NN 2,160)

CLASS WORK

1. A woman is paid N 750 for 5 days, Find her pay for (a) 1 day (b) 22 days
2. A piece of land has enough grass to feed 15 cows for x days. How long will it last (a) 1 cow (b) y cows.
3. A bag of rice feeds 15 students for 7 days .How long would the same bag feed 10 students

4. RATIONAL AND NON-RATIONAL NUMBERS

Objective: By the end of this class, all the students should be able to (i) Explain rational and non-rational numbers (ii) State what an direct, inverse, partial and joint variation is (iii) Solve problems on direct, inverse, partial and joint variation (iv) Apply variations in daily activities

Duration: 80 mins

Week: 4

Entry Behavior (*How you plan to start your Class*):

Rational and Non-rational numbers

Numbers that can be written as exact fractions or ratios are called **rational numbers**. For example, we can write these numbers as 2/3 or 2:3.

In addition, rational numbers are also numbers that can be written as recurring decimals, for instance: is ⅔ is equivalent to 0.66666666667.

Numbers that cannot be written as exact fractions or recurring decimals are called non-rational numbers. Examples of non-rational numbers are 2, 6, 8.

DIRECT AND INVERSE VARIATION

DIRECT VARIATION

This is used to describe quantities that vary in proportion to each other, such that as one increases the other increases, and as one decreases, the other decreases. Thus, if P varies directly as R, then the expression symbolically becomes

$$P \propto R.$$

The expression can now be written in equation form as

$$P = KR$$

Where $\propto$ has been replaced by is a constant of variation.

Example 1:

If x varies directly as the square of y, Find the law of variation between x and y. Given that K = 5, Find the value of X when y = 16.

INVERSE VARIATION

This variation means that related quantities vary inversely or as reciprocal to each other. Hence as one increases the other decreases; and as one decreases, the other increases. Thus if T varies inversely as S, symbolically this is written as

$$T \propto 1/S.$$

The expression can now be written in equation form as

$$T=K/S.$$

Where $\propto$ has been replaced by "= and K".

K is the constant of variation. It can also be expressed as

K=TS

The equation T=K/S is the equation of variation.

Example: Given that T is inversely proportional to S, and given that T = 2 when S = 60, find the
(a) relationship between T and S.
(b) value of T when S = 9.

Assessment

1. If $x \propto y$ and x = 2 when y = 4, find the value of x when y = 8. A. 2 B. 4 C. 6 D. 8
2. $x \propto 1/y$ and x = 3 When y = 4, find the value of y when x = 6. A. 2 B. 4 C. 5 D. 6
3. If p varies directly as q and p = 5, q = 10, what is value of p when q = 40? A. 20 B. 10 C. 5 D.6
4. $m \propto 1/n$ and m = 4 when n = 120. Find the relationship between m and n. A. m = 120/n B. m = 480/n C. n = 480/m D. m = n / 480
   Find the value of m when n = 80. A. 60 B. 120 C. 48 D.84

<u>JOINT AND PARTIAL VARIATION</u>

JOINT VARIATION

Joint variation is obtained when a quantity varies with more than one other quantity either directly and/or inversely.
For instance, P is jointly proportional to both Q and G as in $P \propto QG$.
Also, H is directly proportional to Y and inversely proportional to M as in $H \propto Y/M$.

Example 1:
If $H \propto Y/M$. When H = 42, Y = 7, and M = 3. Find the relationship between H, Y and M.
Find H when Y = 5 and M = 9.

Example 2
The universal gas law states that the volume V (m^3) of a given mass of an ideal gas varies directly with its absolute temperature T (K) and inversely with its pressure P(N/m^2). A certain mass of gas at an absolute temperature of 425K and pressure 1000N/m^2 has a volume 0.255m^3. Find: the formula that connects P, V and T. Find the pressure of the gas when its absolute temperature is 720K and its volume is 0.018m^3.

PARTIAL VARIATION

Partial variation problems occur everywhere around us. Some examples are described below:

- When a hairdresser makes hair, the money he/she charges M, is dependent on both the cost of the wool (thread or weavon in some cases) C, which is constant, and on the time T, taken to make the hair. The less the weaves, the less the time it will take to complete and the less the charges.
  We can write a partial equation for this as: M = C + bT, where C and b are constants.
- Domestic electricity prepaid meter bills are prepared on two components which are N750 rental charge (independent of the amount of power consumed) and consumption charges (dependent on the quantity of power consumed). We can also write the total bill T in partial equation as: T = 750 + bT, where N750 and b are constants depending on the customer.

Thus, partial variation statements can come in these formats described below:

- W is partly constant and partly varies as G is interpreted as W = a + bG
- V varies partly as P and partly inversely as $\sqrt{Q}$ can also be interpreted as $V = aP + b/\sqrt{Q}$

In these cases, a and b are constants that can be obtained simultaneously.

Examples

1. x is partly constant and partly varies as the square of y. Write an equation connecting x and y. Given that when x = 3, y = 4 and when x = 1, y = 5. Write down the law of variation. Find x when y = 2.
2. T varies as partly as V and partly as the cube of V. When T = 30, V = 2 and when T = 15, V = 3. Write the law connecting T and V. Find T when V = 4.

EVALUATION

Z varies partly directly with x and partly varies inversely with y. When Z = 4, x = 3, y = 1 and when Z = 3, x = 0.5, y = 5. Find Z when x = 29, y = 10.

5. FACTORIZATION

Objective: By the end of this class, all the students should be able to (i) factorize simple algebraic expressions (ii) factorize quadratic expression (iii) Solve real life problems on factorizations.

Duration: 80 mins

Week: 5

Entry Behaviour (*How you plan to start your Class*):

FACTORISATION OF SIMPLE EXPRESSION

To factorize an expression completely, take the HCF outside the bracket and then divide each term with the HCF.

Example:

Factorize the following completely.

1. $8xy + 4x^2y$
2. $6ab – 8a^2b + 12ab$

Solution:

1. $8xy + 4x^2y$

$8xy = 2 * 2 * 2 * x * y$

$4x^2y = 2 * 2 * x * x * y$

HCF = $4xy$

$8xy + 4x^2y = 4xy (2 + x)$

$= 4xy (2 + x)$

2. $9a^2bc^3 – 12ab^2c^2$

$9a^2bc^3 = 3 X 3 X a X a X c X c X c$

$12ab^2c^2 = 2 X 2 X 3 X b X b X c X c$

HCF = $3abc^2$

$= 3abc^2 (3ac – 4b)$

EVALUATION

Factorize the following expression

1. $9x^2yz^2 – 12x^3z^3$
2. $14cd + 35cd^2f$
3. $20m^2n – 15mn^2$

FACTORISATION BY GROUPING

To factorize an expression containing four terms, you need to group the terms into pairs. Then factorize each pair of terms.

Example:
factorize ab – 2cb + 2cf – af
Solution:
Group ab and af together and 2cb and 2cf together
I.e. ab – 2cb + 2cf –af = ab – af – 2cb + 2cf
= a (b – f) - 2c (b – f)
= (a – 2c) (b – f)

EVALUATION
Factorize these expressions;
1. 16uv – 12vt + 20mu – 15mt
2. ap +aq +bq + bp
3. mn – pq-pn +mq

FACTORISATION OF QUADRATIC EXPRESSIONS
A quadratic expression has two (2) as its highest power; hence, this at times is called a polynomial of the second order. The general representation of quadratic expression is
ax + bx + c where a ≠ 0.
From the above expression, a, b, and c stands for a number and are called constants.

NOTE
- If ax +bx + c = 0, this is known as quadratic equation
- a is coefficient of x , b is coefficient of x and c is a constant term.
- When an expression contains three terms, it is known as trinomial.
- To be able to factorize trinomial, we need to convert it to contain four terms.

Examples: factorization of trinomial of the form x^2 +bx + c.

1. Factorise x^2 +7x +6

Steps:
- Multiply the 1 and the last term (3rd term) of the expression.
- Find two factors of the above multiple such that if added gives the second term (middle) and when multiplied gives the result in step 1.
- Replace the middle term with these two numbers and factorize by grouping.

Solution to example:
X^2 * 6 = 6x
Factors: 6 and 1
X^2 + 6x + x + 6
X(x+6) +1(x+6)
(x+6)(x+1)

EVALUATION

1. $z^2 - 2z + 1$
2. $x^2 + 10x - 24$

FACTORISATION OF QUADRATIC EQUATIONS OF THE FORM $ax^2 + bx + c$

Example: 5x -9x +4

Solution:

Product: $5x^2 * 4 = 20x^2$

Factors: -5 and -4

Sum: -5-4 = - 9

Hence, 5x – 9x + 4

$5x^2 - 5x - 4x + 4$

5x(x-1)-4(x-1)

(5x-4)(x-1)

EVALUATION

1. 2x +13x +6
2. $13d^2 - 11d - 2$

FACTORISATION OF TWO SQUARES

To factorise two squares with a difference, we need to remember the law guiding difference of two squares i.e. $x^2 - y^2 = (x + y)(x - y)$.

Examples:

1. $P^2 - Q^2 = (P+Q)(P - Q)$
2. $36y^2 - 1 = 6y - 1$

$= (6y)^2 - 1^2 = (6y+1)(6y-1)$.

EVALUATION

1. $121 - y^2$
2. $x^2y^2 - 4^2$

ASSIGNMENT

1. The coefficient of x in x + 3x -5 is 3 B. 1 C. -5 D. 2
2. Simplify $e^2 - f^2$ a. (e+f)(e-f) b. (e+f)(f+e) c. (e-f)(f-e) D. e+f
3. Factorize $x^2 + x - 6$ a. (x+3)(x+2) B. (x-2)(x+3) C. (x+1)(x+5) D. x + 2
4. Solve by grouping $5h^2 - 20h + h - 4$ A. (h-4)(5h+1) B. (h+4)(5h-1) C. (h+2)(h-5) D. h – 4
5. $49m^2 - 64n^2$ when factorized will be A . (7m+8n)(8m+7n) B. (8m-7n)(8m+7n) C. (7m-8n)(7m+8n) D. 7m – 8n

6. Simple Linear equations

Objective: By the end of this class, all the students should be able to (i) Solve simple linear equation (ii) Solve linear equations involving fractions (iii) Real life problems on linear equations

Duration: 80 mins

Week: 6

Entry Behaviour (*How you plan to start your Class*):

SOLVING EQUATION
WORD PROBLEMS
Examples:
1. Find 1/4 of the positive difference between 29 & 11
2. The product of a certain number and 5 is equal to twice the number subtracted from 20. Find the number
3. The sum of 35 and a certain number is divided by 4 the result is equal to double the number. Find the number.

Solutions:

1. Positive Difference 29 – 11 = 18
   $\frac{1}{4}\, of\ 18 = 4\frac{1}{2}$

2. Let the number be x
   x * 5 = 20 – 2x
   5x = 20 – 2x
   5x + 2x = 20
   7x = 20
   $x = 20/7 = 2\frac{6}{7}$

3. Let the number be n
   sum of 35 and n = n + 35
   $divided\ 4 = \frac{n+35}{4}$
   $result = 2 \times n$
   $therefore\ \frac{n+35}{4} = 2n$

$n + 35 = 8n$
$8n - n = 35$
$7n = 35$
$\therefore n = 5$

EVALUATION

1. From 50 subtract the sum of 3 & 5 then divide the result by 6
2. The sum of 8 and a certain number is equal to the product of the number and 3 find the number

SUM & DIFFERENCES

The sum of a set of numbers is a result obtained when the numbers are added together. The difference between two numbers is a result of subtracting one number from the other.

Examples:

1. Find the sum of -2 & -3.4
2. Find the positive difference between 19 & 8
3. The difference between two numbers is 7. If the smaller number is 7 find the other.
4. The difference between -3 and a number is 8, find the two possible values for the number.
5. Find the three consecutive numbers whose sum is 63.

Solutions:

1. $-2 + -3.4 = -5.4$

2. $19 - 8 = +11$

3. let the number be Y i.e. $Y - 7 = 7$
   i.e. $Y = 7 + 7 = 14$

4. Let M represent the number
$M - (-3) = 8$
$m + 3 = 8$
$m = 8 - 3$
$m = +5$

also $-3 - m = 8$
$-m = 8 + 3$
$-m = 11$

m = -11

∴The possible values are +5 & -11

4. Consecutive numbers are 1, 2, 3, 4, 5, 6, ……………..
   Consecutive odd numbers are 1, 3, 5, 7, 9………..….
   Consecutive even numbers are 2, 4, 6, 8,10…………

Representing in terms of X, we have X, X + 1, X + 1, X + 3, X + 4, X + 5…………

For consecutive even numbers, we have X, X + 2, X + 4, X + 6…….

For consecutive odd numbers, we have X + 1, X + 2, X + 3, X + 4…

For consecutive numbers.

let the first number be x,

let the second number be x + 1

let the third number be x + 2

Therefore x + x + 1 + x + 2 = 63

3x + 3 = 63

3x = 63 – 3

3x = 60

x = 60/3 = 20

The numbers are 20, 21, and 22.1. Find the sum of all odd numbers between 10 and 20

2. The sum of four consecutive odd numbers is 80 find the numbers

3. The difference between 2 numbers is 9, the largest number is 32 find the numbers.

EVALUATION

PRODUCTS

The product of two or more numbers is the result obtained when the numbers are multiplied together.

Examples:

1. Find the product of –6, 0.7, & 20/3
2. The product of two numbers is 8. If one of the numbers is 1/4 find the other.
3. Find the product of the sum of -2 & 9 and the difference between -8 & -5.

Solutions

1. Products -6 x 0.7 x 20/3

   -6 x 7/10 x 20/3 = $\frac{-6 \, x \, 7 \, x \, 20}{10x \, 3}$

   = -2 x 7 x 2 = -28

2. Let the number be x

   $\frac{1}{4}$ * x = 8 multiply both sides by 4

   x = 8 x 4 = 32

3. Sum = -2 + 9 = 7

   Difference = -5-(-8) = -5 + 8 = 3

   Products = 7 x 3 = 21

EVALUATION

1. The product of three numbers is 0.084 if two numbers are 0.7 & 0.2 find the third number
2. Find the product of the difference between 2 & 7 and the sum of 2 & 7
3. From 50 subtract the sum of 3 & 5 then divide the result by 6
4. The sum of 8 and a certain number is equal to the product of the number and 3 find the number

7. MID TERM TEST AND BREAK

Objective: By the end of this class, all the students should be able to participate in the periodic test

Duration: 50 mins

Week: 7

Entry Behaviour (*How you plan to start your Class*):

8. CHANGE SUBJECT OF FORMULAS

Objective: By the end of this class, all the students should be able to (i) Express on unknown in terms of others (ii) Manipulate formulae using operations

Duration: 80 mins

Week: 8

Entry Behaviour (*How you plan to start your Class*):

CHANGE OF SUBJECT OF FORMULA

A formula is a general equation involving two or more unknowns. An example is the formula a = πr^2 which gives the area of the circle in terms of its radius r. In this formula, 'a' is called the subject of the formula.

Simplifying a formula by substitution

Example:

1. Given mx + c = y, express x in terms of m, c, and y. Find the value of x if y = 10, c = 2 and m is 4

Solution:

1) $mx + c = y,$

$mx = y - c$

$$x = \frac{y-c}{m}$$

To find the value of X, when $y = 10$, $m = 4$ and $c = 2$

$$x = \frac{10-2}{4} = \frac{8}{4} = 2$$

Evaluation: If I = PRT

- Make p the subject and find the value of p if I = 10, R = 4, and T = 5.

CHANGING THE SUBJECT OF A FORMULA

When a variable that forms a part of the formula is made subject, we say we have changed the subject of the formula.

Examples:

1. In the formula S=2¶r(r+h), make h the subject.
2. Make m the subject if $F = (mv - mu)/T$

Solution:

1) S=2¶r(r+h)

S=2¶r +2¶rh

S- 2¶r =2¶rh

h = (S - 2¶r)/2¶r

2) $F = (mv - mu)/\mathrm{T}$
Cross multiply
FT = mv - mu
FT = m (v - u)
m = FT/(v - u)

EVALUATION
1. Make r the subject if V =¶r^2 h
2. Make u the subject if 1/f =1/v + 1/u

1. Express a in terms of u, v, and t in v = u+at
(a) a = vu - t
(b) a= v - u
(c) a =$(v + u)/\mathrm{t}$

2. If Z = 2p +3, find the value of Z when p=1.
(a) Z=2
(b) Z= 5
(c) Z =7

4. Make U the subject if $V^2 = U^2 + 2as$.
(a) U= V^2 - 2as
(b) U = $(V^2 - 2as)^2$
(c) V – 2a

REFERENCE	KEYWORDS	EVALUATION/ASSESSMENT
	•	

Remark:

9. COMPOUND INTEREST (I)

Objective: By the end of this class, all the students should be able to recap previous lessons on simple interest

Duration: 80 mins

Week: 9

Entry Behaviour (*How you plan to start your Class*):

Compund Interest
When any transaction is done, we either make profit or a loss. When an article is sold at a price greater than the price it was bought, then a profit is made. On the other hand, if an article is sold at a price less than the cost, we have made a loss.
Hence,
Profit = selling price – cost price
Loss = Cost price – selling price
In commercial transactions, profit and loss are usually expressed as a percentage of the cost price
Examples

1. Adamu bought a pair of shoes for N2,000. Find his percentage loss if he sold it for #1 800?
2. Find the cost price of each of these selling prices
    a. N540 at a profit of 25%
    b. N2,500 at a loss of 15%

Simple Interest
Interest is a payment given for saving money. It can also be the price paid for borrowing money. When interest is calculated on the basic sum of money saved (or borrowed, it is called Simple Interest. Simple Interest (I) is calculated using the formula
I = $\frac{P * R * T}{100}$
P = $\frac{I * 100}{T * R}$ T = $\frac{I * 100}{P * R}$ R = $\frac{I * 100}{P * T}$
The initial amount is called the Principal (P) - The sum of money saved or borrowed. Rate (R) is the annual rate of interest given as a percentage. The length of the period in which the principal is used is called the Time (T). The principal plus interest is called the Amount.

Examples:

1. Find the simple interest on N500 for 4 years at a rate of 5%. What is the amount?

Solution
Principal = N500
Time = 4 years
Rate = 5%

I = $\frac{P * R * T}{100}$ = $\frac{500 * 5 * 4}{100} = \text{N}500$

Amount = Principal + Simple interest
= N500 + N100
= N600

2. Calculate the interest rate percent per annum or a loan of N5,862 for 3 year and a repayment of N7,895.

Solution

Amount = N7,895
Principal N5,862
Time = 3 years
Interest = ?
Rate = ?
But we know that,
Amount = Principal + Interest
Interest = Amount - Principal
= N7,895 - N5,862 = N2,033

I = (PRT)/100
R = (1 * 100)/(PT) = (2.033 * 100)/(5.862 * 3)
= 203.3/17.586 = 11.56%

CLASS ACTIVITY

1. Find the simple interest on N800 for 3 years at the rate of 60%.
2. Calculate the simple interest on N8,000 for 2 years at 4% per annum.

10. Compound Interest (II)

Objective: By the end of this class, all students should be able to (i) Solve problems on compound interest (ii) Apply compound interest in real life situations

Duration: 80 mins

Week: 10

Entry Behaviour (*How you plan to start your Class*):

COMPOUND INTEREST
In compound interest, interest is calculated and added to the principal at the end of each interval, thus the principal increases and so the interest becomes larger for each interval. Most saving schemes give compound interest not simple. The total value at the end of the investment is the compound amount.
Thus,
Compound amount = Compound interest + Principal

Example:

1. Calculate the compound interest on N6, 000 for 4 years at 10% per annum. What is the compound amount?

Solution
Solution
First year:
Principal = N6, 000
Interest = (6,000 x 10 x 1) / 100 = N600
Amount at the end of the 1st year = (N6, 000 + N600) = N6, 600

Second year:
Principal = N6, 600
interest = (6,600 x 10 x 1) / 100 = N660
Amount at the end of the 2nd year (N6,600 + N660) = N7,260

Third year:
Principal = N7, 260
interest = (7,260 x 10 x 1) / 100 = N726
Amount at the end of the 3rd year (N7, 260 + N726) = N7, 986

Fourth year:
Principal = N7, 986
interest = (7,986 x 10 x 1) / 100 = N798.60
Amount at the end of the 4th year = 7, 986 + N798.60) = 8,784.60

Compound amount = 8, 784.60
Compound interest N8, 784.60 - N6, 000= N2, 784.00

CLASS ACTIVITY
1. Find the compound amount and interest on N40, 000 at 15% for 2 years.
2. Find the amount that #40 000 becomes if saved for 3years at 6% per annum.

DEPRECIATION

Most of items such as radios, cars clothing, houses, and electrical goods, lose value as time passes. This loss in value is called depreciation. Depreciation is usually given as a percentage of the item's value at the beginning of the year

Example:
A car costing N680,000 depreciates by 25% in its first year and 20% in its second year. Find its value after 2 years.

Solution
1st year: value of car is N680,000
25% depreciation = 680,000 (25/100 X 680,000)
=N680,000 - N170,000
= N510,000
2nd year: value of car is N510,000
20% depreciation = 510,000 - (20/100 X 510,000) = -
= N510, 000 - N102, 000
= N408,000

INFLATION

Due to rising prices, money loses its value as time passes. Lose in value of money is called Inflation. Inflation is usually given as the percentage increase in the cost of buying things from year to the next.

Example:
How long will it take for prices to double if the rate of inflation is 20% per annum?

Solution:
Start with an initial cost of 100 units.
Initial cost = 100
Rise = 20% of 100
= 20/100 x 100 = 20
After 1 year, cost = 100 + 20 = 120
Rise = 20/100 X 120 = 24
After 2 years, cost = 120+ 24 = 144

Rise = 20/100 X 144 = 28.8
After 3 years, cost = 144 + 28.8 = 172.8
Rise 20/100 X 172.8 = 34.56
After 4 years, cost = 172.8 +34.56
= 207.36
The cost after 4 years is a little more than double the initial cost. Hence prices will double in just less than 4 years.

PRACTICE EXERCISE

1. Find the simple interest on the following:
   a) ₦4 500 for 3 years at 6% per annum
   b) $680 for 2 ½ years at 5% per annum
2. Nkedirim collects a loan of ₦500 000 at an interest rate of 20% per annum, what amount will she pay back at the end of the year?
3. Calculate the compound interest and compound amount on £960 000 for 3 years at 3% at the end of first year, 4% at the end of second year and 5 ½ % at the end of third year to 2 decimal places
4. The price of a house was ₦23 400 000 in 2010. At the end of each year, the price increased by 6%. Find the price of the house after 3 years

ASSIGNMENT

1. At what time will a principal of ₦30 000 yield an interest of ₦5 000 at the rate of 5%?
2. Akpan borrowed ₦12 000 at 3% simple interest for 2 years. How much will he pay all together?
3. Find the principal that yields ₦3000 in 5 years at 4% per annum simple interest.
4. A person saves ₦3 000 at 4½ % compound interest. She adds ₦800 to her amount at the end of each year. Find her total savings after 2 years.
5. A new car costs $64 000. It depreciates by 25% in the first year, 20% in the second year, and 15% in each of the following years. Find the value of the cat to the nearest $50 after 4years.

11. REVISION

<u>Objective:</u> By the end of this class, all the students should be able to recall all they have learnt during the term

<u>Duration:</u> 190 mins

<u>Week:</u> 11

<u>Entry Behaviour (*How you plan to start your Class*):</u>

12. EXAMINATION