Name…… Stream……

GAYAZA HIGHN SCHOOL

S.2 MATH WORKSHEET NINE

NUMBER BASES

Summary:

1. Number bases are different ways of writing down numbers.
2. The most common base system is base **10.**
3. The digits of a number in any base are less than the base itself
4. The digits **10** and **11** are represented by **t** and **e** respectively in number bases

NOTE:

(i) Base 10 is called **decimal base**

(ii) Base 2 is called **binary base**

(iii) Base 3 is called **trinary base**

(iv) Base 8 is called **octal base**

EXAMPLES:

1. Convert the following to base ten

(i) 1011_{two} (ii) $312 \cdot 21_{four}$

(ii) $312 \cdot 21_{four} = (3 \times 4^2) + (1 \times 4^1) + (2 \times 4^0) + (2 \times 4^{-1}) + (1 \times 4^{-2})$

$= (3 \times 16) + (1 \times 4) + (2 \times 1) + (2 \times \frac{1}{4}) + (2 \times \frac{1}{16})$

$= 54 + \frac{1}{2} + \frac{1}{16}$

$= 54\frac{9}{16}_{ten}$ **or** $54 \cdot 5625_{ten}$

Question.1: Covert the following to base ten

1.	346_{seven}
2.	2210_{three}
3.	$530 \cdot 12_{six}$
4.	$6205 \cdot 45_{seven}$

CONVERTING FROM BASE TEN TO OTHER BASES

Summary:

(i) Divide the number repeatedly by the required bases

(ii) The remainder in reverse order gives the required number

EXAMPLES:

1. Convert 64_{ten} to base three

3	64	R
3	21	1
3	7	0
	2	1

$\therefore \; 64_{ten} = 2101_{three}$

2. Convert 246_{ten} to base five

3. Convert 2101_{three} to base seven

Hint: First convert 2101_{three} to base ten

$$2101_{three} = (2 \times 3^3) + (1 \times 3^2) + (0 \times 3^1) + (1 \times 3^0)$$
$$= 64_{ten}$$

7	64	R
7	9	1
	1	2

$\therefore \; 2101_{three} = 121_{seven}$

Question.2 Convert the following as required

1.	198_{ten} to base five
2.	864_{eight} to base ten
3.	361_{seven} to base four
4.	1001001001_{two} to base six

5.	2020_{ten} to binary
6.	816_{nine} to binary

Finding the base

When finding the unknown base, express everything as base ten and then solve

Example

1. Find the value of n from, $4001_n = 501_{ten}$

$$(4 \times n^3) + (0 \times n^2) + (0 \times n^1) + (1 \times n^0) = 501$$

$$4n^3 + 1 = 501$$

$$4n^3 = 500$$

$$n^3 = 125$$

$$n = \sqrt[3]{125} = 5$$

$$\therefore \mathbf{n = five}$$

2. Find the value of n from, $201_n = 53_{six}$

$$(2 \times n^2) + (0 \times n^1) + (1 \times n^0) = (5 \times 6^1) + (3 \times 6^0)$$

$$2n^2 + 1 = 30 + 3$$

$$2n^2 = 32$$

$$n^2 = 16$$

$$n = \sqrt{16} = 4$$

$$\therefore \mathbf{n = four}$$

Question: Find the value of **n** in the following equations**:**

1.	$45_n = 1112_{three}$
2.	$21_n = 19_{ten}$
3.	$303_n = 410_{six}$

4.	$202_n = 37_{nine}$
5.	$112_n + 304_n = 421_n$