UNIT ONE

CONCEPT FORMATION

Rechard Skemp describes a concept as the mental object which results when we abstract from a number of examples something which they all have in common.

For example young children learn the concept of dog from repeated contact with many types of dog.words and symbols are used to describe or label concepts.concepts are learned.virtually all children from time of birth can learn concepts.the learning of language and the symbols that name concepts often lags behind the formation of concept itself.children learn their early mathematics by abstracting concepts from concrete experiences.

PRIMARY CONCEPT;;Primary concepts are built from sensory experiences e.g seeing,feeling,smelling,tasting and hearing.for example the concept of Redness is formed from seeing many red objects and recognizing their common property.similarly the concept of threeness is formed from experiencing many different sets,each containing three objects.

SECONDARY CONCEPT;Secondary concepts are built up by combining primary concepts.so,red,blue.green,…etc are all colours and one,two,three,…etc are all numbers.this process of building concepts from simpler ones occurs with incressing complexity within mathematics.according to Skemp,before we try to communicate a new concept,we have find out what are its contributory concepts; and for each of these we have to find out its contributory concepts,and so on,until we reach either primary concepts or experiences which we may assume as given.many of our everyday experiences,are sensory e.g,hot,cold,sweet,round etc.however,in mathematics,once the basics are established,the level of abstraction quickly increases so that abstract concepts are built upon abstract concepts rather than on new sensory experiences.the teacher needs to help learners develop ways to understand new concepts by using good examoles.skemp gives two principles of learning mathematics that relate directly to the notion of concepts as follows;

1.concept of higher order than those a person already has cannot be communicated to that person by a definition. Only by arranging for the person to encounter a suitable collection of examples can such a concept be communicated.

2.since in mathematics examples are almost invariably other concepts, the concepts used in the examples must already be formed in the mind of the learner.

MATHEMATICAL SCHEMAS;This is an outline,diagram,plan or preliminary draft of a mental image produced in response to a stimulus,that becomes a framework or basis for analyzing or responding to other related stimuli.

What is the function of mathematical schemas? Answer this question and drop it in my email.

UNIT TWO

TEACHING OPERATIONS ON WHOLE NUMBERS

NUMBER WORK

Counting of numbers

Counting is done in two stages. They are Rote counting and Enumeration.

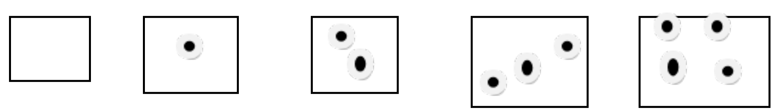
1.Rote counting.

In rote counting, children learn how to count numbers orally. oral counting is done, through the use of Rhymes, such as; one-two buckle your shoes, three-four shut the door, five-six lay them straight,seven-eight,pick them up, nine-ten a good fat hen.

2.Enumeration counting

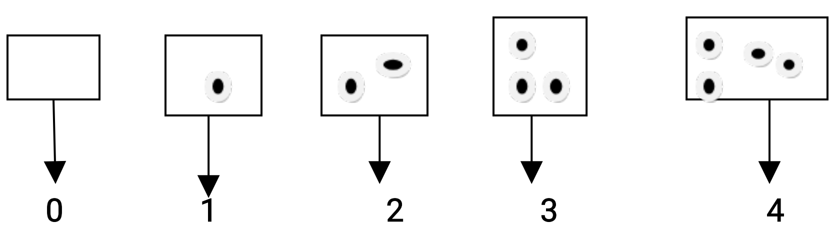
Enumeration is counting objects into a definite group. Enumeration is done by

a) Counting sets with the number of things so that the number of elements in each set is defined

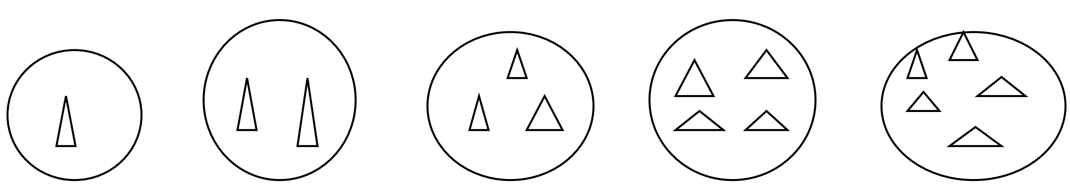


Counting of objects

b) Matching number of objects with number names



c) Ordering of sets in order of magnitude and in the natural order of sequence



1 2 3 4 5

d) Pick and count

With the activities of pick and count, teacher puts some cards on the table; children then pick a card and then count up to the number of the cards.

e) The game of dominoes.

Guide the pupils to play the game of dominoes.

Writing of numbers

Writing of numbers is developed in children through repeated association with numbers and assisting children to practice through the activities of drawing or writing numbers

i. In the air
ii. In the sand
iii. On the slate/board
iv. Using my first copy book.

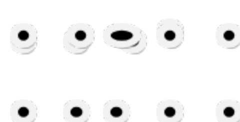
Conservation of number

Children are assumed to have understood the cardinal concept of numbers when they can

i. Recite the number name
ii. Constantly match objects with number names
iii. Realize that they will always get the same number if they count the same set
iv. Realize that the order of a set does not change the magnitude of the set.

To test that a child has conserved number, we take two sets of objects, which contain the same number of objects, say ten bottles tops each.

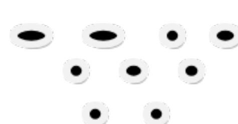
Group A



Group B

We ask children to count the number of bottle tops in each group. The objects are then re-arranged in different order as below

Group A



Group B

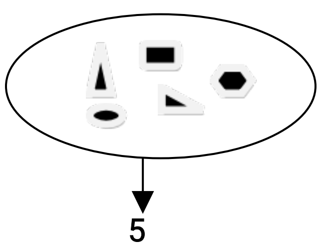
We then ask which of the two arrangements contains more objects. If they are able to say that they contain the same number of objects, then it shows that they have conserved number.

Introduction of zero

The concept of zero is introduced to children when they can appreciate the existence of counting numbers. The teacher packs objects in a container and discloses the number of objects in the container. Then the teacher start reducing the objects one after the other until all the objects exorsted.then the teacher would now find out from the children the number of objects that are left in the container, the children would then say nothing. Then the teacher would then say that, that nothing is call zero.

Cardinal number

A cardinal number is a number that will tell how many objects are in a group not in what order the numbers appear.e.g



Ordinal number

Ordinal number shows the order in which objects are arranged or grouped e.g 1^{st} 2^{nd} 3^{rd} 4^{th} 5^{th}

Nominal number

These numbers are used for identification purposes e.g a house number, a jersey number, a car number.

Basic operations on whole numbers

The basic operations on whole numbers are

i. Addition ii.subtraction iii.multiplication iv.division.

Before children are introduced to the operations on whole numbers, there are some important ideas which they are expected to understand. Some of these ideas are

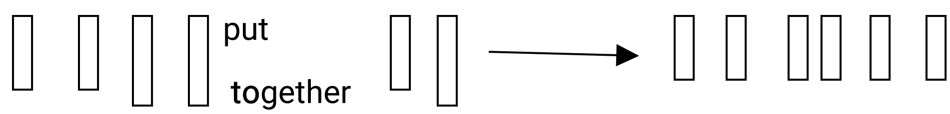
a).identification of set of objects b) matching sets of objects with the numbers. c) Ordering sets of objects d) ordering numbers e) counting of numbers f) writing down numerals.

Addition of whole numbers.

Addition is the process of putting two or more numbers together. The numbers we add are known as the addends and the result after the addition is called the sum. If 2+5=7,then 2 and 5 are the addes nd is the sum.to develop the concept of addition and the skill of addition in children,we may use the activities involving.

1) Counters or array of dots.e.g.4+2

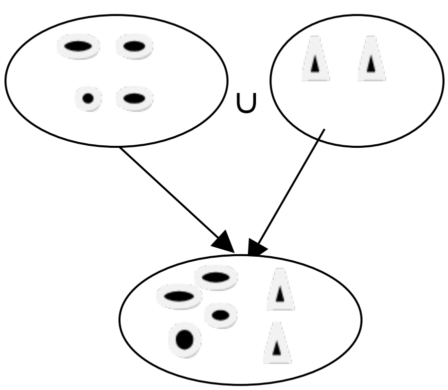
Here we take 4 counters and 2 counters and put them together and count.



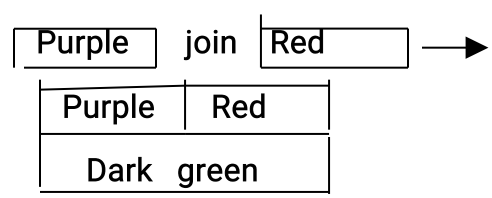
4 + 2 = 6

2) The union of disjoint sets for 4+2

We make two disjoint sets one containing 4 elements and the other two elements and find the union of the two sets.

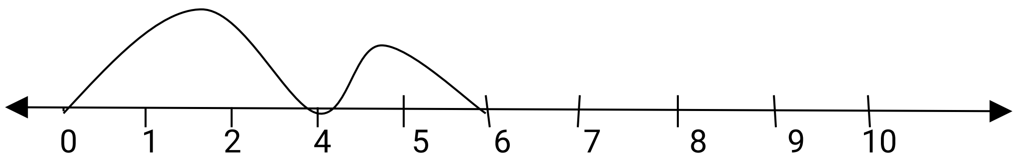


3.using cuisinaire rods for 4+ 2



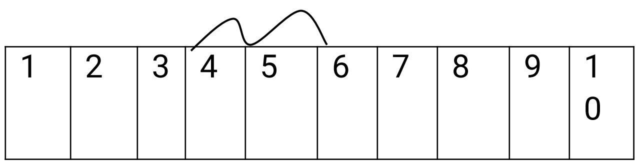
4. Using number line for 4+ 2

We draw a number line with whole numbers starting from zero we move four places to 4 and then move another two places, we will land on 6.



5. Using number track for 4+2

We draw a number track on the floor. On the number track we count on. We start from 4 and walk two places, we get to 6.



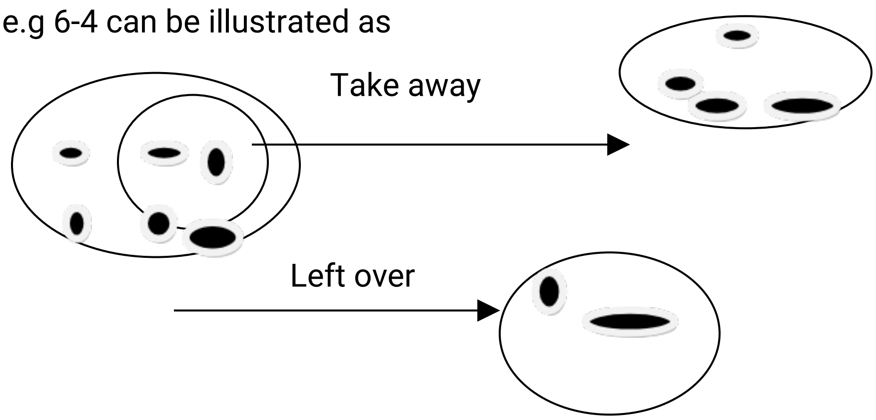
Subtraction of whole numbers

Subtraction can be taken as the reverse of addition. When we subtract, we are finding the difference between numbers. Subtraction may occur in three situations which are

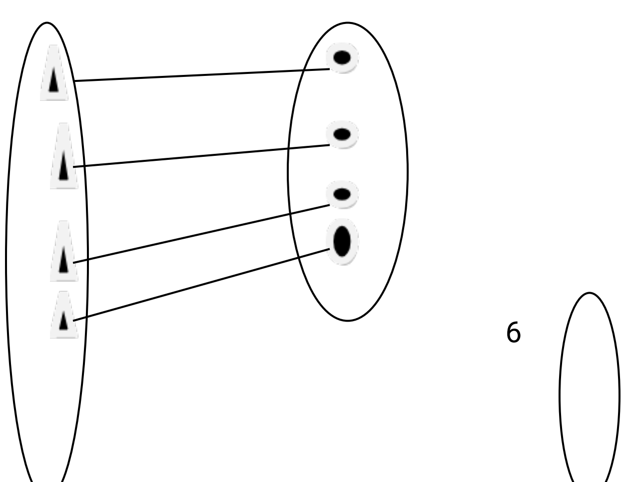
1).Take away 2).comparison 3).missing addend

1. **Take away; this** can be taken as having a set and taking some elements from it.

e.g 6-4 can be illustrated as



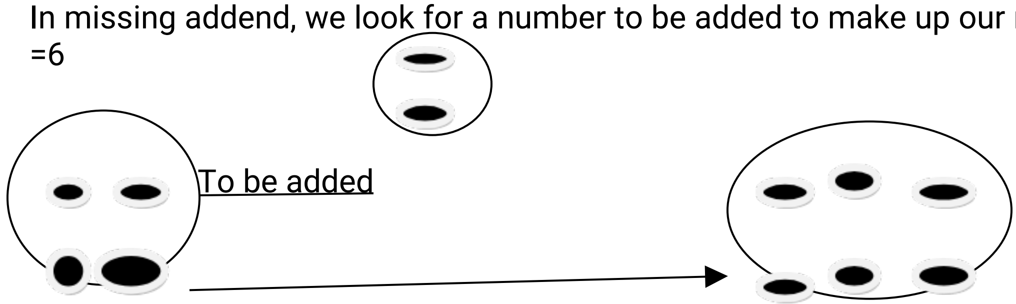
2. **Comparison**; two sets are compared by matching and then find the left over.



6 _ 4 = 2

a. Missing addend

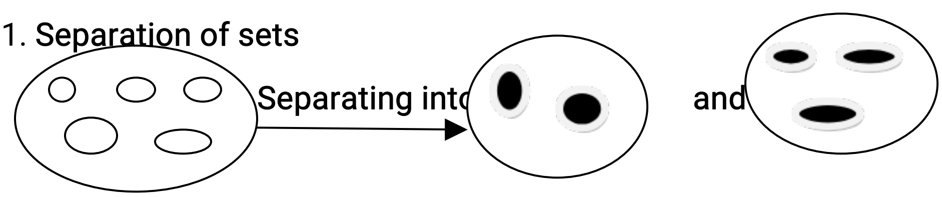
In missing addend, we look for a number to be added to make up our result.eg.4+ =6



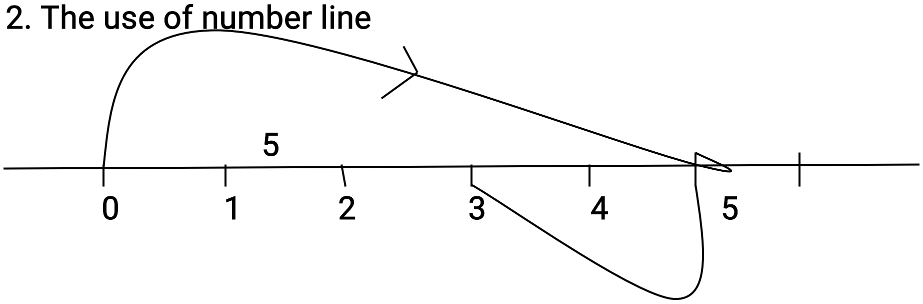
To help a child to develop skill of subtraction we may use activities involving(i) the separation of sets.(ii) the number line.(iii) matching of sets.

Let us consider how to model 5-2 with above activities.

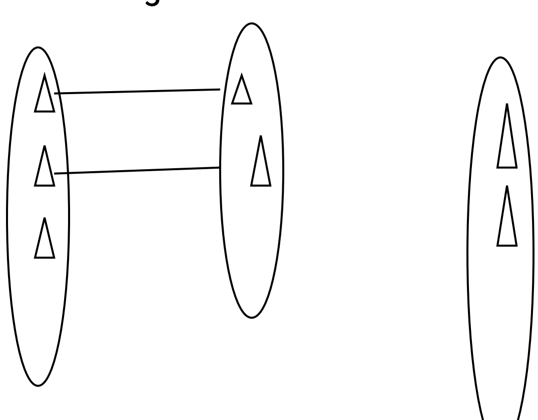
1. Separation of sets

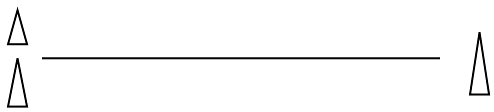


2. The use of number line



3. Matching of sets



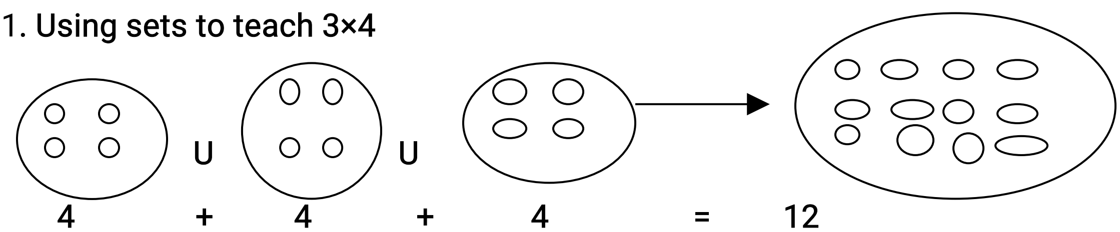


Multiplication of whole numbers

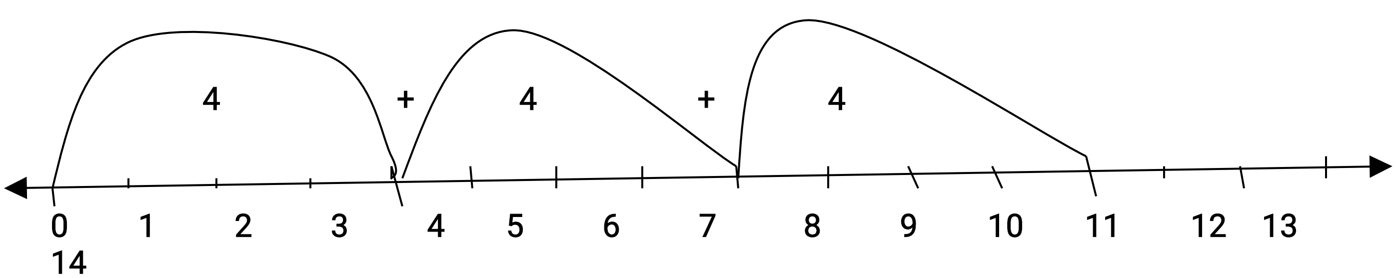
When we multiply two or more numbers, we call the result the product. We may introduce multiplication as; a) repeated addition. b) Set of sets.

a) Introducing multiplication as repeated addition For example if we want to evaluate 3×4.in repeated addition it is seen as adding 4 three times ie.3X4=4+4+4=3groups of 4,this can be model using various materials like (i) sets (ii) number line (iii) Cuisenaire rods (iv) multibase blocks

1. Using sets to teach 3×4



2. Using number line to illustrate repeated addition



We have moved on the number line 4 places 3 times.it brought us to the position of 12

3. Using cuisinaire rods to illustrate repeated addition

We take a rod of length 4 units ie the purple rod.we take 3 purple rods,join them and find a rod which will be of the same length as the 3 purple rods.this will be orange and red rods.

Purple	Purple	Purple	
Orange			Red

Division of whole numbers

Division is the inverse of multiplication. When we divide a number by another number, the result is called the quotient. The statement 12÷ 3 means 12 divided by 3.this statement could be written in different forms. This could be i)$\frac{12}{3}$ ii.$\frac{1}{3}$ of 12 iii.12×$\frac{1}{3}$.

Division may occur in three situations as; i) sharing (partitioning) ii) grouping (repeated subtraction) iii) inverse of multiplication.

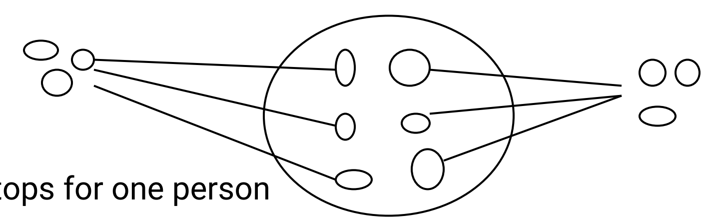
Let us interpret 12÷ 3 using the three situations of division.

1. Cut 12 things into 3 equal parts. How big is each part or Suppose 3 pupils were given 12 pens to share equally	partition sharing
2. How many groups of 3 are in 12 or How many times can you subtract 3 from 12	grouping repeated subtraction
3. What number multiplied by 3 that will give 12	inverse of multiplication

We now consider the activities which we could use to illustrate the situations of division.

1. Sharing

In sharing, we know the number of sets, and our aim is to find how many are in each set. Consider 6÷ 2.this means we are sharing 6 bottle tops among 2 children.this can be done in a "one for you and one for me bases" until all the bottle tops are finished.



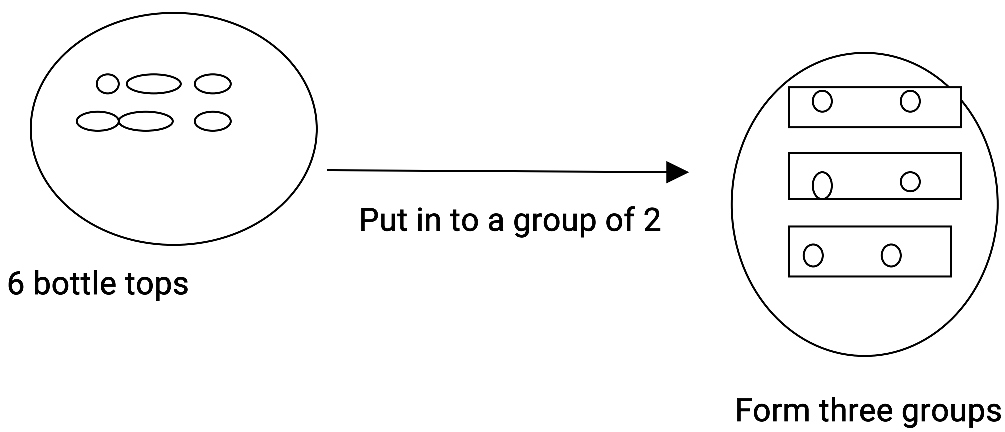
3 bottle tops for one person

3 bottle tops for another person

6 bottle tops in total

2. Grouping or repeated subtraction

6÷ 2. this is asking how many groups of 2 are in 6.here we know how many in each set and therefore we look for how many sets to be formed. We put the 6 bottle tops in a group of 2 and find how many groups will be there.



In repeated subtraction, we find how many times 2 can be subtracted from 6.

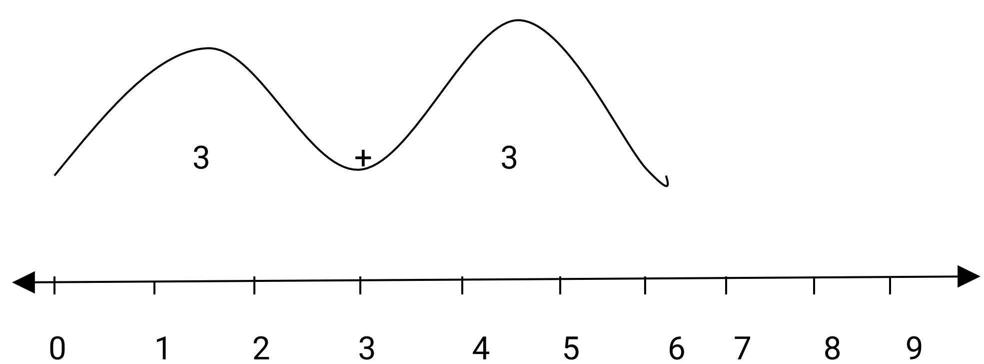
6-2=4 one we subtract two until we are left with 0 or less than 2

4-2=2 twice

2-2=0 three times

3. Inverse of multiplication

In such situation 6÷ 2 is written in the form of 2× □ =6.the question now is what must be multiply by 2 to 6.



This can be seen as how many groups of 2 will make 6 and our answer is 3.

Application of properties of operations

What do you understand by the term operations as used in mathematics? they are the four basic arithmetic signs that help us in computing numbers. They are Addition

(+).subtraction(-),multiplication (x). And division (÷)

The basic properties of operations are commutative, associative and distributive.

Commutative property of addition.

This property is seen as a general rule of addition where the order of addition does not alter the result. Therefore no matter the position of the number the result will be the same.e.g 3+5=5+3.this implies that a+b=b+a.

Commutative property of multiplication.

In general the property for multiplication states that AXB=BXA.this means that in multiplication irrespective of the order of arrangement of the numbers involved, the result will be the same.e.g 3×5 = 5×3

Associative property of addition.

We hope you are familiar with the communicative property; we now introduce the associative property of addition as a situation where irrespective of the order of operation (addition) of three quantities, the same result will be obtained. In general the associative property could be written as (A+B) + C= A + (B+ C)

For example (2 + 4) + 3= 2+ (4 + 3)= 6 + 3 = 2 +7 = 9

Associative property of multiplication

In general the associative property of multiplication can be written as (A×B)×C = A(B×C).

This means that in finding the product of three numbers, you can decide to multiply the first two numbers before multiplying the result by the third number or you may also decide to find the product of the last two numbers and multiply the result by the first number and the final in each case will be the same. For example, if you group two (2) sets of four (4) pencils three (3) times or four (4) sets three (3) pencils two (2) times. In all circumstances, the same total of 24 pencils will be available.

(2×4)×3 = 2×(4×3)

8×3 = 2×12

24= 24

Distributive property of multiplication over addition.

This concept can be explained as multiplying a number by the sum of two other numbers gives the same results as multiplying each of the addends respectively by the multiplicand and adding the results of the two products.e.g

$3(3+2)= (3x3) + (3x2)$

$3x5 = 9 + 6$

$15 = 15$

Distributive property of multiplication over subtraction.

This concept can be explained as multiplying a number by the difference of two other numbers gives the same results as multiplying each of the numbers respectively by the multiplicand and finding the difference in the results of the two products

For instance,if we consider a girl who had six eggs for breakfast,lunch and supper.how many apples would she be taken in all,if she decided to reserve two out of six apples? This can be calculated in two ways.

a) Subtract two from six snd multiply by three or

b) Multiply three by six ,multiply three by two and find the difference between the two products.it can be seen that in each case,answer is 12 apples.

$$3(6-2)= 3(3\times6)-(3\times2)$$

$$3\times4 = 18-6$$

$$12==12$$

This can be generally written as $A(B-C)==(A\times B)-(A\times C)$

UNIT THREE

INVESTIGATION WITH NUMBERS.

Natural and whole numbers.

The set of natural numbers (N) is given by:N={1,2,3,4,5……..} and the set of whole numbers(W) is given by:W={0,1,2,3,4,………}.

The intersection of N and W=N and the union of N and W=W.The smallest natural number is 1 and there is no largest natural number. The smallest whole number is 0 and there is no largest whole number.

Factors.

If one number divides a second number exactly then the first number is a factor of the second one.e.g if 3 divides 12 into 4.we say 3 and 4 are factors of 12.let us find other factors of 12. Any two numbers that multiply to get 12 those two numbers are factors of 12.

12	
a	b
1	12
2	6
3	4
4	3

The figures above shows that any number that satisfy the condition of axb=12 is a factor of 12 therefore the factors of 12 are {1,2,3,4,6,12}.the set consist of 6 numbers.

Another way factors can be explained using concrete material to children is to take pebbles, arrange them several different ways to form a rectangle.e.g

```
000000000000   1×12    000000
                       000000   2×6

0000
0000   3×4
0000

000
000
000    4x3
000

00
00
00
00     6×2
00
00

0
0
0
0
0
0      12x1
0
0
0
0
0
0
```

now factors of 12 can be written from the arrangement as 12= {1, 2, 3, 4, 6, 12}.note that when a number is repeated in a set, it is counted once.

Proper factors

We are already familiar with factors of numbers. Let us list factors of some numbers e.g 4,6,7,8,10 and 12.

4={1,2,4}   6={1,2,3,6} 8={1,2,4,8}   10={1,2,5,12}   12={1,2,3,4,6,12}

Now let us observe from all the set of factors above. Do you realize that, in all cases the number itself and 1 form part of the set of factors?

Have you also taken notice that, apart from the number itself, there are other numbers forming the set of factors. The set of factors of a number apart from the number itself are known as proper factors. From above, the proper factors are:

4={1,2} 6=={1,2,3} 8=={1,2,4} 10={1,2,5} 12={1,2,3,4,6}

Perfect ,deficient and abundant numbers

Let us complete the table below

Number	Factors	Proper factors	Sum of proper factors
6	1,2,3,6	1,2,3	1+2+3=6
8	1,2,4,8	1,2,4	1+2+4=7
9	1,3,9	1,3	1+3=4
10	1,2,5,10	1,2,5	1+2+5=8
12	1,2,3,4,6,12	1,2,3,4,6	1+2+3+4+6=16
18	1,2,3,6,9,18	1,2,3,6,9	1+2+3+6+9=21
24	1,2,3,4,6,8,12,24	1,2,3,4,6,8,12	1+2+3+4+6+8+12=36

We can tell from the table above, the numbers whose sums of factors are less than the numbers themselves are known as deficient number.

It could also be seen that the sum of proper factors of 6 is the same as 6.numbers that are the same as the sum of its proper factors let children understand that this is called a proper perfect number.

Numbers whose sum of proper factors is greater than the numbers themselves are 16,18 and 24.they are known as abundant numbers.

In conclusion we can say that:

a) Proper factors are factors of a numbers apart from the number itself

b) Deficient numbers are numbers whose sum of proper factors is less than the number itself

c) Abundant numbers are numbers whose sum of proper factors is greater than the number itself

d) Perfect numbers are those sum of proper factors is equal to the number itself.

Subsets of a given set

What do you understand by the word set? It can be explained as a well defined collection of objects. We hope you can mention some examples of a set as a set of drawing instruments, a set of counting numbers, a set of even numbers, a set of table tennis equipment etc.sets are denoted with capital letters like A,B, etc and can be represented as

A={1,2,3} or B = {4,6,7,9,13} and so on

Let us compare the two sets A and B

A={1,2,3,4,5,6,7,8,8,10}

B={2,4,6,8,10}

Have you observed that all the members in B are found in A ? .since all the members in B are found in A,we say B is a subset of set A.symbolically,subset is represented by $\subset$,so from the sets above,we write B$\subset$A or A$\subset$B.How ever if at least an element of B is not contained in A,then B is not a subset of A. this can be represented as B $\not\subset$ A.for example P={a,b,c,d.e,f.g.h,i,j} and Q={a,e,i,o} since ‘o’ is not found in the set P,it means that Q is not a subset of P ,s0 we write Q P.

Listing subsets of a given set.

Let us investigate the number of subsets in a given set.if A={1,2,3},List all the possible subsets of A.the subsets are { },{1},{2},{3},{1,2},{1,3},{2,3},{1,2,3}.

Let us consider another example.set B={a,b}={ },{a},{b},{a,b}.the indication is that every member of the set is a subset of the given set,and every set is a subset of it self and a null or empty set is also a subset.

A given set and a null set of any set are called improper subsets.all other sets are proper subsets.

Let us consider the pattern below to establish a relationship between the number of members of a set and the number of subsets.

SET	SUBSETS
{ }	{ }
{1}	{ },{1}
{1,2}	{ },{1},{2},{1,2}
{1,2,3,}	{ },{1},{2},{3},{1,2},{1,3},{2,3},{1,2,3}

{1,2,3,4}	{ },{ 1},{2 },{3 },{4 },{1,2 },{1,3 },{1,4 },{2,3 },{2,4 },{3,4 },{1,2,3 },{1,2,4]},{1,3,4 },{2,3,4 },{1,2,3,4 }

From the table above, another table could be built as follow

Number of elements (n)	Number of subsets	Relation
0	1	2^0
1	2	2^1
2	4	2^2
3	8	2^3
4	16	2^4
5	32	2^5
-		
N		2^n

Pupils can now observe that the exponent is the same as the number of elements (n) in the set. Generally the number of subsets that can be formed from a set is given as 2^n.

Prime factorization

Prime factorization is a way of expressing a number as a product of prime numbers. Factor tree can be used to find the prime factorization of numbers. This very often used and enjoyed by children e.g let us see how we would use factor tree to find the prime factors of 42 and 48.

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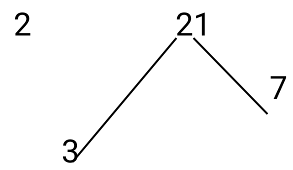
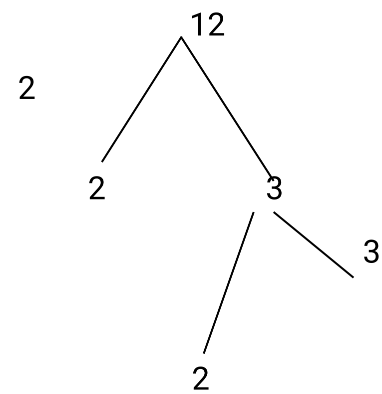


$42=2x3x7$



$48=2x2x2x2x3 \quad =2^4x3$

The Highest Common Factor (H.C.F)

The highest common factor or sometimes called the greatest common factor(G.C.F) or greatest common divisor (G.C.D) of two or more numbers is the highest number which is a factor of all the given numbers.

To find the H.C.F of 24,36 and 48,we find the factors of 24,36 and 48.

Factors of 24 are ;{1,2,3,4,6,8,12},factors of 36:{1,2,3,4,6,9,12,18,36},factors of 48:{1,2,3,4,6,8,12,16,24,48}.

The common factors of 24,36 and 48 are {1,2,3,4,6,12}.therefore the H.C.F of 24,36 and 48 is 12.

The least common multiple (L.C.M).

The least common multiples of two or more numbers are the smallest counting number that is a multiple of each of the given numbers. The L.C.M. of two or more numbers can be found using the multiples of the numbers.e.gfind the L.C.M of 3, 4,6.

Multiples of 3={3,6,9,12,15,18,21,24………}

Multiples of 4={4,8,12,16,20,24,28,32,36,…..}

Multiples of 6={6,12,18,24,30,36……}.the common multiples of 3,4 and 6 are {12,24,36,….}.

The least common multiple of 3,4 and 6 is 12.

Children can use table below to find prime numbers and composite numbers

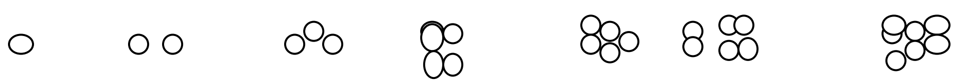
Numbers	Set of factors	Number of factors
1	(1)	1
2	(1,2)	2
3	(1,3)	2

4	(1,2,4)	3
5	(1,5)	2
6	(1,2,3,6)	4
7	(1,7)	2
8	(1,2,4,8)	4
9	(1,3,9)	3
10	(1,2,5,10)	4
11	(1,11)	2
12	(1,2,3,4.6.12)	6

Even and odd numbers.

Looking at the table we can see that some of the numbers have 2 in the set as a factor such numbers are call Even numbers. Those that do not have 2 as a factor in their set are call Odd numbers.

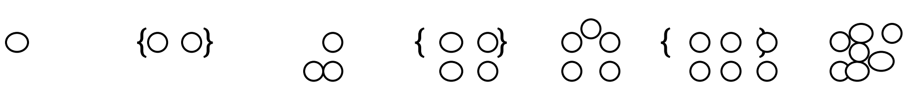
To help pupils to develop the concept of even and odd numbers children need to be taken through grouping of objects in twos. Children are asked to use pebbles in this activity. They group pebbles into ones, twos, threes, fours etc.e.g



1 2 3 4 5 6 7

Children are then guided to find the numbers which can be paired and those numbers which cannot be paired. The paired numbers should be put in to bracket.

Group pebbles into ones, twos, threes, fours etc.e.g



Children realized that those numbers which can be paired are 2,4,6,etc these numbers are called even numbers and those not in the bracket are called odd numbers.

Multiples of numbers

We see that 2 is factor of 6.if 2 is a factor of 6 then we say that 6 is a multiple of 2.this shows that if a number ‘a’ divides a number ‘b’ exactly then ‘a’ is a factor of ‘b’ then ‘b’ is a multiple of ‘a’.e.g 4 is a factor of 20 and 20 is a multiple of 4.with our example, we can see that (i) the set of multiples of 2={2,4,6,8…} (ii) set of multiples of 3={3,6,9,12,15,18…}note that the set of multiples of numbers is infinite set.

Prime and composite numbers.

Guide children to write numbers from 1 to 100 in a 10x10 grid paper as;

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Children find out that (1) cannot divide any given number hence one is not included. Starting from 2, children circle 2 and cross out all numbers 2 can divide without a remainder in the 10x10 grid paper. The next number is 3 circle the 3 and cross out all the numbers that 3 can divide without any remainder. The next number is 5, circle it and cross out any number that 5 can divide without any remainder. This is carried out till every number is taken care of.

Children then write all the numbers which were circled. These numbers are called prime numbers.

Refer pupils to the first table to find out that all numbers that have more than 2 factors are called composite numbers

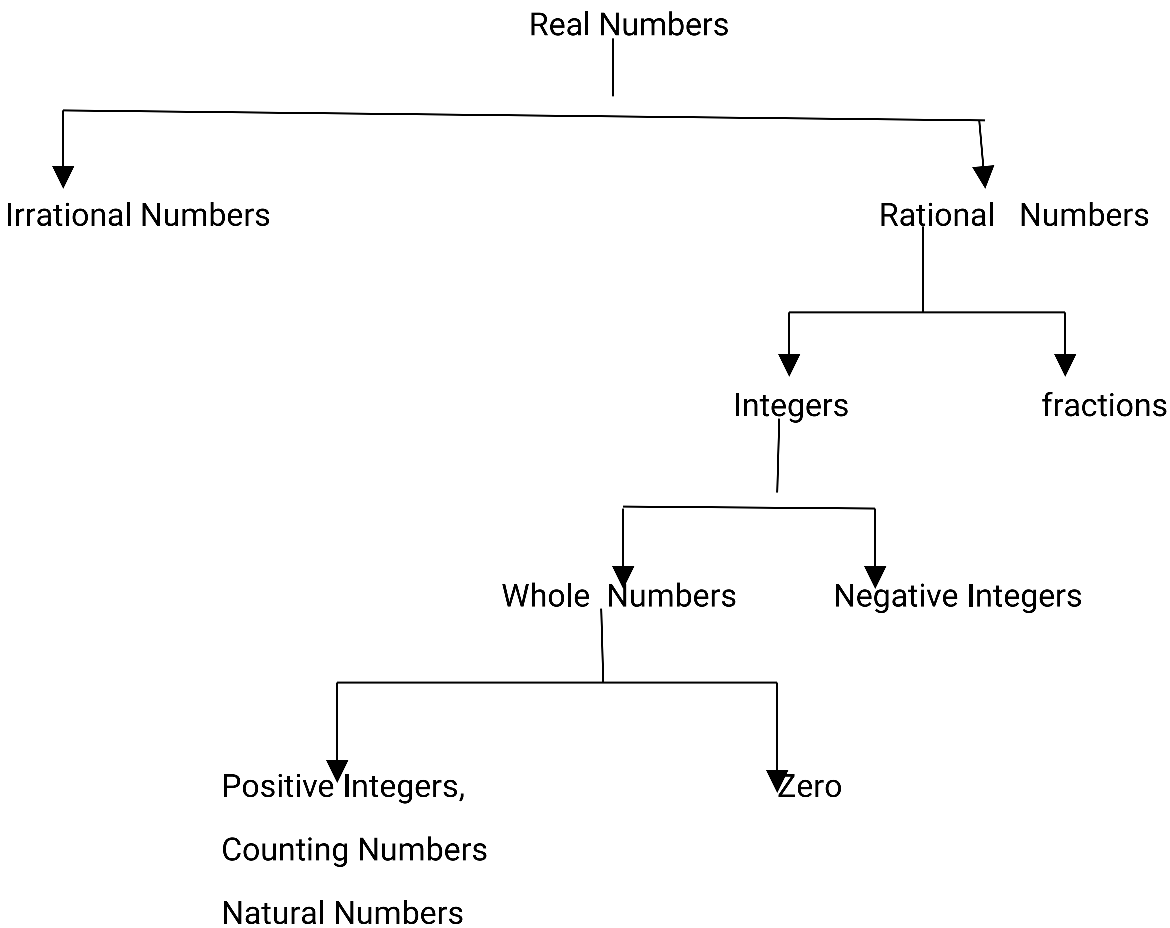
UNIT FOUR

TEACHING RATIONAL NUMBERS

What is a real Number?

The set of all rational and irrational numbers is known as the set of real numbers. Thus the set of real numbers is the union of the set of rational numbers and the set of irrational numbers.

Real Numbers={Rational Numbers}∪ {Irrational numbers}



Rational Numbers

Rational numbers are numbers which can be expressed as the ratio of two integers like $\frac{a}{b}$ where a and b are integers where $b \neq 0$ e.g. $\frac{2}{3}, \frac{2}{1}, \frac{6}{5}$ etc.

The set of rational numbers consists of integers and fractions, both positive and negative. A rational numbers can be converted into a decimal which may be terminating or repeating.

Terminating and non-terminating fractions

Repeating Decimal

For children to have an idea about terminating and repeating decimal. They need to work problems of converting common fractions to decimal fractions.

e.g expressing common fractions like.i) $\frac{1}{2}$,ii $\frac{3}{8}$, iii $\frac{17}{4}$,iv $\frac{2}{3}$ v $\frac{14}{11}$ in to decimal fractions

solution

$$\frac{1}{2} = 0.5,\ \frac{3}{8} = 0.375,\ \frac{17}{4} = 4.25 \quad \frac{2}{3} = 0.666....\ \frac{14}{11} = 1.2727.....$$

We see that the fractions $\frac{1}{2}$,$\frac{3}{8}$,and$\frac{17}{4}$,come to an end when expressed as decimals.such numbers are called terminating decimals.however the fraction $\frac{2}{3}$ and $\frac{14}{11}$ do not come to an end when expressed as decimals, such numbers are called repeating decimals.

In $\frac{2}{3}$ 6 is repeated in the numbers.in $\frac{14}{11}$,2 and 7 are repeated.

We indicate that a decimal numeral is repeating by placing dots over the digits which repeated themselves. For example$\frac{2}{3}$ = 0.666....is wrtten as $0.\dot{6}$,$\frac{14}{11}$ = 1.2727.....is written as $1.\ddot{2}\ddot{7}$ .for a number which has more than 2 digits repeating,we place dots over the first and the last of the digits that repeat.thus 3.324132413241..... is written as $3.\dot{3}24\dot{1}$.

Example

Show to a J H S. Child that a repeating decimal like i) $0.\dot{3}$ and $1.\ddot{2}\ddot{7}$ Can be represented as the ratio of two integers and hence a rational number.

Solution

Let $x= 0.\dot{3}$ --------------- (i)

Multiply equation 1 by 10

$10x=3.\dot{3}$ ………………… (ii)

Subtract equation one from equation two

$$10x=3.\dot{3}$$

$$-x=0.\dot{3}$$

$$9x= \quad 3.0$$

$$X=\frac{3}{9}$$

$$X=\frac{1}{3}$$

Consider $1.\dot{2}\dot{7}$

Let $y=1.\dot{2}\dot{7}$ …………………equ 1

Multiply equat. 1 by 100

$100y=127.\dot{2}\dot{7}$…………..equat.2

Subtract equation 1 from equation 2

$99y=126$

$$Y=\frac{126}{99}$$

$$Y=\frac{14}{11}$$

Irrational Numbers

A rational number corresponds to points on the number line, but there are points on the number line that do not correspond to any rational number. Such numbers are called irrational numbers. Irrational numbers are numbers whose decimals are neither terminating nor repeating e.g.1.01002000300000400000005---------, 2.313113111311111311111113……

Numbers like these, do not end or repeat themselves, they only follow a pattern. Such members are called irrational numbers.

Irrational numbers cannot be expressed as the ratio of two integers but they however correspond to definite points on the number line.

We can not find the actual value of an irrational number.

Examples of irrational numbers are

c) The ratio $c/d=\pi$

d) The square roots of numbers like $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$

Teaching of fractions

The word fraction is describing how the material you are holding is not complete or in your possession is not whole. Therefore we can conclude that fraction is part of the whole object. We may look at fraction in three different ways, part of a whole, part of a group, ratio of comparing two quantities.

Fraction can be introduced by letting pupils experience the action of dividing a concrete material into several equal parts.

For children to form the concept of fraction, they should have practical experiences such as

i. Breaking a stick into equal parts

ii. Folding paper into equal parts

iii. Cutting a strip into equal parts

iv. Finding how many times the content of a small container will go into a larger container

Development of fractions

The best sequence of the development of fraction may be:

i. The meaning of fraction

ii. Writing down fractional notation

iii. Equivalent fractions

iv. Addition and subtraction of fractions a) with the same name b)with different name c)with mixed number fractions

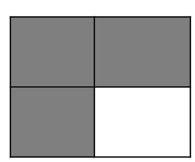
v. Multiplication of fractions a) by a whole number b) by another fraction

vi. Division of fraction a) by a whole number b) by another fraction.

When introducing fractions to children, it is very important to always name your whole, the whole should not necessary be a unit object. The whole can be one unit, a group .let children be aware that in fraction, we measure part of what we have and compare to our original.

Naming of fraction.

A fraction is represented by two numbers separated by a division bar.



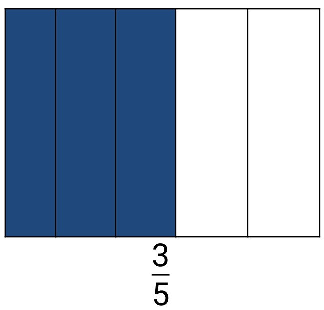
$\frac{3}{4}$

Looking at the fraction $\frac{3}{4}$ .the bottom number is called the denominator and it gives us the name of the fraction and indicates, in to the number of equal parts the whole is divided. The top number is called numerator, it gives the number of parts taken.

Let us go through some activities to see how fraction can be named.

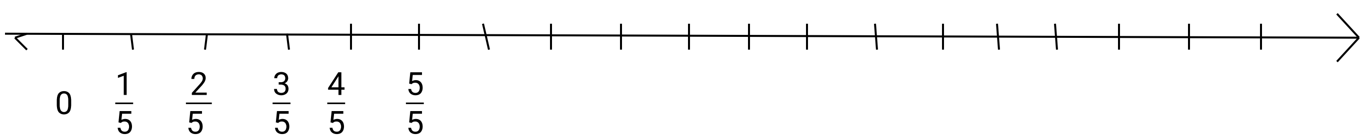
ACTIVIT 1

Folding paper in to equal parts.



ACTIVITY 2

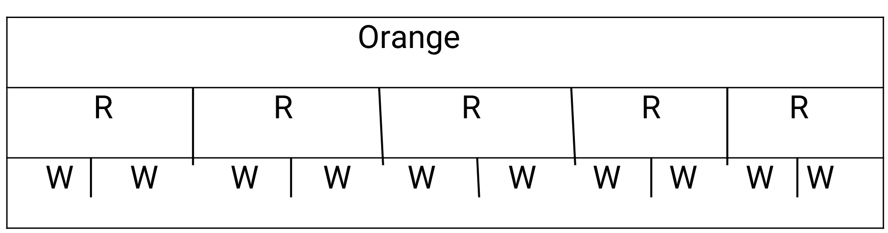
Fractions on the number line



ACTIVITY 3

Using Cuisenaire Rods

In the activity we choose any rod or a set of rods to be our whole. We then make up a row of the same length as our original whole using rods of the same colour.see the diagram below



One R represents $\frac{1}{5}$ of the orange so three R represents $\frac{3}{5}$ of the orange

One W represent $\frac{1}{10}$ of the orange   Two W represents $\frac{2}{10}$ of the orange rod.

Equivalent Fractions.

The term equivalent is made up of two words which may be interpreted as “equal in value” therefore Equivalent fractions are forms of fractions that are equal in value.

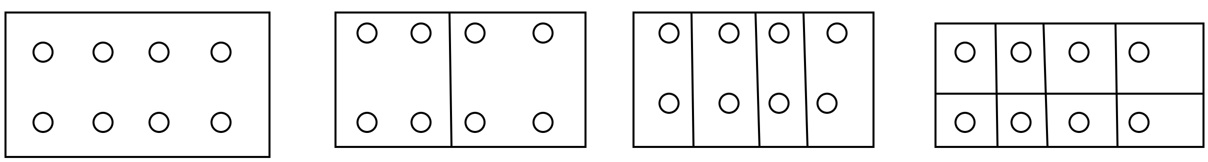
Equivalent fractions may be defined as fractions which represent the same number but have different names. E.g. $\frac{1}{2}, \frac{2}{4}, \frac{3}{6}, \frac{4}{8}$ etc.

To show the equivalence of fractions such as 1/2, =2/4=4/8, we can use materials like;

a) Sets   b) Cuisenaire rods c) paper folding d) fractional board e) number line

(a) Using Sets

Consider a set with say eight members. Divide the set into two equal parts. Further subdivide into four equal parts and then eight equal parts.



A set of 8 members   Divide into 2 equal parts   Divide 4 equal parts   Divide 8 equal parts.

(b) Using Cuisenaire Rods

Choose any rod or set of rods to be your whole.e.g orange and dark green. You then make up as many rows using rods of one colour only e.g. all red or blue etc.

Each must be of the same length as the original whole chosen. You may make a diagram of rods and write down your observation.

Orange					Dark Green		
Brown				Brown			
Purple		Purple		Purple		Purple	
Red	Red	Red	Red	Red	Red	Red	Red

W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W

Making coloure observations,we may have.

i. Two brown make the orange/dark green whole
ii. Two purples make one brown
iii. Four purples make the orange/dark green whole
iv. Two reds make 1 purple
v. Four reds make one brown
vi. Eight reds make the orange/dark green whole
vii. Four whites make 1 purple
viii. Eight whites make one brown
ix. Sixteen whites make the orange/dark green whole

These colour observations can then be turned into fractional statements as;

i. A brown is one half of the orange and dark green whole
ii. A purple is one fourth of the orange and dark green whole
iii. A red is one eighth of the orange and dark green whole.

Comparing,we see that 8 whites=4 reds=2 purple=1 brown.

I.e $8(\frac{1}{16})=4(\frac{1}{8})=2(\frac{1}{4})=1(\frac{1}{2})$ =8/16=4/8=2/4=1/2

(c) Using fractional Board.

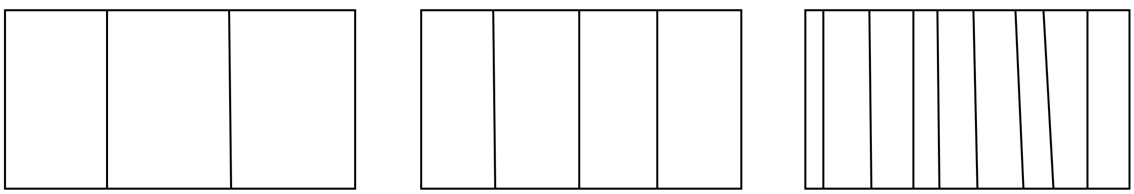
ONE WHOLE							
$\frac{1}{2}$				½			
¼		¼		¼		¼	
1/8 1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
1/16							

From the board you can find out how many one fourths are in halves

(d) Using paper folding.

Let us see how we can use paper folding to describe to a primary five pupils that 2/3,4/6 and 6/9 are equivalent.

Take three equal size of sheet of papers. Fold one into 3 equal parts and shade 2 parts which represent2/3.Fold another one into 6 equal parts and shade 4 parts which represent 4/6.Fold the third sheet into 9 equal parts and shade 6 parts which represent 6/9.compare the three shaded sheets. What do you notice?



2/3 4/6 6/9

Comparing fractions

Children must be able to compare fractions to tell which of the fractions is less or greater than the other or equal to the other and also be able to arrange fractions in order of magnitude ie in ascending or descending order.

Fractions may be compared using

i. Idea of equivalent fraction
ii. Converting fraction into decimal fractions
iii. Expressing fractions as percentages
iv. Using concrete materials

For example let us consider the fractions $\frac{4}{5}$ and$\frac{3}{4}$

Method 1.

Using idea of equivalent fractions.

You find the L CM of 4 and 5 which is 20 find out the numbers of times 5 will divide 20, use that number to multiply both the denominator and the Numerator $\frac{4\times4}{5\times4} = \frac{16}{20}$ this is for the first fraction.theSecond fraction it will be $\frac{3\times5}{4\times5} = \frac{15}{20}$ since the Denominators of the two fractions are equal we can now Compare the numerators. Since 16> 15 therefore$\frac{4}{5} > \frac{3}{4}$.

Method 2

Converting the common fraction into decimal fraction and compare the two fractions to find out which of them is greater than the other.

Eg.$\frac{4}{5}$ = 0.8 $\frac{3}{4}$ =0.75 .let us now find out the digit after the point which one is greater than the other that fraction is the greatest.since 0.8 is greater than 0.75 the fraction $\frac{4}{5}$ is greater than the fraction $\frac{3}{4}$.

Method 3.

Using percentages

Take the fractions and multiply them by 100 .the fraction that have the highest percentage is greater than the other.

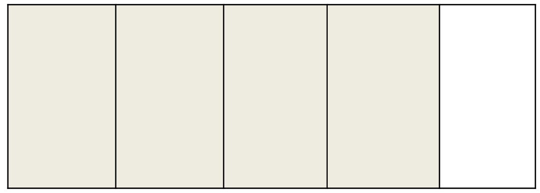
$\frac{4}{5} = \frac{4}{5}\times100 = 80\%$ $\frac{3}{4} = \frac{3}{4}\times100 = 75\%$

Since $\frac{4}{5}$ is equal to 80% and $\frac{3}{4}$ is 75% we conclude that the fraction $\frac{4}{5} > \frac{3}{4}$.

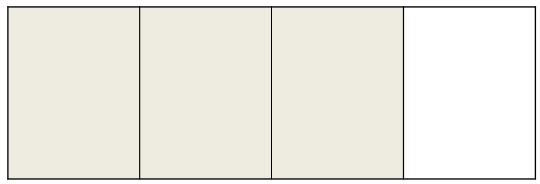
Method 4:

Using concrete material

We take two rectangular sheet of paper of equivalent shape. We fold one into five equal parts and then shade 4 parts to represent $\frac{4}{5}$.the other paper is then folded into four equal parts.then 3 parts are shaded to represent $\frac{3}{4}$.



$\frac{4}{5}$



$\frac{3}{4}$

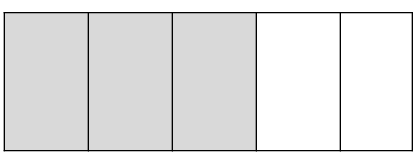
The two papers are brought side by side and then compared the shaded portion. It would be observed that the shaded portion for 4/5 is bigger than ¾.

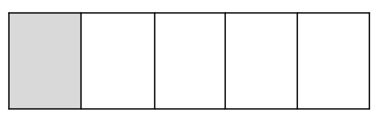
Operation on common Fraction.

To develop operations of fractions in children,we need to use materials like;Cuisinaire rods,paper folding and number line to name a few.

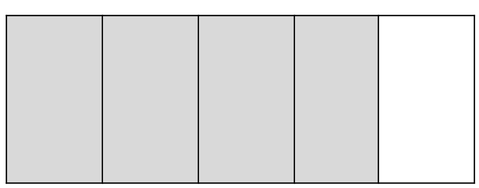
Addition and Subtraction of fractions

Using paper folding $\frac{3}{5} + \frac{1}{5}$





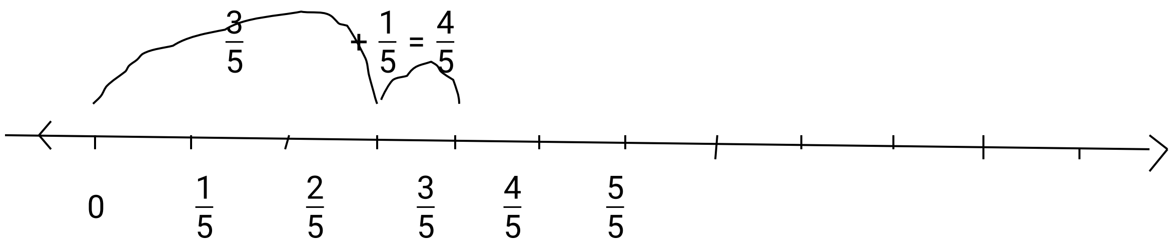
$\frac{3}{5}$ $+$ $\frac{1}{5}$



$\frac{4}{5}$

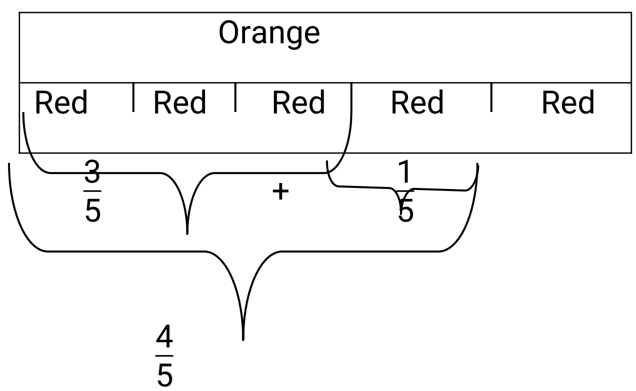
guide pupils to take two similar sheets of paper.guide them to divide one sheet into 5 equal parts and shade 3 parts take the second sheet and divide it also in to 5 equal parts and shade 1 part since the denominator is the same take the third sheet divide it also into 5 equal parts and count the number of shaded portions we have in the 2 sheets and use it to shade the third sheet and that will give you fourth fifth .

Using number line.



Using cuisinaire Rods

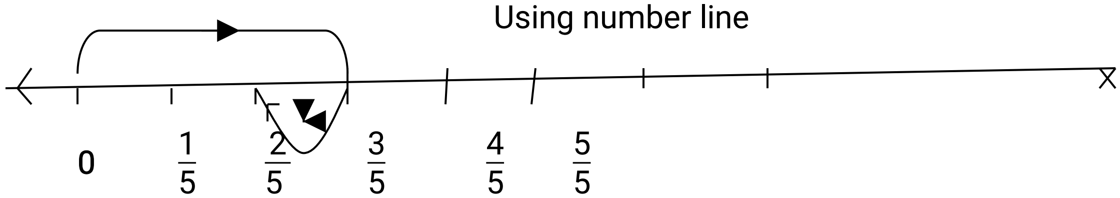
Choose a rod to be your whole. Here we choose the orange rod as a whole, then the red rods are each one fifth.



Let us do subtraction

$$\frac{3}{5} - \frac{1}{5}$$

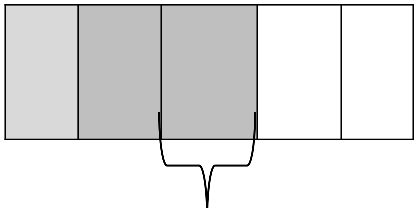
Using number line



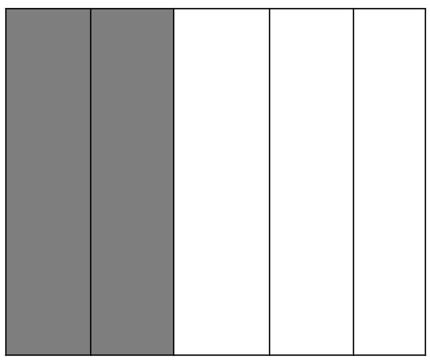
Using paper folding.

$$\frac{3}{5} - \frac{1}{5}$$

Take away the first shaded portion

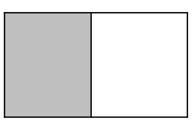


We will be left with $\frac{2}{5}$

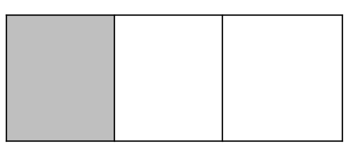


Addition of fractions with different denominator .

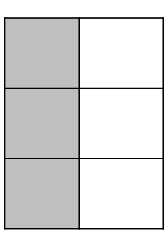
$\frac{1}{2} + \frac{1}{3}$



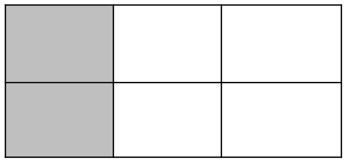
$\frac{1}{2}$ +



$\frac{1}{3}$

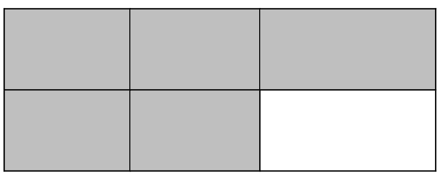


$\frac{3}{6}$ +



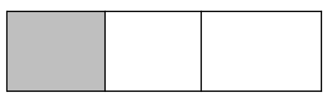
$\frac{2}{6}$

Now that the two fractions have the same denominator we can add the fraction.

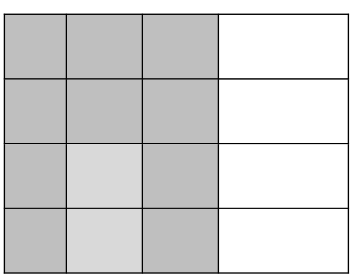


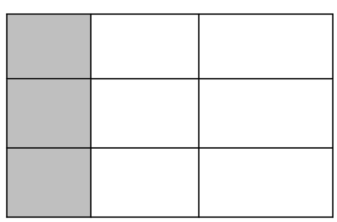
$\frac{3}{6}+\frac{2}{6} = \frac{5}{6}$

Let us now subtract $\frac{3}{4}-\frac{1}{3}$



$\frac{3}{4}$ - $\frac{1}{3}$





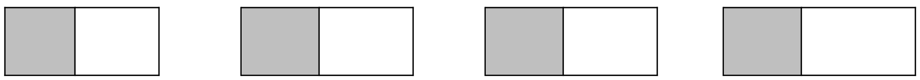
$\frac{9}{12}$ - $\frac{3}{12} = \frac{6}{12}$

Since the denominator are equal now we can subtract the numerators

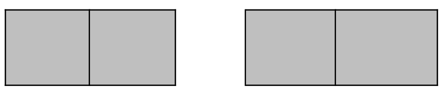
MULTIPLICATION OF FRACTION.

Multiplication of a common fraction by a whole number and vice versa could be seen as repeated addition of the given fraction.the whole number would indicate the number of times the fraction is to be added to itself.e.g $\frac{1}{2}$x4

Using Paper folding.

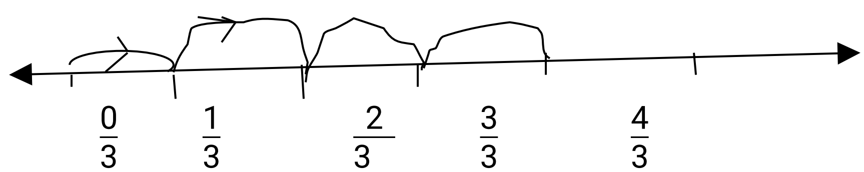


4 identical sheets of paper,each one is divided into 2 equal part and one-half of each is shaded and put together.the result is 4 halves.this is 2 whole papers.



This becomes 2 papers.

Using number line.



Solve the following

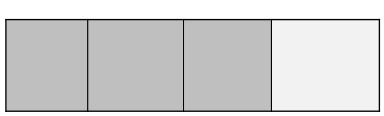
$\frac{1}{3}$x4

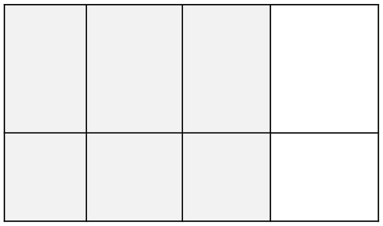
This is taking $\frac{1}{3}$ four times, equal to $\frac{4}{3}$ or $1\frac{1}{3}$

Multiplication of fraction by another fraction

For example $\frac{1}{3}$x$\frac{3}{4}$

This could be explained as $\frac{1}{3}$ of$\frac{3}{4}$ .using paper folding, take a sheet of paper, fold into four equal parts and shade 3 parts. Divide the $\frac{3}{4}$ in to 3 equal parts and re-shade a third of what fraction is the re-shaded/double shaded portion to the whole.





$\frac{3}{12}$ to find the answer, the double shading is the numerator and the squares in 1 unit square is the denominator=$\frac{3}{12}$

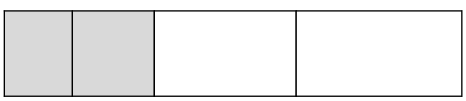
Division of Fractions.

Division of common fraction by a whole number.

$\frac{1}{3}$ divided by 2 means sharing $\frac{1}{3}$ into 2 equal parts.

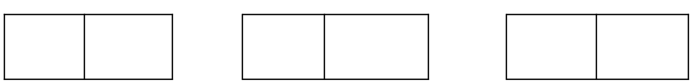
Using Paper Folding.

Take a sheet of paper, fold into three equal parts and shade a third. Share the one third into 2 equal parts. Compare your results to the entire whole. Thus$\frac{1}{3} \div 2 = \frac{1}{6}$.



This become $\frac{1}{3}$x$\frac{1}{2}$=$\frac{1}{6}$

Again 3×$\frac{1}{2}$. This is explained as how many halves are in 3 whole?



This is 3×$\frac{1}{2}$ = 6.

Division of common fraction by another common fraction

One of the meaning of division of a common fraction by a fraction is represented by how many times can the divisor be subtracted from the dividend e.g:$\frac{1}{2} \div \frac{1}{4}$

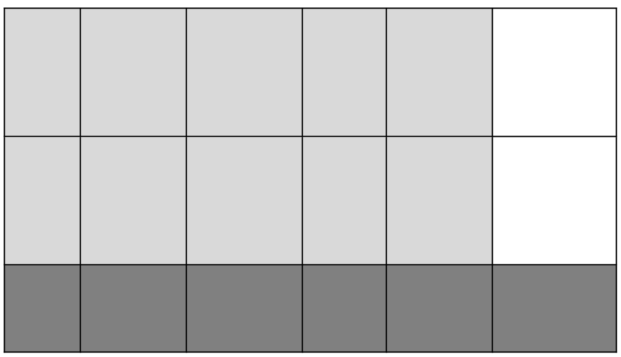
Using paper folding

Take a sheet of paper,divide it into two equal parts.now determine the number of quarters that the whole could be obtained from the half.

$\frac{1}{4}$

There are 2 quarters in a half. Therefore $\frac{1}{2} \div \frac{1}{4}$= 2 thus $\frac{\frac{1}{2}}{\frac{1}{4}} \times \frac{\frac{4}{1}}{\frac{4}{1}} = \frac{1\times4}{2\times1}$ = 2.

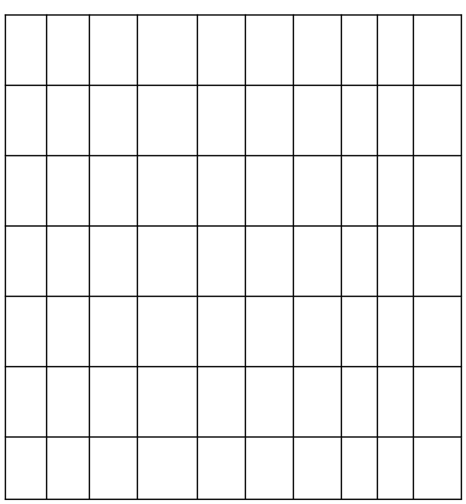
$$\frac{5}{6} \div \frac{1}{3}$$

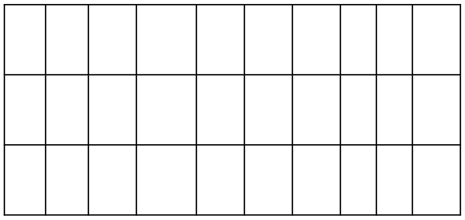


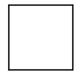
In the diagram above $\frac{5}{6}$ occupies 15 boxes, while $\frac{1}{3}$ occupies 6 boxes of the whole.divding 15 by 6 is $\frac{15}{6}$ or $\frac{5}{2}$,therefore $\frac{5}{6} \div \frac{1}{3} = \frac{5}{2}$

Decimal Fractions.

In decimal fractions we represent $\frac{1}{10}$ as o.1 (tenths)as o.o1 (hundredths).again materials to use is the multibase blocks.

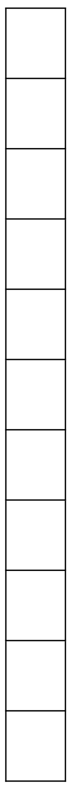






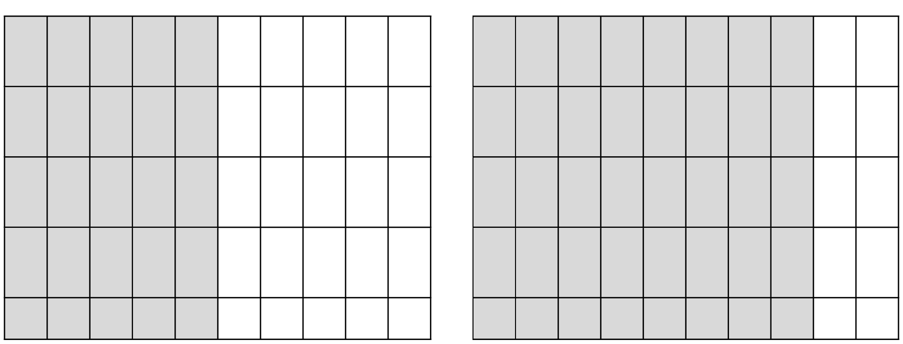
1 unit

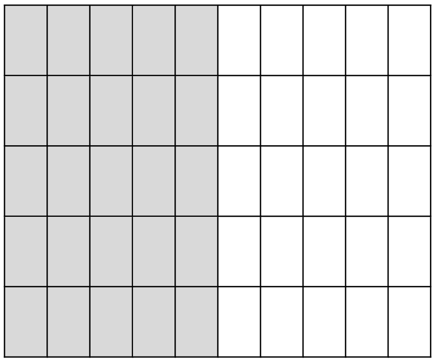
0.01 (hundredth)



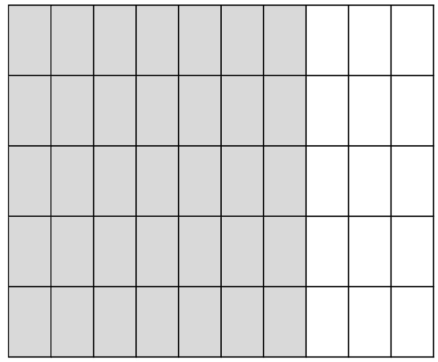
0.1(tenth)

The flat, long and unit represent unit, tenth and hundredths respectively.e.g 0.2 can be shaded as





0.5

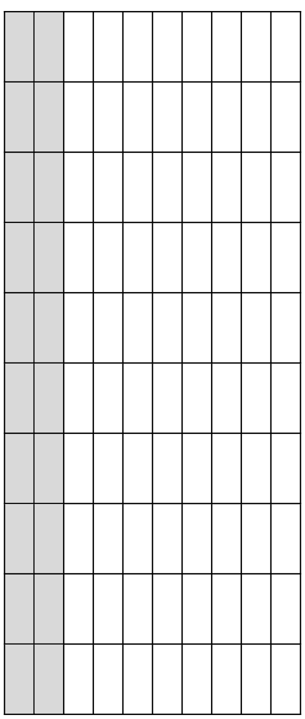


0.75

The first shaded region is five-tenth,second is seventy-five-hundred.

Changing common fraction to decimal fraction.

Eg change $\frac{1}{5}$ to decimal fraction.$\frac{1}{5}=\frac{1x20}{5x20}=\frac{20}{100}=0.2$ the flat can be used for this activity.it contains 100 squares and it is divided into five equal parts which is twenty hundred (0.20).



0.2

$\frac{1}{5}$ can also be divided using long division method .

Changing decimal fractions to a common fractions

Change 0.25 to a common fraction .thus $0.25=\frac{25}{100}=\frac{1}{4}$ .similarly $0.5=\frac{5}{10}=\frac{1}{2}$.

Convert $0.\dot{3}$ to common fraction.

i. Let $x=0.\dot{3} \rightarrow (1)$ multiply both sides by 10 .$10x=3.\dot{3} \rightarrow (2)$ .1.2. 9 = 3 9, $= \frac{1}{3}$.

Write $0.\ddot{12}$ as a common fraction. Let $x=0.\ddot{12} \rightarrow (1)$ multiply by $100 \rightarrow 100x=12.\ddot{12} \rightarrow (2)$

UNIT FIVE

TEACHING RATIO AND PERCENTAGES

A ratio is a pair of positive numbers that is used to compare two quantities or two sets.

The idea of ratio is the comparison of two or more quantities in the same dimension or unit.

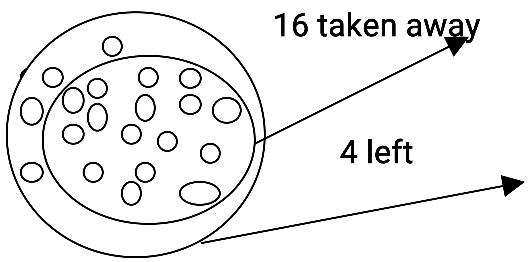
Step 1

To teach ratio guide pupils to share oranges. The sharing can be when one person takes two oranges the other person takes three oranges by so doing we can say that the oranges have been shared in the ratio of two is to three. To compare two quantities, we can ask how much more is one quantity more than the other quantity.

Step 2

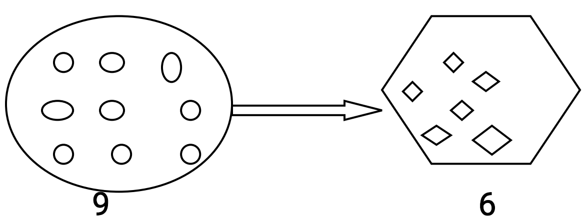
Another way of teaching ratio is to let pupils compare two quantities or numbers by finding the difference between the two numbers. For example. How many more is 20 than 16?

The result of how many more is 20 than 16 is illustrated below. There are 20 objects that are circled .when 16 is taken away, 4 is left.



We can also compare two number or quantities by finding how many times of one is the other?

Let pupils compare two numbers or quantities by finding how many times one is as many as the other and write this as ratio.example,9 is one and half times as many as 6 because $\frac{9}{6} = \frac{3}{2} = 1\frac{1}{2}$.this is illustrated below where members of the first set is compared with members of the second set.



Thus we write this ratio as 9: 6

Get more examples on this and work them.

Step 4

After finding ratios of many pairs of quantities or numbers, let pupils find and simplify the ratios. For example the ratio 9:6 can be simplified to get 3:2 since $\frac{9}{6} = \frac{3}{2}$. Group pupils into two and let them find the ratio of the two groups of pupils.

Work more examples with pupils. We can divide a quantity or a number into a given ratio. For example divide oranges in to the ratio of 2:3 we first find the total number of parts into which 15 oranges are divided.

Ie 2+3=5.for the first number; we find $\frac{2}{5}\times 15$, which is 6.similarly the second number is $\frac{3}{5}\times 15 = 9$.therefore,dividing 15 oranges in to the ratio 2:3 is 6 oranges and 9 oranges. Work out more examples of this with pupils.

PROPORTION

The ratio 8 to 40(i.e. 8:40) may be simplified to its lowest term as 1 to 5.this is because $\frac{8}{40} = \frac{1}{5}$.this fraction $\frac{1}{5}$ is the same as the ratio 1:5.an equality of two or more ratios is called proportion. Proportions are useful in problem solving.

For example, if the ratio of teachers to students is 1 to 15 and there are 210 students in a school, how many teachers are there in the school?

In solving this problem, we can represent the number of teachers in the school by n then by proportion we have.

$$\frac{1}{15} = \frac{n}{210}$$

Now we multiply the numerator and denominator of $\frac{1}{15}$ by the same number to get the result in an equal fraction.(note;15×15 = 210) hence $\frac{1\times 14}{15\times 14} = \frac{14}{210}$ so the number of teachers in the school is 14.

Another approach is to cross multiply and find n ie
$\frac{1}{15} = \frac{n}{210} \leftrightarrow 15n = 210 \leftrightarrow n = \frac{210}{15} = 14$.

Use proportion to find if two pairs of numbers or quantities are in proportion.

Example:are the following pairs of quantities in proportion? 5 litres,3 litres and 10 hours,6hours.

To answer this question we write the two ratios and compare to see whether they are the same.

Thus 5 litres,3 litres=5:3

10 hours,6 hours=10:6=5:3

Hence the quantities are in proportion.

To solve problems on direct proportion

Method 1

Use unitary method to solve the problem.

For example:two bags of rice cost Gh¢32.00.find the cost of 5 bags of rice.

Cost of 2 bags of rice=Gh¢32.00

Thus the cost of 1 bag of rice= Gh¢$\frac{32.00}{2}$

The cost of 5 bags of rice=Gh¢$\frac{32.00}{2}\times 5$

= Gh¢80.00

Work more examples on this method with pupils

Method 2.

Use ratio method to solve problems on direct proportion

For example: four oranges cost 8oGp. What is the cost of 12 oranges?

We let the cost of the 12 oranges be ¢N.then by equal ratios, we have

$80:N=4:12 \longrightarrow \frac{80}{N} = \frac{4}{12} \rightarrow 4N = 80\times 12 \rightarrow N = \frac{80\times 12}{4}$=240Gp.

The 12 oranges w1ll cost Gh¢2.40

PERCENTAGES.

Percentages are ways of representing fractions with denominators of 100.percentages are introduced in primary 5.

CHANGING FRACTIONS TO PERCENTAGES.

We have looked at fractions,we saw that a fraction can be described as a ratio of two numbers.for example the ratio 2:5 is the same as $\frac{2}{5}$.

To teach how to rename a fraction in percentage,begin with halve,fourth and tenths.in other words,find hundredths and percentage names that are equal to halves,fourths and tenths.

For example:

1. $\frac{1}{2} = \frac{1}{2}\times\frac{100}{100} = \frac{100}{200} = \frac{50}{100}$.this is written as 50 percent or symbolically 50%

2. $\frac{1}{4} = \frac{1}{4}\times\frac{100}{100} = \frac{100}{400} = \frac{25}{100} = 25\%$.

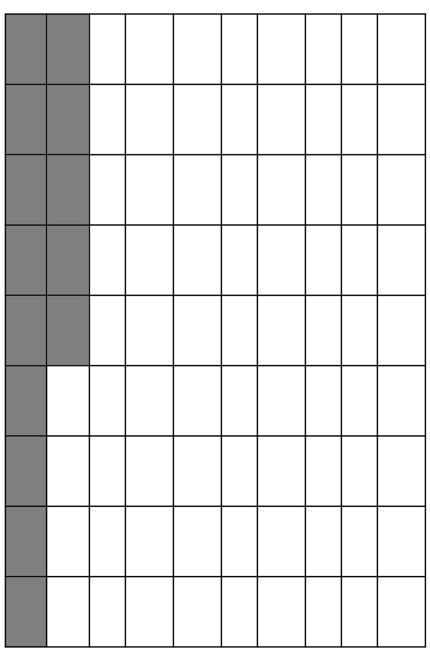
3. $\frac{3}{4} = \frac{3}{4}\times\frac{100}{100} = \frac{300}{400} = \frac{75}{100} = 75\%$

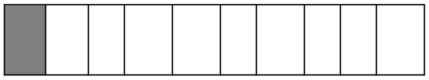
4. $\frac{1}{10} = \frac{1}{10}\times\frac{100}{100}=\frac{10}{100} = 10\%$

5. $\frac{7}{10} = \frac{7}{10}\times\frac{100}{100} = \frac{70}{100} = 70\%$

Hence we rename $\frac{1}{2}$ in percentage as 50%;$\frac{3}{4}$ as 75%.

Diagrams are one method of gaining an understanding of percent. a 10×10 grid with 100 equal parts is one of the common models for illustrating percentages or decimals.for example showing 15% using diagram.





For example,to rename $\frac{2}{5}$ in percent,we write 2:5= w : 100

Therefore $\frac{2}{5} = \frac{w}{100} \rightarrow 5w = 2\times100 = w = \frac{2\times100}{5} = 40$

Hence the percentage name for $\frac{2}{5}$ is 40%.work more examples with pupils.

CHANGING PERCENTAGES TO FRACTIONS

Once we know how to change a fraction to percentage,the reverse process is quite easy.

For example to change 40% to fraction,we write 40% as $\frac{40}{100}$ and we simplify it.

Thus $40\% = \frac{40}{100} = \frac{4}{10} = \frac{2}{5}$

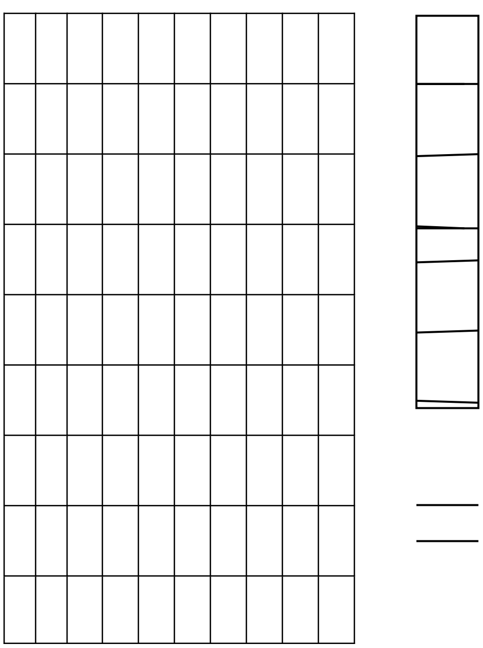
Again $38\% = \frac{38}{100} = \frac{19}{50}$

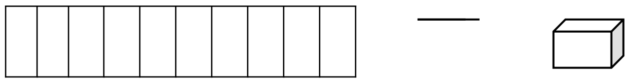
Work more examples.

CHANGING DECIMALS TO PERCENTAGES AND VICE VERSA

The approach to decimals should be placing emphasis on models and oral language.

For example,we can represent the Dienes base-ten piece the flat as unit,the long as one-tenth and the cube as one-hundredth,let us look at how it looks like

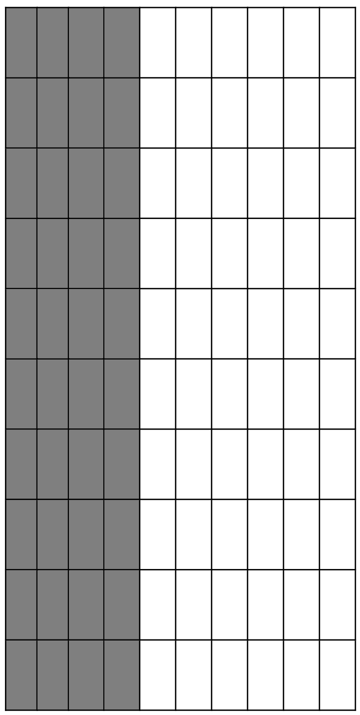




1 0.1 0.01

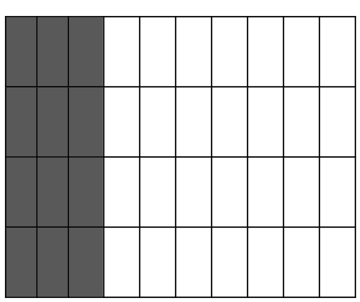
We can use these models to represent some given fractions.

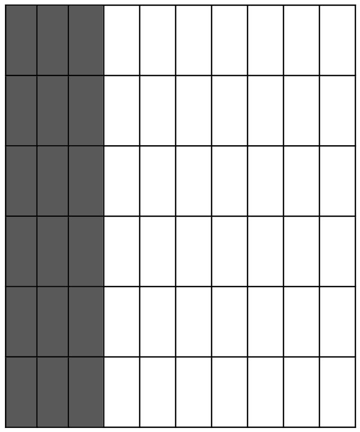
We are aware that we are changing from decimals to percentage therefore we can use model of a flat representing unit. For example the shaded portion represent 0.4 which shows that 40 out of 100 of smaller squares have been shaded.this represent 40%.



Similarly we can model 0.2,0.25and 0.43

We can also model the percent into decimal for example 30%, 52% 8% into decimals.let us model 30% so that you can also try your hands on the others





This is 30%=$\frac{30}{100}$ = 0.3

FINDING PERCENTAGE OF A GIVEN QUANTITY

This is the aspect of percent that may be called calculations with percents.calculation with percent fall into three categories.

- Given the whole and percent,find the part.
- Given the whole and part,find the percent.
- Given the percent and the part,find the whole.

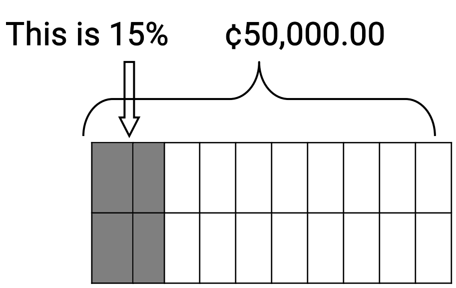
This section is of the category 1

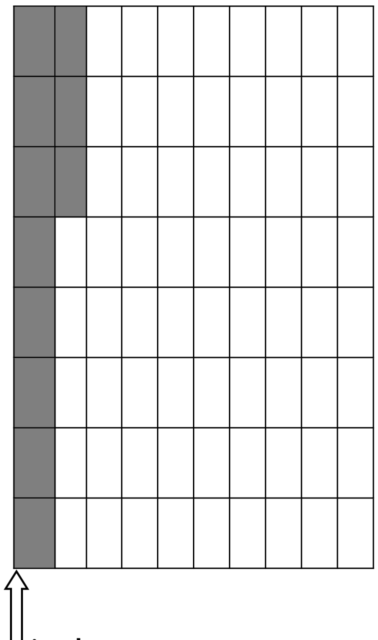
When the whole and the percent are given,the part can be found by multiplying the percent by the whole.for example.find 15% of ₵50,000.00.

The word of is a clue that the percent is acting as a multiplier.thus 15% of ₵50,000.00=$\frac{15}{100}$×₵50.00.00 = ₵7,500.00.

On the other hand we can model to solve this problem.

15 out of 100 of small squares are shaded indicating 15%.now the whole 100 squares represent the₵ 50,000.00.this means that 1 small square represents ₵500.00 (ie ₵50,000.00÷ 100) thus 15% of ₵50,000.00=15×₵500.00=₵7,500.00





Every single square represent ¢500.00

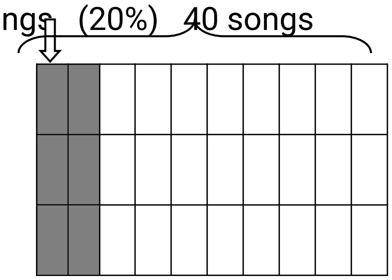
EXPRSSING ONE QUANTITY AS A PERCENTAGE OF ANOTHER QUANTITY.

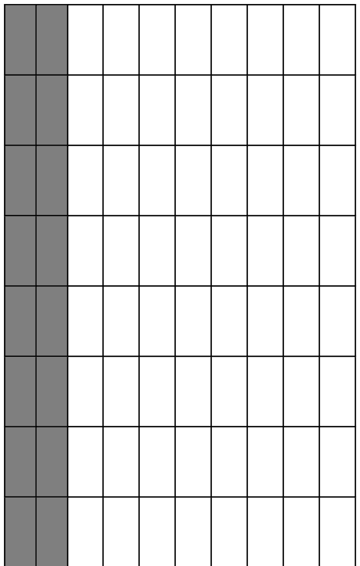
As stated earlier ,calculations with percent fall into three categories.expressing one quantity as a percentage of another falls under the second category.ie given the whole and the part,find the percent.

When the part and the whole are given,the percent can be found by writing the fraction for the part of the whole and then writing this fraction as a percent.for example,if 8 of the radio stations top 40 songs for a given week are new songs,then $\frac{8}{40}$ of the songs are new.to represent $\frac{8}{40}$ as a percent, we can divide 8 by 40 to obtain a decimal and then represent the decimal by a percent. $8 \div 40 = 0.2 = \frac{20}{100} = 20\%$ so 20% of the top songs of the radio station are new.

The model may be used to provide a visual approach to solving the problem above.

8 songs (20%) 40 songs





⇧ 0.4 songs

What percent of 40 is 8? The total of 100 small squares represent the 40 songs,then each square represents 40÷ 100 = 0.4.hence 2 squares represent 0.8 and 10 squares represent 4 songs.therefore 20 squares will represent 8 songs.20 squares are then shaded,which represent 20%.

When the percent and the part are given,the wholecan be found by using proportion.suppose a down payment of ¢50,000.00 is required for a loan and this down payment is 10 percent of the loan.then the amount of the loan will be: $\frac{\text{part}}{\text{whole}} = \frac{10}{100} = \frac{50,000}{a}$.

Using the rule for equality of fractions,we can write this equation as 10a=50,000×100

Therefore $a= \frac{50,000\times100}{10}$

$a=500,000$

so the amount of loan is ¢500,000.00

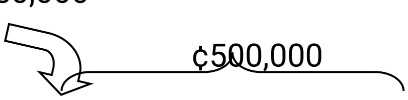
another method of solving the problem is illustrated using 10x10 grid paper.

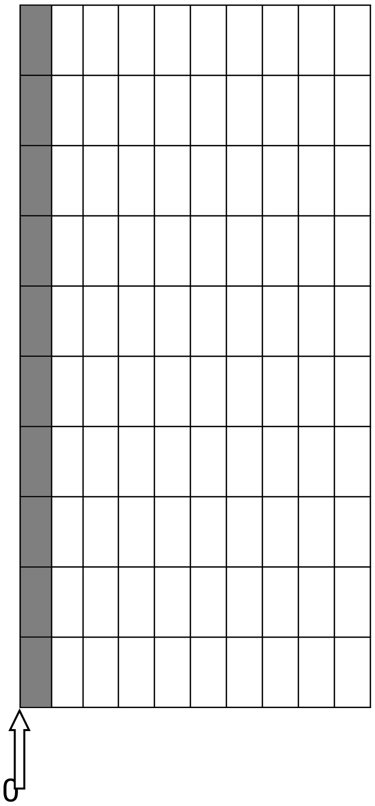
The shaded squares are 10 percent,and these represent ¢50,000 down payment.

If the 10 shaded squares represent ¢50,000 then each small square represents ¢50,000

10=¢5,000.so the total of 100×5,000 =¢500,000.

¢50,000





¢5,000

UNIT SIX

TEACHING MEASUREMENT.

Measurement of length.

Measurement forms a very important part of our everyday life. There are many things that we measure, some of these are length ,distance,,capacity,volume,weight,time,money,angles and several others.

Length is the measure of how long a thing is from one point to the other. In measurement of length some few vocabularies are learnt,like long, longer than,longest,short,shorter than, shortest.

In teaching the concept of measurement of length we first perform activities on direct comparison, indirect comparison, and then introduction of standard unit of measure.

Direct comparison of length.

This is where a child is guided to place objects side by side on the same level to determine which of the objects is longer than the other, shorter than the other, as long as the other.

Indirect comparison of length.

Indirect comparison is introduced when the lengths you want to measure cannot be brought to be placed side by side, therefore a medium is introduced .like measurement of the length of two adjacent walls, these two walls cannot be brought together and place them side by side but to use either your hand span your foot a stick these measure medium is called arbitrary unit. You will use any of these to find out how many of this measure can a particular wall take and compare with how many the other wall too had.

Introduction of standard unit for length

We talked about the use of arbitrary unit this unit differ from persons. everybody choose what ever measure he/she wants to use therefore it brings a lot of confusion in the system.for example in this classroom if I call two men to measure the length of the teacher’s table with their hand span,the two people will give us different measurement, to eliminate this confusion,it is necessary to introduce a standard unit measure like centimeter,milimiter,meter,kilometer etc.

need to use the same size of tables exercise books or postage stamps to spread them in the two classrooms to find out which of the classrooms has more of those objects used.this shows that the classroom that got more of those objects used has more large surface area and these objects are called arbitrary units.

Measurement of Capacity

At the lower level,we place more emphasis on capacity while emphasized both volume and capacity at the upper primary.what is the difference between volume and capacity?are the concept of volume and capacity similar in a way?

Volume can be said to be the amount of space contained in a three dimensional shape and this may include how much space is found in a box,a room, or a jar.capacity however, is the amount of substance that a particular space can contained.like how much water or sand will fill a box or a jar.well,volume and capacity are close related and the capacity of a given container is determined by its volume.

Direct comparison.

In direct comparison of two or more empty containers can be filled with water and pour it back in to another container to see which container can hold more water.

Indirect comparison.

This is where one container can not be lifted to pour out its content into another container,therefore need another smaller container that can be used to fill the other one.in this case we find out how many times the smaller container can fill the bigger one that can not be lifted and compare to see which is bigger containers can hold more water.

Introduction of standard measure.

The liter is used as a standard unit measure. Guide the pupils to use a liter bottle or any graduated container with liter to fetch water to filled the bigger containers to see how many liters will fill each of them.

Measurement of weight and mass.

We normally use weight and mass interchangeably. Weight is refers to as the measure of force o gravity acting on an object. Mass on the other hand, is the amount of matter in an object.

How do we determine which object is heavier than the other? We compare various pair of objects to find out which one weighs the most by holding one object in each hand. Some of the objects may have equal weight so let the pupils compare and re-check, pair until they are able to put the objects in order from the lightest to heaviest. Do several experiments in comparing weight and after these introduce the use of device for weighing.

Simple balance

Get an improvised balance, if you don’t have one, by getting a coat hanger and two empty tins at either ends. This is the simplest balance to make. It may not be very sensitive but don’t wory.it will be adequate for the purpose of demonstrating the principle of the balance. Put an eraser in one end, a stone in the other one, you will discover that one end will go down showing that one is heavier than the other. Guide the pupils to compare weight of objects directly like that and arrange the objects in the order of lightest to the heaviest. After comparison and ordering of masses pupils will notice that there is the need for a standard measure. We introduce the kilogram as the basic unit for the measurements of mass. We provide 1kg weight in hand to get the “feel” of it. They then pick up objects in the classroom or outside and determine whether they weigh about 1kg or more or less. They check their results using a balance.

Measurement of time.

Many events take place in the lives of children and it help them to develop the idea of passage of time. We list here some of the events familiar to children ,school time, break time, closing time, time to get out of bed, let your pupils tell you which of the above events occur first, which is second and so on. Again what do the following words mean to your pupils.today, tomorrow,yesterday,morning,evening and afternoon. Guide them to explain the words. Guide the pupils to tell how time is measured without using standard measure of time. That is the sound of birds, sun.

Unit of time.

Help your pupils to understand the unit of time by providing improvised clock. Guide the pupils to understand that any time the minute hand is on 12 and the hour hand is on any number, that number is the time.

Guide the pupils to read the clock by the hour by telling and fixing the hands of the clock to show 9,o’clock ,6,o’clock, 12,o’clock, 8,o’clock.

Lunch time, closing time, play time, sunrise and sunset. There is now the need to read the clock by half hour and quarter hour. Guide the pupils now to discover that 60 minutes make an hour,24 hours make a day,7 days makes a week and so on.

Teaching of money.

Money is any legal document that can be used for exchange of goods and services is called money.

Introduce all the currency in circulation to the pupils to let them touch it and be able to describe the nature of that note, its colour, the fixtures on it.

Organized a play shop in the classroom for the pupils to buy and sell after that close the play shop and ask questions about the change their suppose to receive when items are bought and pay using a higher denomination the balance and how much money can be used in paying for a number of items bought with a particular price. After that you introduce the cedi sign to the pupils and how it is written.

UNIT SEVEN

TEACHING OF GEOMETRIC CONCEPTS

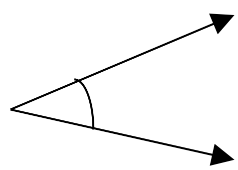
Teaching of angles.

Angle is introduce by explaining to the pupils that when you make a turn an angle is form or when two or more lines meet the space created is called an angle.

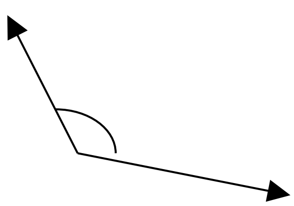
Angle can be introduced to pupils using the corners of the classroom, when a door is open and closed; when two interloping circles are fixed together angles are form when turning them.

Types of angles.

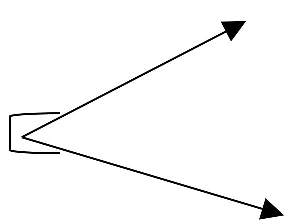
An angle that is less than a right angle is an acute angle.see the illustration below.



- An angle which is greater than a right angle but less than two right angles is or a straight line is an obtuse angle. See also the illustration below.



An angle that is greater than two right angles but less than one turns a reflex angle.



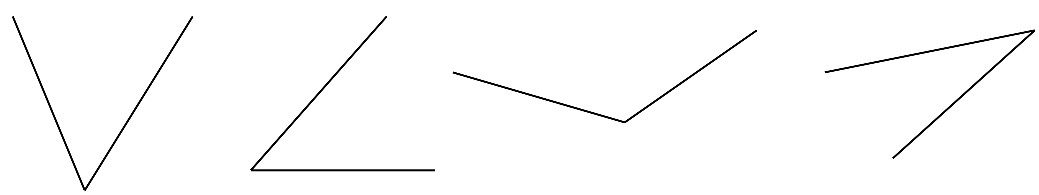
- Direct comparison.

An angle can also be described as the union of two rays that have the same endpoint. When we measure an angle, we assign a number to the spread between the two arms, or rays.

To introduce the idea of the size of an angle, we can open a pair of scissors and draw pupils attention to the angle formed by the two blades. We explain that the size of an angle has to do with the spread between the two blades.

We guide pupils to compare two angles by first asking them to trace one of them and directly compare the tracing with the other angle.in comparing the two angles pupils place the vertex and one of the arms of the tracing on the vertex and one arm of the other angle.the other arm of the smaller angle lies in the interior of the large angle.

We then give the pupils tracing paper and a sheet on which are drawn angles of various measures in a number of different positions. We instruct the pupils to order the angles according to size by tracing and comparing the angles with each other.



Angles of various measures

NON-STANDARD UNIT.

We can draw an angle on the chalkboard and ask pupils to determine “how big” angle is. They can make a small angle as a unit of measure and find how many copies of this small angle fit inside the angle to be measured. This small angle can be a wedge cut from cardboard.

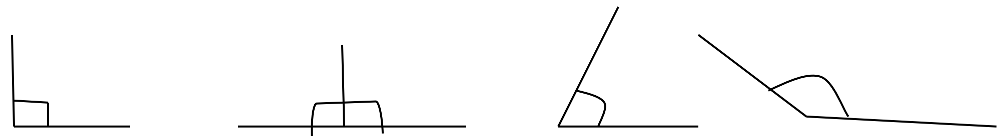
Pupils should predict and verify the results of using a smaller unit angle to measure angles. Pupils could prepare several copies of cardboard wedges representing angles of three different sizes. They would then draw an angle on paper and measure it using the three different units. Pupils first estimate before measuring and they measure to the nearest unit.

Pupils can be guided to create an instrument for measuring angles by dividing a semi-circular cut out into equal sectors by folding. The teacher can then challenge them to use this to find the measures of angles of various cardboard wedges.

STANDARD UNITS

Before pupils learn about the degree as a standard unit of measure of angle, they can use the right-angle as a reference.

Pupils should be shown how to fold a piece of paper twice to produce a right angle.they then use the right –angle to identify right angles on object in their claaroom and to classify other angles as greater than or less than or less than a right angle.we tell pupils that an acute angle has a measure that is less than a right angle and an obtuse angle has a measure greater than right angle but less than a straight angle.



Right angle   straight angle   acute angle   obtuse angle

We can define the degree as the amount of turning (or the size of unit of an angle)

Such that the measure of a quarter turn (or right angle) is 90^0.pupils then note that the measure of a half turn (or straight angle) is 180^0 and the measure of a full turn is 360^0.pupils also estimate the measures of various acute and obtuse angle, angles drawn on the board or on paper. The teacher then demonstrates how to use a protractor to measure angles in degrees, emphasizing the correct placement of the baseline and the vertex. Pupils estimate and measure the sizes of angles in degrees using a protractor. They also draw angles of giving measures using a protractor. Pupils can also work in pairs, with one pupil drawing an angle and the other estimating and then measuring it.

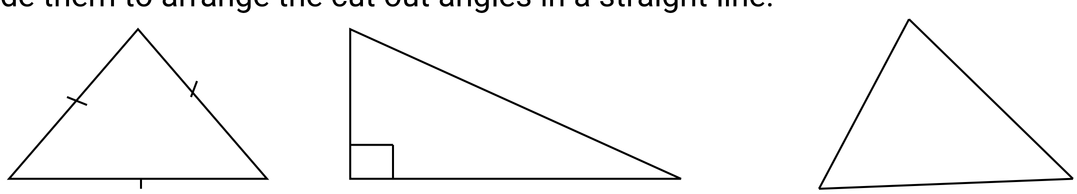
THE SUM OF THE INTERIOR ANGLES OF A TRIANGLE.

Guide pupils to draw at least three different types of triangles.

Guide them to use a compass and open it to any radius and mark angles in the triangle.

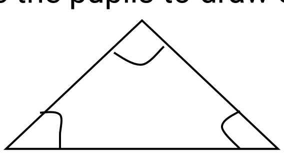
Guide them to use a sharp object to cut the three angles out.

Guide them to arrange the cut out angles in a straight line.

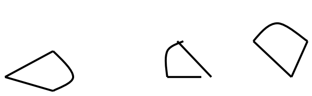


Equilateral triangle   right angle triangle   isosceles   triangle

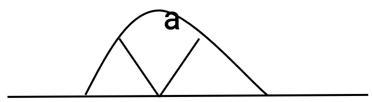
Guide the pupils to draw equilateral triangle



Guide the pupils to cut out all the three angles

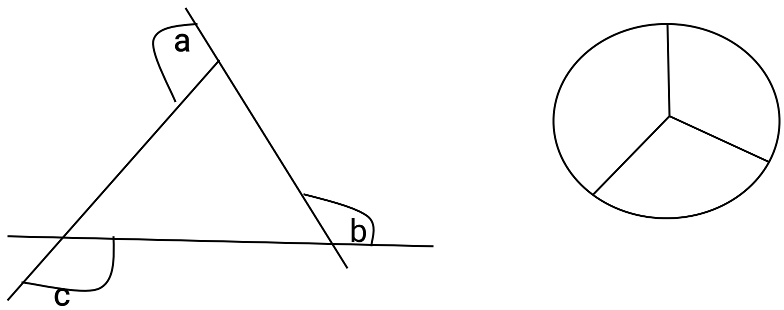


Guide them to arrange the cut out angles in a straight line



Guide the pupils to try this same procedure for all the three triangles. This shows that the sum of interior angles in any triangle add up to 180^0.

SUM OF THE EXTERIOR ANGLES OF A TRIANGLE.



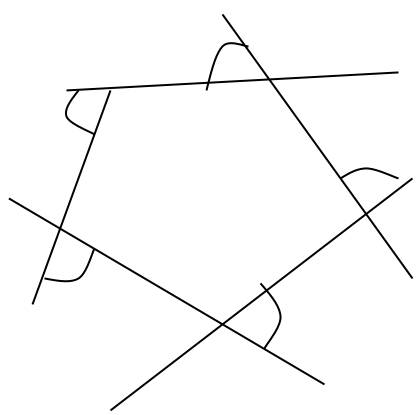
Guide the pupils to use a compass to mark the outside angles

Guide them to use a sharp object to cut out the angles

Guide them to arrange the angles

They will notice that a circle has been formed. This shows that the exterior angles of a triangle add up to 360^0.

THE SUM OF EXTERIOR ANGLES OF A PENTAGON.

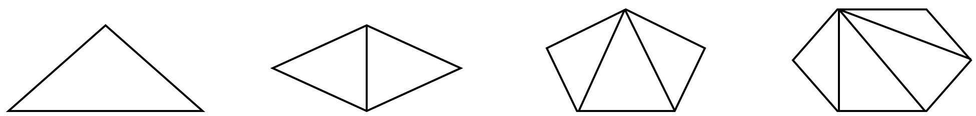


Guide the pupils to cut out all the marked angles.

Guide the pupils to arrange the cut out angles and it will form a circle which shows that all the exterior angles of any polygon add up to 360^0.

THE SUM OF THE INTERIOR ANGLES OF A REGULAR POLYGON.

We classify polygons by the number of sides that the have. The number of sides of a polygon gives the number of angles. A polygon with equal length of sides is called a regular polygon.let us go through the following activities to establish the formulae for finding the sum of the interior angles of a polygon.

- Guide the pupils to draw various successive polygons on a cardboard and split it into triangles by drawing diagonals from one vertex to all the other vertices.
- 

One triangle 2 triangles 3 triangles 4 triangles

- Since the interior angles of a triangle sum up to 180^0,pupils calculate the sum of the interior angles of each polygon by counting the number of triangles and multiply it by 180^0.
- The results are shown in a table for pupils to see the pattern which emerges.

Polygon	NO.of sides	No.of triangles	Sum of interior angles
Triangle	3	1	$1x180=180^0$
Quadrilateral	4	2	$2x180=360^0$
Pentagon	5	3	$3x180=540^0$
Hexagon	6	4	$4x180=720^0$
Heptagon	7	5	$5x180=900^0$
Octagon	8	6	$6x180=1080^0$
-	-	-	-
-	-	-	-
-	N	n-2	(n-2)x180

- Pupils would notice that in each case that the number of triangles is two less than the number of sides of the polygon.
- Pupils should infer that the sum of the interior angles of any regular polygon with n sides is (n-2)180.

PERIMETER OF PLANE SHAPES

Plane shapes

When three or more points are not found to be on the same line, we have a kind of geometric figure called a plane figure. a plane fiqure is the same as a plane.it is a figure in two dimensions.rectangle,triangle and hexagon are examples of plane shapes. Can you now mention other examples of plan shapes?what do they have in common? They normally have flat surfaces

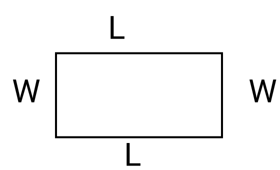
PERIMETER OF 2-D SHAPES.

let us look at perimeter.it is the measure of the total distance around a plan shape.we shall now focus on finding the perimeter of plane shapes or plan figures.some activities leading to the determination of perimeter of plan shapes include:

- Explaining the concepts of perimeter as total length or distance around a plan shape.
- Provide different cut-out shapes of different dimensions. Measure and record the lengths around each shape.
- Sum all the measured lengths as the perimeter of a given shape.

How would you determine the perimeter of a rectangle?let us consider the following activities to determine the perimeter of a rectangle.

- Draw a rectangle as shown



- measure the length around the rectangle as l,l,w and w where l and w are lengths and widths respectively.
- Sum the measured lengths as the perimeter (p)

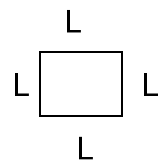
$P=l+l+w+w=2l+2w=2(l+w)$

Similarly,the perimeter of a square and other shapes can be found as follows:

Square.

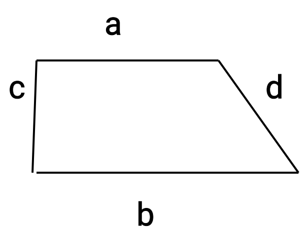
- Draw a square on a cardboard
- Measure the lengths around the square as l,l,l and l

- Suum the measured lengths as the perimeter of a square
- the perimeter of a square P=4l



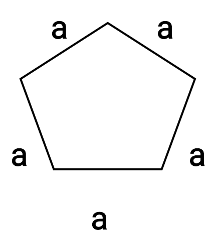
P=L+L+L+L=4L

Trapezium



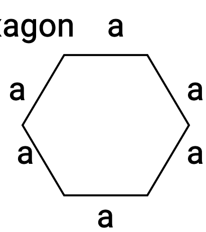
P=a+b+c+d

Regular pentagon



p=a+a+a+a+a=5a

Regular hexagon



p=a+a+a+a+a+a= 6a.

CIRCUMFERENCE OF A CIRCLE

circle.

A circle is a plane figure bounded by one line called the circumference,which is such that all points on the circumference are equidistance from a fixed point within.the fixed point is call the centre of the circle.the diameter is the chord which passes through the centre of a circle.

MEASURING THE CIRCUMFERENCE OF A CIRCLE.

There are so many ways of doing this.we shall discuss two methods under two activities.

ACTIVITY 1

You will need a cylindrical object like a milk tin,a milo tin, a paper strip,a needle and a ruler.wrap the strip of paper around the tin so many times.using the pin or needle,make a hole through the strip .remove the strip and you will observe several holes of equal interval on the strip.with a ruler,measure any of the intervals and that is equal to the circumference of the cylindrical object.

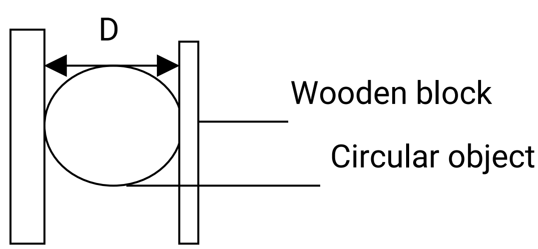
Activity 2.

You will need a cylindrical object like a milk tin,milo tin and an oil paint.use the oil paint and make a mark on the cylindrical object.roll the object gently on a cement floor.the mark of the oil paint will make a mark on the floor measure the distance between the two marks and that is the circumference.

The Diameter of a circle or a circular object

Determine the diameter of a circle or a circle object is not easy unless the exact centre of the object is determined. You will need materials like two wooden blocks, a ruler and a cylindrical object like the milo tin.perform the activities below to determine the diameter

- place a circular object e.g.milo tin such that it lies on its curved surface
- hold the Milo tin firmly between two wooden blocks
- measure the distance between the two wooden block as the diameter of the milk tin



RELATIONSHIP BETWEEN THE PI (π), CIRCUMFERENCE AND THE DIAMETER

Using the methods above, let us go through the following activities to establish the relationship between the pi (π),circumference and the diameter.what is pi? It is the ratio of the circumference of a circle or a circular object to its diameter.to determine the pi lets follow the activities

- collect several circular objects such as milk tin,milo tin,jago tin etc
- tie a piece of string or wrap a strip of paper around each object,stretch out the string or the strip of paper and measure out the length on a ruler.
- Record this measure as the circumference (c) of each circular object.
- Measure the diameter (d cm) of each circular object by holding it firmly between two wooden blocks and measure the distance between the two wooden blocks as the diameter.
- The results are recorded in a table

Circular object	Length of circumference	Length of distance	Ratio $\frac{c}{d}$
Milk tin Tomato tin G			

ei s h a ti n			

- Calculate the ratio of the circumference to the diameter of each object
- Notice that the ratio of the circumference to the diameter $\frac{c}{d}$ in all cases is approximately 3.1 or 3.2
- Explain to pupils that the approximate value which is constant for all cases is denoted by pi (π).
- Ie $\pi=\frac{c}{d}$ is the relationship between the circumference and the diameter of a circular object
- With the previous knowledge that the ratio of the circumference (c) to diameter (d) equal to pi (π).
- $\pi=\frac{c}{d}$ and d=r +r=2r
- therefore the circumference (c)=2π

MEASUREMENT OF AREA.

Area is the space or surface occupied by something. In teaching the concept of area there is the need to make our lesson very practical. We need to have the following items postage stamps,playing cards, exercise books,cut-out squares,rectangles,geoboard and empty tins.

Direct comparison.

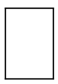
This is where the teacher guide pupils to bring two or more area to be placed on top of the other to find out which of the area is larger than the other in the performance of this activities words like larger than,equal and smaller than are learnt by pupils.the pupils will also become aware of difference in area of surfaces.

Indirect comparison.

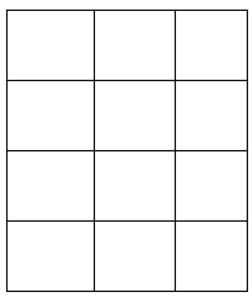
When the area of two or more surfaces ca not be brought together to be placed on top of the other,then there is the need to introduced the use of another object as a medium to be used in measuring the two surfaces to find out which is larger than the other e.g when you want to find out which of the two classrooms has a larger surface area,then there is the need to use the same size of tables exercise books or postage stamps to spread them in the two classrooms to find out which of the classrooms has more of those objects used.this shows that the classroom that got more of those objects used has more large surface area and these objects are called arbitrary units.

Area of plane shapes.

To help pupils to understand the area of plane shapes better, cut-out unit squares can be used in covering a given region of squares and rectangles.e.g



Cut –out square



Guide the pupils to arrange these cut-out squares in the rectangle and find out how many of them will cover the whole rectangle.now count them and record the number and find out those at the rows and those at the column of the rectangle,use that to find the rule of finding the area of a rectangle.

Relationship between the area,the length and with of a given rectangle or square.

Activity.

I. Chose some rectangles and squares with various sizes.
II. Count the number of centimeter squares of each rectangle or square.
III. Measure the length and width
IV. Multiply the length by the width.
V. Put your results in a table as shown

No.	Shape	No.of square centimeter	Length (L)	Breadth (B)	LXB
1	Rectangle A				

2	“ B				
3	„ C				
4	Square A				
5	„ B				

Compare the number of unit centimeter squares that could cover the face of each shape and the corresponding product of its length and breadth.can you see a pattern? Then state it.it clear that what emerges from our activities above is that,the area of a square or a rectangle is as shown below.

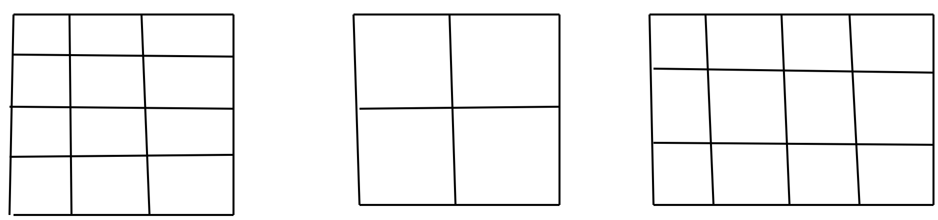
Area= length ×Breadth

= LL×B

We can also use the geo-board to determine the area of some shapes.

TLM:Geo-board and rubber band

- Form rectangles of different dimensions (at least 3) on the geo-board using rubber band.e.g



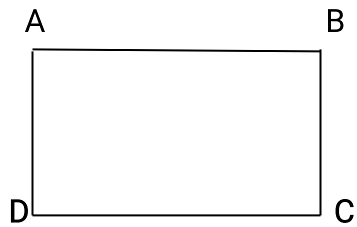
- Count the total number of small squares enclosed and record the result as the area.
- Count the number of squares along the length and the width of the rectangle and record the results as L and B respectively.
- Multiply the number for L by the number for W and record the result as LXB.
- compare the product LXB with the total number of squares in (ii) above and note that they are equal.
- The area of a rectangle or a square is the product of its length and width (L X B).

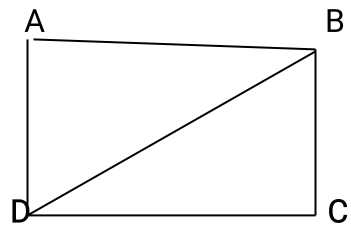
Let us extend our activities to find the area of a triangle.

AREA OF A TRIANGLE.

To find the area of a triangle,we apply the concept of area of a rectangle.let us first take a rectangular sheet of paper as our main TLM and follow the activities below.

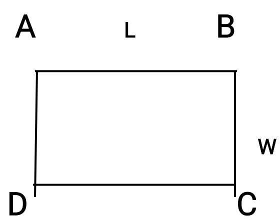
- Fold and cut the rectangular sheet of paper along one of its diagonal to obtain two equal triangles from the rectangular paper.

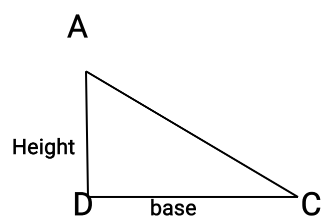




We can now notice that one rectangle is equal to two triangles or $\frac{1}{2}$rectangle = 1 triangle

- Relate the length of the rectangle to the base of the triangle and the width to the height of the triangle





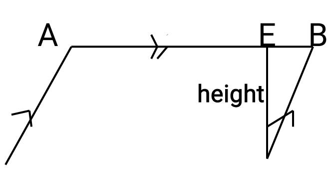
We can now conclude that,the area of a triangle is half the area of a rectangle.

$=\frac{1}{2}(l\times w) = \frac{1}{2}h\times b$

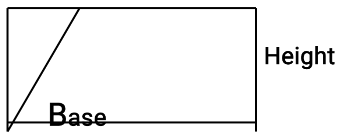
AREA OF PARALLELOGRAM

Activities

- Revise your knowledge on finding the area of a rectangle
- Draw a parallelogram on a paper as shown



- Cut along the line CE and fix it along the side AD

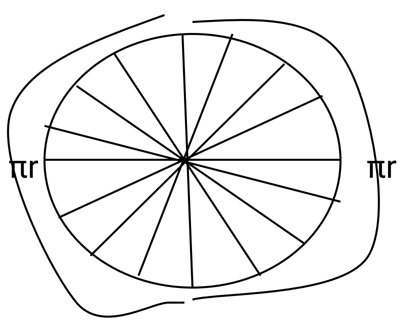


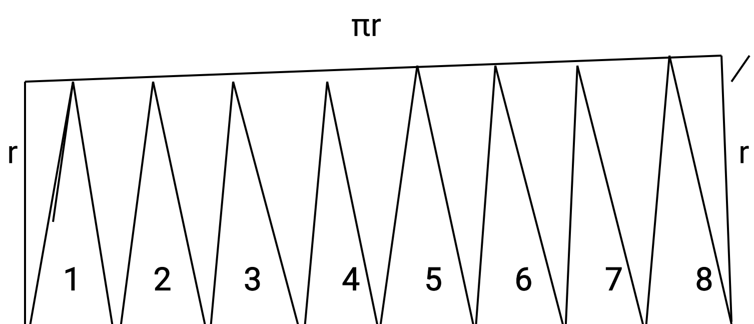
- Take notice that the figure so formed is a rectangle
- You have to realize that length of a rectangle corresponds with the base of the parallelogram while the breadth of the rectangle corresponds with the height of the parallelogram.
- Find the area of the rectangle to be equal to the area of parallelogram as L X B=base x height.

AREA OF A CIRCLE

To find the area of a circle,we will need a cardboard and a sharp instrument.let us now proceed as follows

- Draw a circle of any radius on a hard cardboard and cut it out as a circular disc.
- Divide the circular disc into two equal parts and shade one halve.
- Divide the entire circle into sixteen equal sectors
- Cut out the circular disc using a pair of scissors,the sectors into sixteen pieces
- Rearrange the pieces head to tail in a rectangular form as shown





πr

- Explain that the curved edge of each semi-circle is half the circumference and therefore the length $\frac{1}{2}\times 2\pi = \pi r$

- Multiply the length labeled as πr by the width r to get the area of the rectangular shape as

  A=LXB

  $=\pi r\times r$

  $=\pi r^2$

Measurement of volume.

Volume refers to the amount of space in a given shape that has three dimention.we want to determine the volume of several containers using arbitrary units.guide pupils to collect many bottle tops of the same variety.provide them with various containers such as empty milk tins,chalk box,drinking cups and so on.guide them to estimate and determine the volume of each container in terms of the number of bottle tops.let them order the containers based on their findings.

Measurement of volumes using standard measure.

Guide pupils to obtain cubes and boxes like chalk boxes.guide them to estimate how many cubes they think will fill each box.let them carefully stack the cubes in to boxes to find the actual volume.explain to pupils that the size of each small cube is 1 cubic centimeter.

Guide pupils to get the number of 1x1 centimeter cube fill the boxes guide them also to find out how many cubes filled the length of the box, width of the box and the height of the box. Guide them to find the product of L×W×H.guide the pupils to form a table and record their findings.

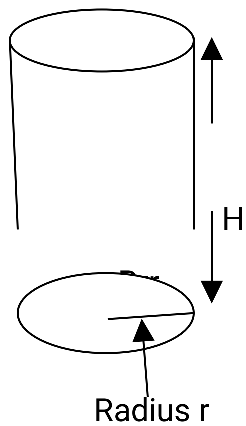
Box	Length(L)	Width (W)	Height (H)	LXWXH	Total no.of cubes
A	2	3	2	2X3X2	12
B	3	2	3		
C	2	2	2		
D	4	2	1		

The volume of a cylinder and a cone.

From our previous lesson we learnt that the volume of a cuboid is base area which is LXB and the height which is LXBXH.also we earlier learnt that the area of a circle is πr^2.all these will be necessary in this lesson.

Consider,this figure below

a) Closed cylinder



It is a cylinder with circular base radius ‘ r ‘ and height ‘ h’.how then Shall we find its volume? Find the area of the circular base and multiply by the height.

as such, we simply state that the volume of a cylinder=

Base area x height=$\pi r^2 \times h$ =$\pi r^2 h$

THE VOLUME OF A CONE.

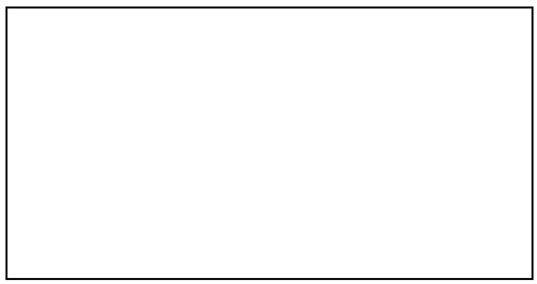
The volume of a cone is determined by forming a cone from two rectangular sheet of paper of the same dimension.

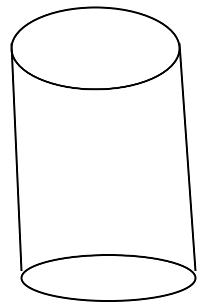
Use one of the sheets to form a cylinder. Use the second sheet to form a cone.

Guide the pupils to fill the cone with sand and transfer it into the cylinder to find out the number of times the sand in the cone will fill the cylinder. Since the formula of the cylinder is $\pi r^2 h$ then we can divide the formulae of the cylinder by the number of times the sand in the cone filled the cylinder and that give us the formulae of the cone.

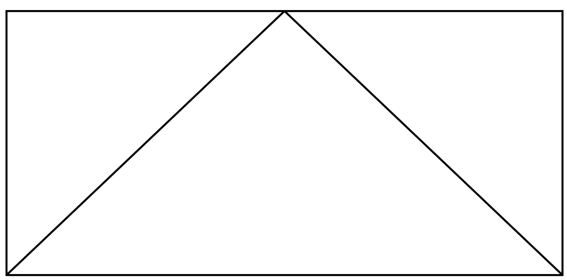
Activities

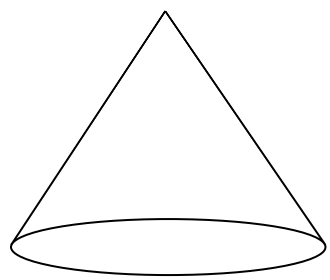
1. Guide the pupils to take two similar shape of a rectangular sheet of paper.
2. Guide them to take one sheet to form a cylinder.
3. Guide them to form a cone from the second sheet.
4. Take the cone fill it with sand and transfer it into the cylinder.
5. Guide them to find out the number of times the content of the cone will fill the cylinder.
6. Guide them to conclude.





First sheet of paper cylinder formed out of the sheet.





Second sheet of paper cone formed out of the sheet.

UNIT SEVEN

TEACHING GEOMETRICAL SHAPES AND CONSTRUCTION

Plane shapes

Plane shapes are considered to be shapes that are two dimensional; we can only find their area by using length and breadth or width. We cannot calculate their volume, because they do not have height.

We normally consider plane shapes as i) circle ii) triangles iii) quadrilateral .etc.

The first shape which children learn to recognize is the circle. The distance around a circle is called the circumference. All points on the circumference are equal distance from the fixed points called the centre.

A circle has a radius which is referred to as the distance from the centre to the circumference.

Chord is the lines that join two points on the circumference.

Diameter is the chord which passes through the centre.

Semi-circle is half of a circle

Quadrants are formed when a circle is divided into four parts each part is called a quadrant.

Sector is the area that is formed by two radii.

Arc is part of a circumference we have major and minor arcs.

Segment is the area formed by a chord and an arc; we have major and minor segments.

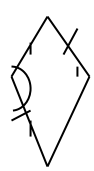
Quadrilateral.

Quadrilaterals are plane shapes bounded by four straight lines. We have different categories of quadrilaterals. We may sort quadrilaterals by using three criteria's as shown;

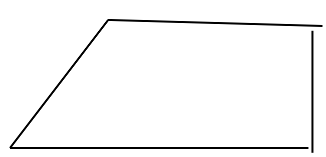
a) How many sides are equal?
b) How many pair of sides is parallel?
c) How many angles are equal?

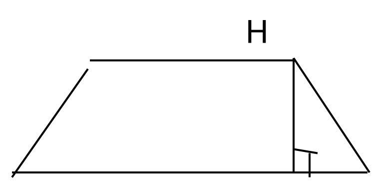
Types of quadrilaterals

1. KITE;-it has one pair of opposite angles equal and adjacent sides equal.

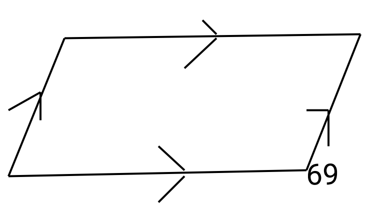


2. Trapezium; - it has one pair of opposite sides parallel

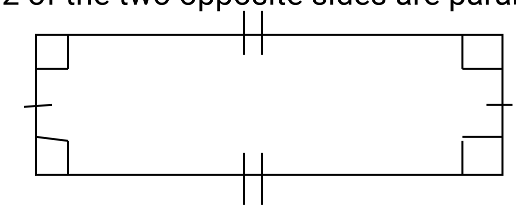




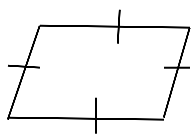
3. Parallelogram;-it has two pair of opposite sides parallel and has 2 pair of opposite sides also equal.



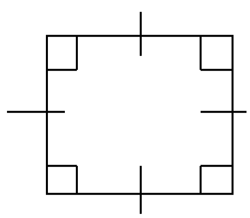
4. Rectangle; - it has 4 equal angles, these angles are right angles. It also parallelograms which mean that 2 of the two opposite sides are parallel and equal.



5. Rhombus;-it has four equal sides and can be referred to as a rickety square.



6. Square;-it has four equal angles and four equal sides.



<u>How do we teach children plane shapes?</u>

You can teach plane shapes by dueling so much on the properties of the shapes.

1. Use the manila cards to prepare the shapes.
2. Put the pupils in to groups of 5 members
3. Give each group all types of the prepared shapes
4. You the teacher must also have all the prepared shapes with you.
5. Pick a shape and let each group also pick the same type of shape. Guide them to identify the characteristics of the shape and write them on the board. Find out from the pupils how that kind of shape can be called. If they're not able to mention the name, then you mention it to them.

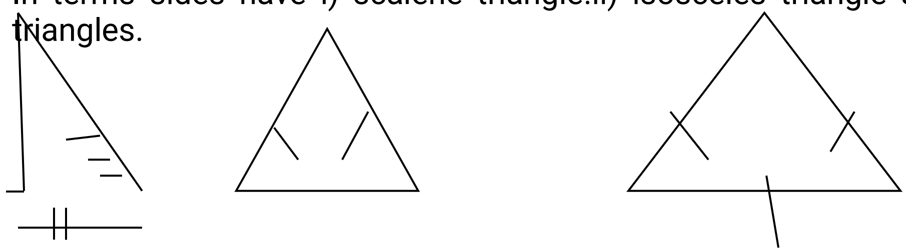
Triangles

A triangle is a plane shape bounded by three sides. It has three sides and three angles. If two sides are equal then two angles will also be equal, if three sides are equal then three angles will also be equal.

Types of triangles

Triangles can be grouped in terms of how many sides are equal, how many angles are equal. In terms of sides, we have three triangles and in terms of angles we have three, in all we have six types ‘of triangles.

In terms sides have i) scalene triangle.ii) isosceles triangle and iii) equilateral triangles.



Scalene triangle isosceles triangle equilateral triangle

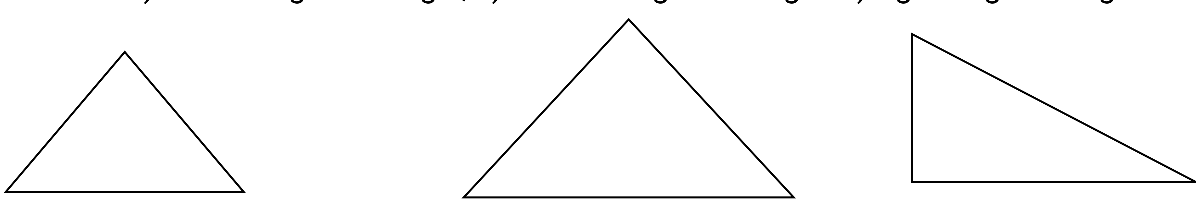
scalene triangle; - it is a triangle with no sides and no angle is equal.

Isosceles triangle; - it is a triangle with two sides equal and two angles equal. In isosceles triangle the third side is called the base the two angles are base angles and they are equal. The third angle is called the vertical angle. From the vertical angle you can divide the base line in to two equal parts.

Equilateral triangle; - it is a triangle with all the three sides and all the three angles are equal. It has each angle equal to 60^0.

In terms of angles.

we have i) Acute angles triangle, ii) obtuse angles triangle.iii) right angle triangle.



Acute angle triangle Obtuse angle triangle Right angle triangle

An acute angle triangle:-it is a triangle with all the angles less than 90^0.

An obtuse angle triangle:-it is a triangle with one angle greater than 90^0.

A right angle triangle:-it is a triangle with one angle is 90^0.the side which is opposite to 90^0 is called the hypotenuse.

Solid shapes.

Common solids

Solid shapes are shapes that are three dimensional, they have length, breadth and the height, and therefore their volumes can be calculated.

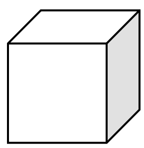
Identification of solid shapes.

Solid shapes can be grouped in to three categories known as i) prisms ii)pyramids iii) spheres.

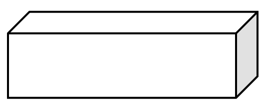
Prisms:-these are the solid shapes that have a uniform cross section.prisms are named after the shape of its end face.

Examples of prisms are:-

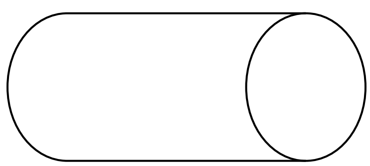
Cubes ,



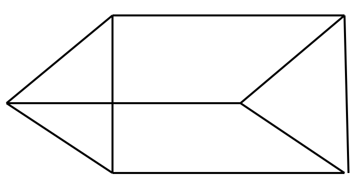
Cuboids,



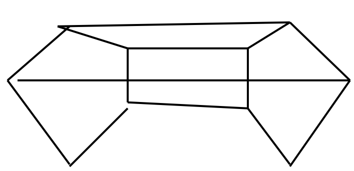
Cylinder



,triangular prism

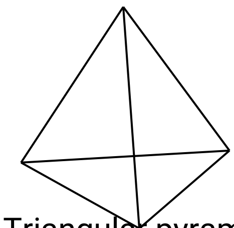


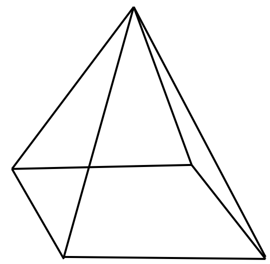
,pentagonal prism



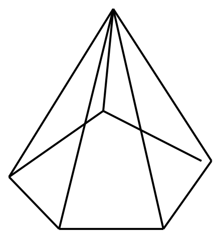
Pyramids:-these are the solid shapes that have all their points projected to meet at a point called apex. A pyramid is named after the face with the greater number of edges.

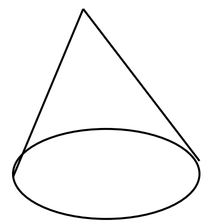
Examples of pyramids are:-





Triangular pyramid, Rectangular pyramid

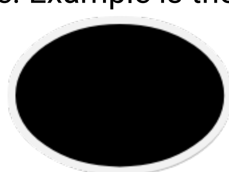




, Pentagonal pyramid, Circular pyramid.

Spheres:-

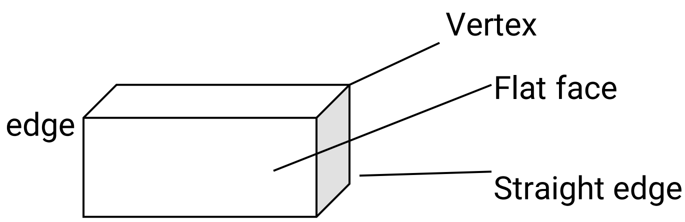
They have round shape. Example is the shape like orange, football, tennis ball etc.

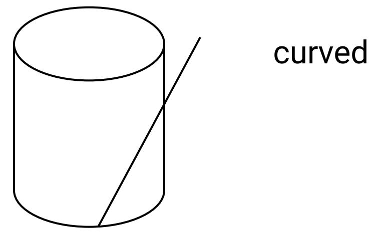


Identification of faces, edges and vertices

With the use of everyday objects, the teacher must help children to identify faces, edges and vertices of solid objects. A solid object may have flat, curved or both flat and curved surface. Solids which look like chalk box, have flat surfaces, solids like oranges or balls have round or curve surfaces and solid like Milo tins are partly flat and partly round. The surfaces of a solid object are divided into different regions and each region is called a face.

Two faces meet in an edge; some edges are straight while others are curved. A corner where two or more edges meet is called a vertex. Curve surface Flat face





Guide the pupils to draw a table and identify number of edges, number of faces and number of vertices that any solid shape have.

Name of solids	Number of faces (F)	Number of edges (E)	Number of vertices (V)
Cuboids	6	12	8
Cylinder	2	2	0
Pentagonal prism	7	15	10
Square pyramid	5	8	5
Triangular pyramid	4	6	4
Triangular prism	5	9	6
Cube	6	12	8
Cone	2	1	1
Sphere	1	0	0

Teacher must guide the pupils to draw all the shapes correctly and also guide them to identify the various face, edges and vertices. Guide the pupils to be able to determine the relationship between the number of faces, the number of edges and the number of vertices. You may notice that F+V-2=E.

NET OF SOLIDS.

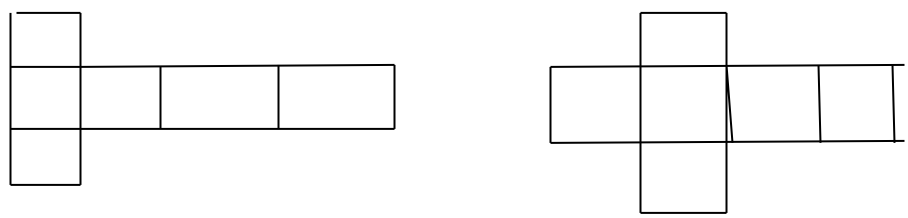
Making solids from Nets

Practical work on volumes and area of curved surface can be associated with geometrical work on nets of solids.children should draw nets of solid shapes,cut them out and fold them to form the various solids.

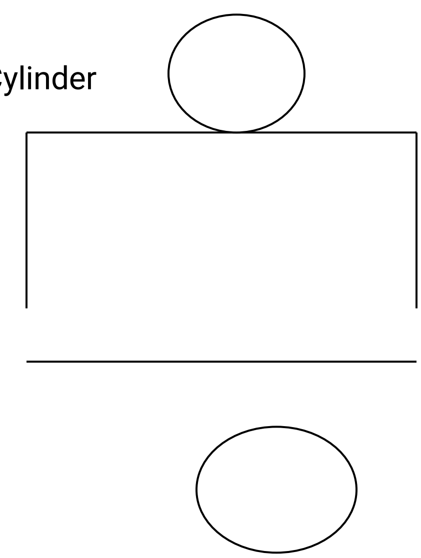
Let children use cards to make the following nets and fold them to form the solids.

a) prism

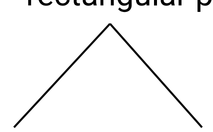
Net of Cuboids

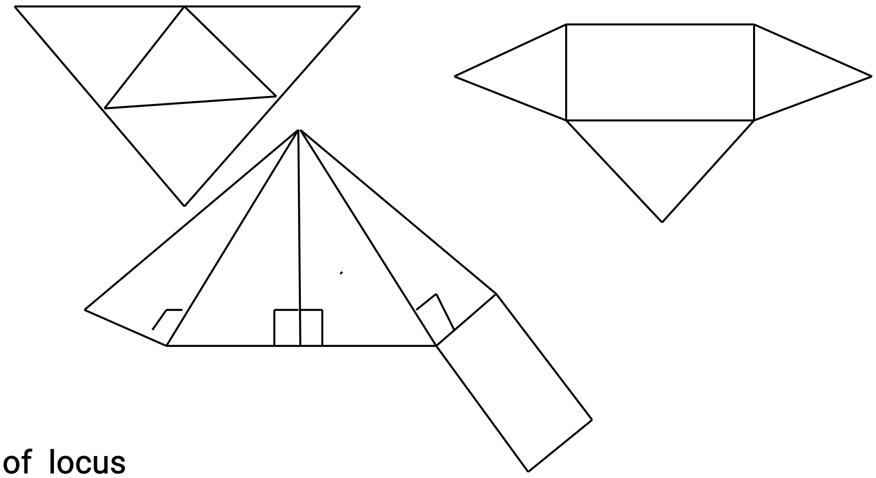


Net of Cylinder



b) Pyramid :- triangular pyramid rectangular pyramid



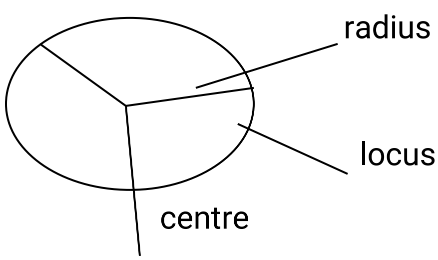


The idea of locus

Locus is the path of points which move in a plane in relation to other points in a plane.at the elementary work,we may talk about four different types of locus.these locus are usually drived from our basic constructions.

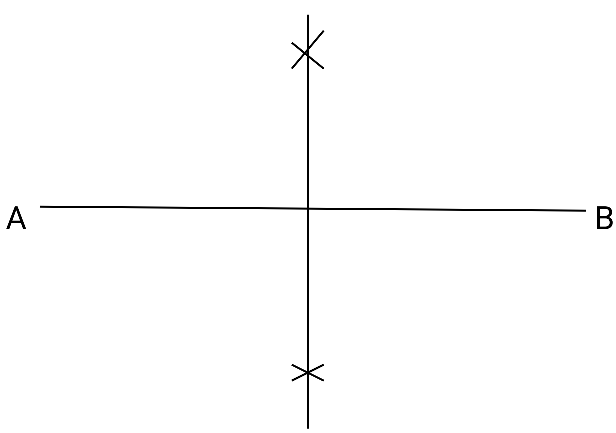
a. The circle:this is the locus(path) of points which moves in such a way that its distances from a fixed point like o is always the same ie .the circle is the locus which is equidistance from one point.

   Note :the fixed point is the centre and the distance is the radius.



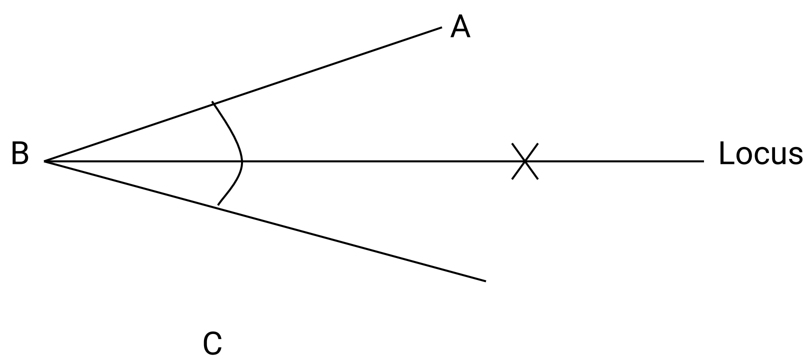
b. The perpendicular bisector (mediator)

   This is the locus of points which moves in such a way that its distance from two fixed points say A and B are always equal ie equidistance from two points.



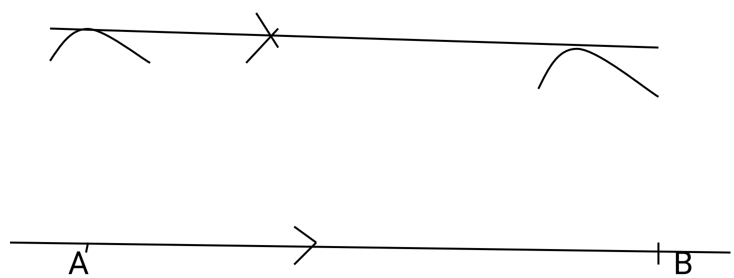
c. The Bisector of an angle

This is the path of point which moves in such away that its distance from two intersection rays of angle are always equal ie thay are equidistant from two lines



d. The parallel lines

This is the path of points which moves in such away that its distance from a line say AB is always the same ie it is equidistant from a line.



Take students through to construct

- Copy angles
- Constructing angles- 90^0 ,45^0 ,60^0,$30^{0.}$
- Triangles
- Regular hexagon.

COPYING OF ANGLES

Transfer of the value of an angle to another position is what we called copying of angle.

Activities

1. Guide the pupils to draw a horizontal line and name it AB.

2. Guide the pupils to measure the length of the line that cuts the lines of the angle.

3.guide them to place the compass point at the beginning of the angle and describe an arc.

4.let pupils measure the length of the arc at the given angle and transfer it to the new angle.

5. guide the pupils to draw a line from the beginning to cut the arc that was described.

CONSTRUCTION OF ANGLES 90^0 ,45^0,60^0 AND 30^0.

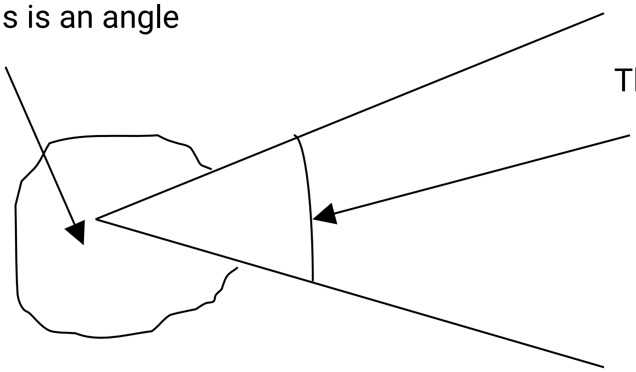
An angle is form when two or more lines meet and created space.

When one makes a turn an angle is formed.

e.g

This is an angle

This is also an angle



Constructing 90^0

Activities

- Guide the pupils to draw a horizontal line AB.
- Guide them to mark a point on the line AB.
- Guide them to place the compass point on the marked point and describe a semicircle.
- Guide them to put the compass at the place where the semicircle ends and make an arc.
- Guide them to place it at the second point and describe another arc again. Where the two arcs meet, draw a line to meet the point marked on line AB.

Constructing of Angle 45^0

Angle 45^0 is half of angle 90^0

Activities

- Guide the pupils to bisect angle 90^0 for them to get angle 45^0

Constructing of Angle 60^0

In constructing angle 60^0 ,the following activities must be carried out.

- Guide the pupils to draw line AB.
- Guide them to make a mark on line AB.
- Guide them to stand on the marked point on line AB and draw a semicircle.
- Let them maintain the radius of the compass
- Stand on the point where you started the semicircle and mark on the arc.
- Join the line from the marked point to line AB.

Constructing of Angle 30^0

In constructing angle 30^0 the following Activities must be carried out

- Angle 60^0 has been constructed already therefore the next thing to do is to bisect angle 60^0 to get your 30^0.

Construction of Triangles

Triangles can be constructed when the following conditions are given.

a) Three sides

b) Two sides including angle

c) Two angles and a side

d) Right angle hypotenuse and another side.

Construction of Triangle with three sides.

Construct triangle PQR such that PQ=8cm, QR=5cm, PR=6cm

Steps

a) With a ruler and a compass draw the line PQ=8cm

b) With centre P and radius 6cm draw an arc

c) With the centre Q and radius 5cm draw an arc to meet the first arc at R.The point R will then be 5cm from Q and 6cm from P.

d) Complete the triangle by drawing straight line PR and QR.

Construction of Triangle with two sides and one angle.

Construct triangle ABC with AB=8cm,BC=6.5cm, and angle ABC=45^0

Steps

a) Make a rough sketch of the triangle

b) Draw line AB=8cm

c) Construct angle 45^0 at B

d) With B as centre and 6.5cm as radius make an arc intersecting the line making 45^0 with AB at C.

e) Join AC to complete the triangle.

Constructing triangle with two angles and one side.

Construct triangle STR such that ST=7cm angle STR=45^0 and angle TSR=30^0 .

Steps.

a) Make a rough sketch

b) Draw line ST=7cm

c) Construct angle 45^0 at T

d) Construct angle 30^0 at S

e) Let the two lines meet at R to describe the required triangle.

Construction of a regular Hexagon

A hexagon is a polygon with six sides. To construct a regular polygon we draw a circle of a given radius and divide the circle into equal angles .for 5 sided polygon, Angle=$\frac{360^0}{5}$ = 72^0,for 6 sided,angle = $\frac{360^0}{6}$ = 60^0

Construct a regular Hexagon of sides 3 cm.

Steps

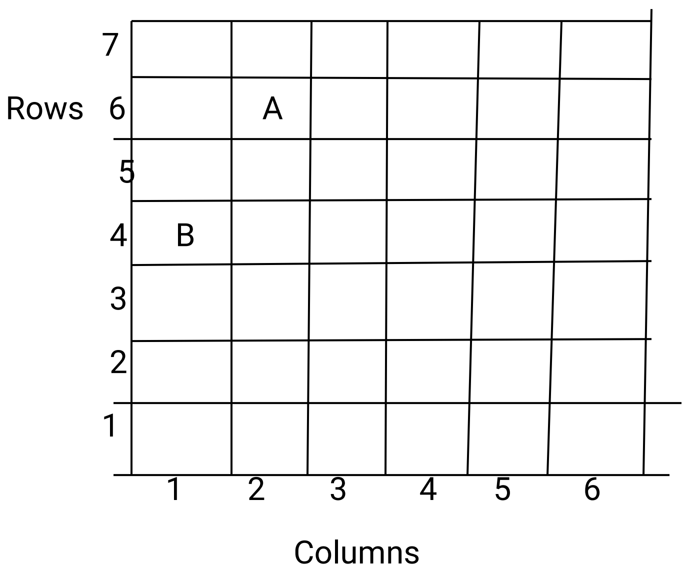
a) Draw a circle of radius 3cm
b) Using the same radius as the circle, place the compass point anywhere on the circumference and draw an arc on the circumference.
c) Place the point of the compass at the end of the arc and draw another arc on the circumference.
d) Repeat the process until you get to the point where you started it.
e) Join the arcs with the straight lines to complete the diagram.

UNIT EIGHT

TEACHING OF NUMBER PLANE

In this lesson we shall be discussing the number plane. This will lead us to how to plot and locate points on the X-Y plane.

We first of all use classroom arrangement, how tables and chairs are arranged in the class. Let pupils understand that the front desks horizontally is the first row and the desks that are arranged vertically is called the column



Guide the pupils to identify the sitting positions of pupils in the class in identifying the position, we read from the column first before the row therefore we get a point like (column.row). Guide them to identify the position of A using column and row.let them understand that the point A is plotted there using a point from the column and another from the row so that gives us (2,6) this point is what we called ordered pair.

Guide the pupils to translate the classroom situation on to the board.

Points in a plane.

A point in a plane is made up of an ordered pair usually denoted by (a,b) where ‘a’ is a number from the horizontal axis and ‘b’ from vertical axis.to fix the position of a point in a plane,we use two straight lines cutting each other at right angles.these two lines fix our directions. The point of intersection of the two lines is called the origin which is denoted by ‘o’.all measurements is taken from the point of intersection ‘o’.Units of distances are marked off on the two intersecting lines,starting from the origin.we measure positive in one direction and negative in the other. The line drawn horizontally is called the x-axis and the one drawn vertically is called the y-axis.the plane containing these axes is called Cartesian plane.

Let us go through the following activities to locate and plot points on the Cartesian plane.

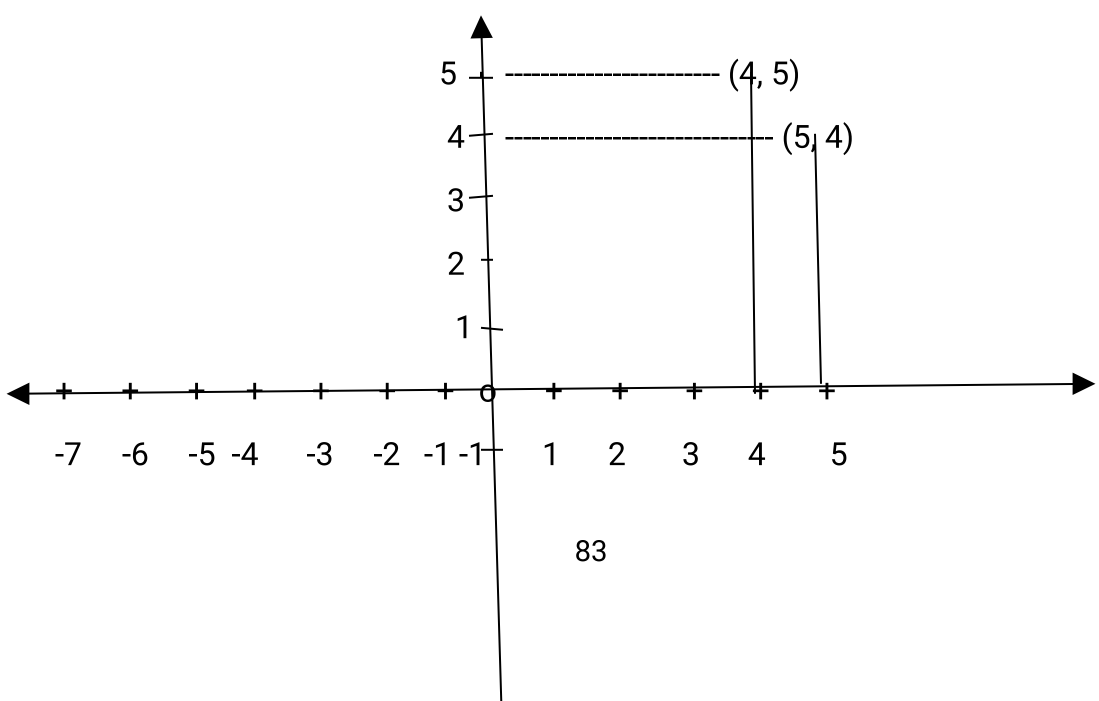
- Draw the horizontal and vertical axes on a graph sheet and label their points of intersection O as the origin.
- Mark and label each of the axes with numbers of equal intervals and divisions.
- Identify the co-ordinates of a point as an ordered pair (x,y) ie.where the first co-ordinate represent 'x' the distance of the point from the origin along the horizontal axis and the second co-ordinate represent 'y' as the distance along the vertical axis.
- Assist pupils to locate and plot points on the number plane for any given co-ordinates.

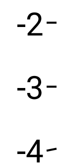
EXAMPLE.

A JHS1 pupil thought that (4,5) and (5,4) represent the same point on a number plane.show and explain how you would help the child to understand that the two are different points.

SOLUTION

- Guide pupils to draw and label the x and y axes on a graph sheet.
- Guide pupils to note that (4,5) is 4 units along the x-axis (horizontal line) from the origin and 5 units measured along the y-axis (vertical lin) from the origin.
- For the point (5,4),help pupils to note that first number 5 is measured along the x axis and 4 measured along the y-axis from the origin.





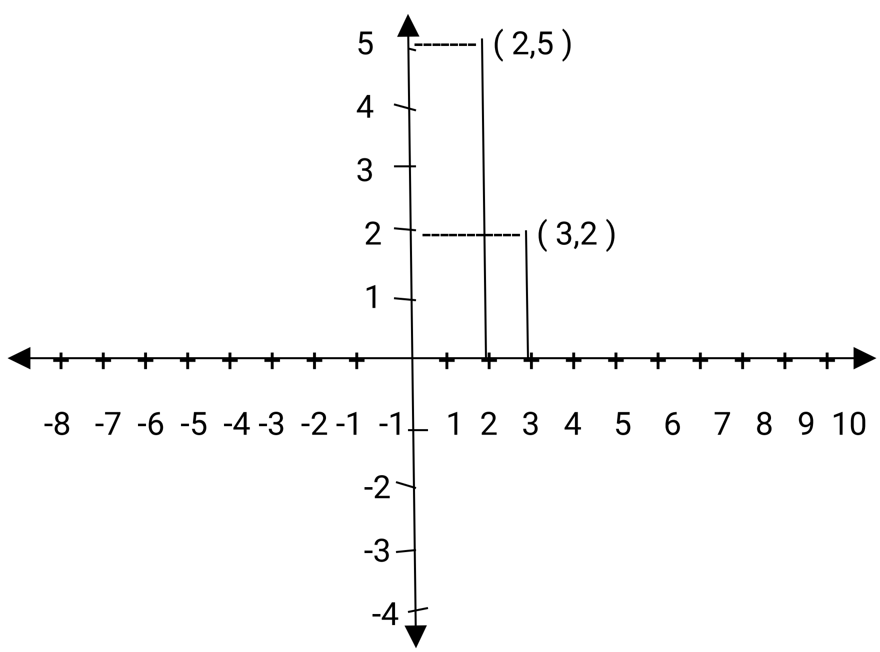
- Help pupils to locate and plot the two points as shown above
- Hence as shown on the number plane the two points are different.

EXAMPLE II

How would you guide a child to locate the points (2,5) and (3, 2) on the Cartesian plane.

SOLUTION

- Draw and label an a graph sheet the X and Y axes.
- Guide the pupils to plot the point (2,5) by moving 2 units from the origin along the x-axis and 5 units from the origin along the y-axis.
- Also, the point (3, 2),guide them to move 3 units along the x-axis and 2 units along y-axis from the origin.
- Guide the pupils to plot the points on the graph sheet as shown



STRAIGHT LINE GRAPHS.

Ask the pupils to perform the following activity

- Using a scale of 2 cm to 1 unit on both axes draw two perpendicular axes ox and oy on a graph sheet
- On the same graph sheet, mark the x-axis from -5 to 5 and the y-axis from -6 to 6.
- Plot on the same graph sheet the points A $(1,1\frac{1}{2})$,B $(4,1\frac{1}{2})$ and C (1,4)
- Join the points to form a triangle. What type of triangle have you drawn?

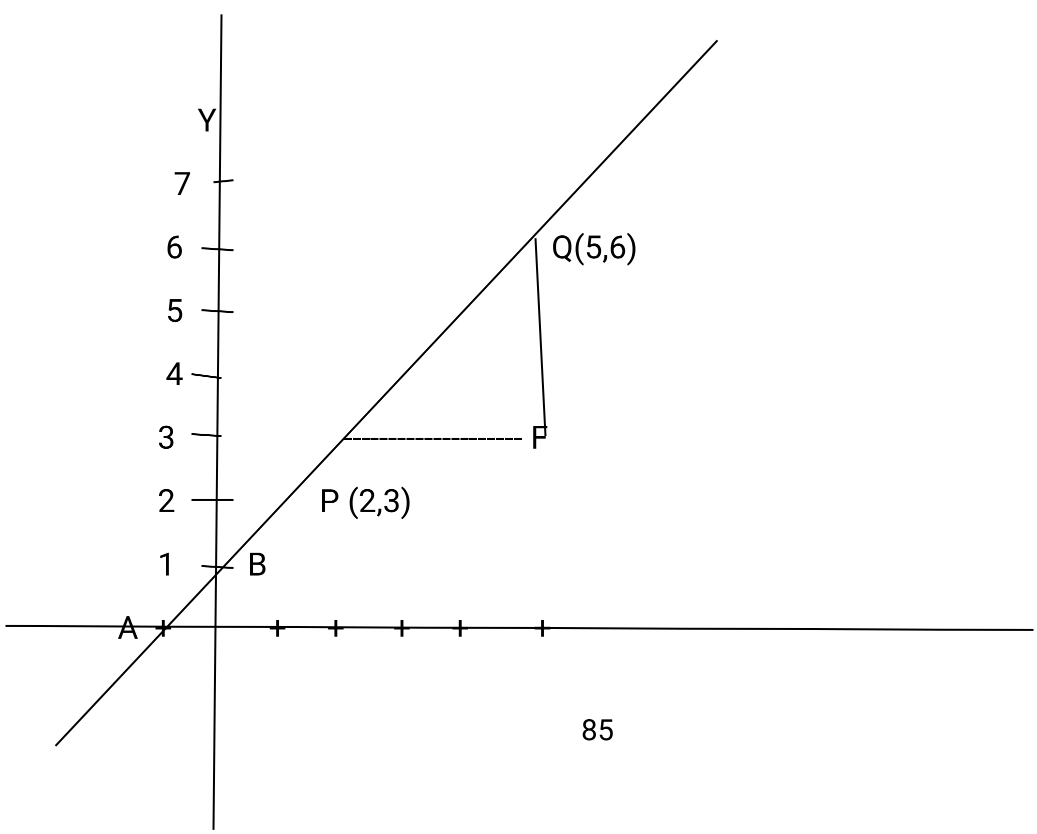
Gradient of a Straight Line.

Consider a straight line which passes through the points P (2, 3) and Q (5,6).If we take x -axis as the horizontal and the line through and P and Q as a road,then,if you walk from P to Q.You would rise by a vertical distance FQ.whilst at the same time you move a horizontal distance PF.

The gradient of the road is= $\frac{FQ}{PF} = \frac{6-3}{5-3} = \frac{3}{3} = 1$

Instead of using the two points P and Q,we could have consider any other two points say A and B on the line. In this way the gradient would be expressed as: $\frac{OB}{AO} = \frac{1-0}{0-(-1)} = \frac{1}{1} = 1$

This is the same as $\frac{FQ}{PF}$



-1 1 2 3 4 5

The Gradient of the straight line is therefore taking as $\frac{\text{increase in y}}{\text{increase in x}}$ in moving from one point on the line to another.this means in moving from point A to point B.

The gradient = $\frac{\text{y-coordinate of B-y-coordinate of A}}{\text{x-coordinate of B-X-COORDINATE OFA}}$

Thus if A is (x_1,y_1) and B is (x_2,y_2) then gradient of AB=$\frac{y2-y1}{x2-x1}$

Example 1

Go through this example with your children.find the gradient of the line joining the following pair of points a) A(4,2) and B(7,11) b) P(-2,-3) and Q(4,6) c) T(4,6) and S(5,-3)

GRAPH OF LINEAR FUNCTIONS (straight lines)

Let us consider the mapping which shows the relationship between the domain X and the range Y

X	-1	0	1	2	3
↓	↓	↓	↓	↓	↓
Y	-1	1	3	5	7

We see that the rule of the mapping is $x \longrightarrow 2x+1$ ie y=2x+1 if we mark the domain of the relation (the x's) on the horizontal axis and the range (the y's) on the vertical axis y-axis, we will notice that the set of the ordered pairs lie on the straight line. Guide the pupils to draw the graph.

Guide the pupils to design activities to teach congruent and similar shapes and symmetry.

Guide them to teach images of shapes under translation, reflection, rotation and enlargement.

Transformation

Transformations are actions carried out on shapes. The actions of the operations upon the geometrical figures may change the shape,size or position of figures.

Transformation may therefore be taken as the mapping between two points,plane shapes or solid figures.

Types of transformation.

i) Translation

ii) Reflection

iii) Rotation

iv) Enlargement

Translation

This is a movement in which all the points of a figure move by the same distance in a certain direction.

A translation transforms or maps each of the points of a figure into another point in a certain distance away in a given direction.these points are called the images of original points.

Examples of translation in every day life are:

a) The motion of a car on a smooth (flat) straight road.

b) The movement of your chair nearer your table in a straight line.

To understand translation we go through these activities.

Activities 1

Identification of Congruent Shapes.

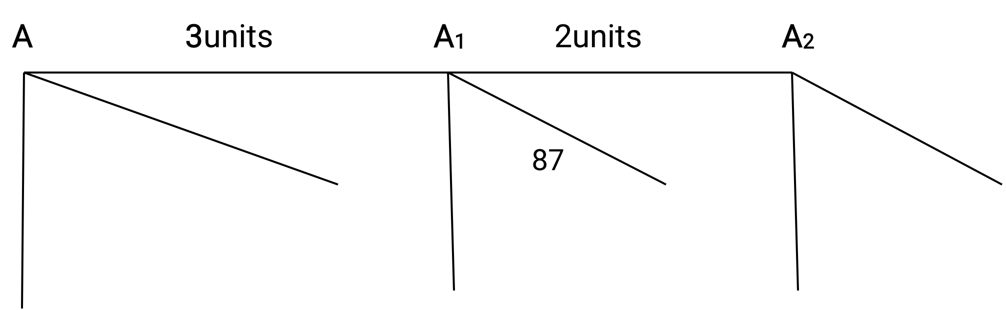
Congruent shapes have the same shape and same size.

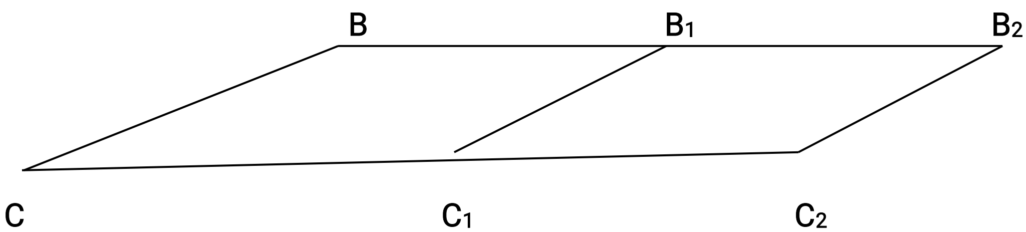
In this activity shapes are placed on a table. One shape is taken and children are asked to pick shapes which are congruent to the picked shape. Congruent cut out shapes or figures may be used. Ensure that there will be shapes that will be congruent and those that will not be congruent.

Activity 2

Sliding of shapes

Children are asked to slide or change the positions of given objects without turning, to a given distance to explain translation as a movement in a straight line.





Shape ABC is slide forward 3cm to shape $A_1B_1C_1$ from this position it is slide forward 2cm to $A_2B_2C_2$.

Activity using Geoboard.Dot paper or Square paper

Shapes are made n a geoboard and pupils are asked to translate in a given distance and direction.

2. Use a rubber band to form a shape on a geoboard
3. Identify each point of the shape
4. Move each point to another point with the same distance and direction
5. Measure the size of the shape at the new position.

What we should look for

1. The original shape is the same as the new shape.
2. Each point moves in the same vertical direction and the same horizontal direction.
3. Children must discover that.

The above activity is best used to introduce translation.

Activity to describe Translation using Numbers (Translation vector)

In this activity we could use dot paper or graph sheet.

Let children draw two perpendicular axes OX and OY on a graph sheet using 2cm to 2 units on both axes.

Plot on the grap sheet the points (0,2),(2,1),(2,-1),(0,-2),(-2,-1),(-2,1).join the points with straight lines to form a shape.

On the same graph sheet plot the point (5,4),(7,3) (7,1),(5,0),(3,1),(3,3) and join the points with straight lines to form a shape .children should study the two shapes on the graph sheet. The shapes can be taken as an object and its image under translation.

Help pupils to complete the following table given the co-ordinates of shapes before and after the transformation.

BEFORE AFTER.

(0,-2)	(5,0)
(0,2)	(5,4)
(2,1)	(7,3)
(2,-1)	(7,1)
(-2,-1)	(3,1)
(-2,1)	(3,3).

Let children answer questions like

Question ;- what relationship is there between the x-co-ordinate before and after?

Answer ;-it is increased by 5

Question;-what relationship is there between the y-co-ordinate before and after?

Answer;-it is increased by 2.

Question ;-how could you describe this translation using number?

Answer;- it is discovered that translation can be represented by a number.

The first number represents movement along the x-axis (horizontal) and the second number represents movement along the y-axis (vertical).in the example shown above each point is moved or translated 5 places to the right along the x-axis and 2 places upwards along the y-axis.in mathematics, the movement can be represented using the notation $\begin{pmatrix}5\\2\end{pmatrix}$.this is what we called the translation vector.from the above activity we may see that a translation may be represented by the mapping of co-ordinates as $\begin{pmatrix}x\\y\end{pmatrix} \rightarrow \begin{pmatrix}x+p\\y+q\end{pmatrix}$ where $\begin{pmatrix}p\\q\end{pmatrix}$ is the translation vector.

REFLECTION.

Like translation, a reflection is also a transformation of one set of points to another set of points. In reflection a shape is flipped over a line. In teaching reflection, we can use the analogy of looking into the mirror. Let children see the difference in reflection and looking in to the mirror. In transformation we normally carry out reflection on two dimensional shape,which is drawn on paper.the image is real as original shape.the image we see in the mirror is vitual,we can not touch it and if we look behind the mirror we can not see it.

For the understanding of transformation of reflection,the children must understand the mathematical properties of reflection.this must be done through activities below.

Activity 1

Paper folding and cutting along a common line.

Children fold a piece of paper into half and cut a shape or shapes from the double thickness.they open out the piece of paper and compare the shape on either side of the fold.

Activity 2.

Place an object before a mirror.look into the mirror to see patterns of symmentarical shape.the object in front is moved backwards and forward.they will notice that the image will also behave in the same manner.

Activity 3.

<u>Making congruent shape on fold paper.</u>

Let children take a piece of paper and fold it in to half.on one side of the fold let them draw a simple polygon and label the vertixes A,B,C etc.

With the paper still folded,let the children push a pin through each of the vertices.on the back of the other have of the paper label the pin holes A_1,B_1,C_1 etc.ask the children to join up the points with a pencil and then unfold the paper.

They will notice that the shapes are the mirror image of the other.let the children join the points AA_1,BB_1,CC_1, etc and label the points where the lines cross the fold of the paper TSR.what angle do these lines make with the fold of the paper?.

Measure and compare AT and A_1T,BR and B_1R and CS and C_1S.

question;-what conclusion can you make?

Answer ;- it develops the idea that each point and its image are the same perpendicular distance from the line of reflection but on opposite sides of it. $AT=A_1T$,$BR=B_1R$,$CS=C_1S$.

The above activities will develop the following properties in children.

1. The movement that takes a shape on to a corresponding shape over a line is called a reflection in the line which is the fold of the paper/mirror line or line of reflection
2. In a reflection a point and its image are at equal distance from the mirror line and other opposite sides.
3. The line joining a point to its image is perpendicular to the mirror line.
4. Any point on the mirror line is its own image.
5. The size of angle is not changed, however, the sense of reflection is reversed and the length of a line is not changed.

6. To describe a reflection, you only need the line of reflection.

To draw an image of an object on graph sheet children should apply the above properties but not formula. The formula under the reflection will be developed latter on.

Example.

Draw on a sheet of graph paper, two perpendicular axes OX and OY for $-6 \le x \le 8$ and $6 \le y \le 12$. mark the following points A(2,2),B(-1,1),C(1,1),D(2,8),E(4,7),F(3,10),G(1,5),H(2,5),K(2,6).

1. Draw $A_1B_1C_1$, the reflection of ABC in the X-axis. Write down the co-ordinates of $A_1B_1C_1$.
2. Draw D1E1F1 the reflection of DEF in the y-axis. Write down the co-ordinates of $D_1E_1F_1$.
3. Draw $A_2B_2C_2$ the reflection of ABC in the line x=-2.write down the co-ordinates of $A_2B_2C_2$.
4. Draw a square $G_1H_1J_1K_1$,the reflection of GHJK in the line y=x.write down the co-ordinates of $G_1H_1J_1K_1$,

ROTATION.

A rotation is a transformation of movement which is achieved by turning. Rotation is the mathematical term for turning. a rotation takes place about a point from a given distance and it has a size, which is measured in terms of an angle. The angles usually given in degrees.

The centre of rotation can be either inside or outside the figure.in our everyday activities we come across turning objects.for example we turn our heads to look at some one,the knbs of radio sets are turned.the tap turn on and off.the door turns on its hinges.

Rotation is measured in degrees like bearing but bearing is measured clockwise,a rotation is measured in ant-clockwise direction.anti-clockwise rotation is positive and clockwise rotation is negative.

In rotation, a point and its image is at the same distance from the centre of rotation.every line through the centre of rotation is turned through the same angle.

A rotation can be described by given the centre of rotation and the angle of rotation.the centre of rotation is the only point that does not move.

A rotation of 180^0 is called a half turn.in a half turn, a line and its images are parallel but in opposite directions and the line joining a point to its image passes through the centr of rotation.

To develop the concept of rotation in children,they must go through activities like;-

Activity 1

Turning objects in everyday life.

Children must be asked to turn their heads to look at friends sitting beside them.they may also turn the door handle to open or close the door in its hinges.in this activity,clockwise rotation and anti-clockwise rotation must be explained.

Activity 2

On a geo-board the children are asked to make shapes of their choice.the shapes are turn abour a marked point.

Activity 3

Turning cut-out shapes.

Make cut –out shapes of simple polygons.label points ABC……etc.

Trace the cut-out shapes on a paper.fit the cut out shape on its outline.mark a point either inside or out side the cut out shape.rotate the cut out shape about the point at an angle.trace the new position of the cut out shape.

Activity 4

Drawing with ruler and protector.

Draw any simple polygon say rectangle ABCD, suppose we want to rotate it about point o outside the shape at an angle 90^0.draw OB_1 Making 90^0 with OB and $OB=OB_1$.

UNIT NINE

COLLECTING AND HANDLING DATA,CHANCE

Statistics is a branch of mathematics that involves the collection of information and then decides how to display, interpret and use the information.

There are two main tasks involved in statistics

a) To collect and describe measurement

b) To make estimates where all measurements are known.

The information which is collected is usually referred to as data. The data is quite often in numerical form. There are different forms of data which is involved in statistics eg. Records of rainfall, weather records, population census count, patients treated at health centre, arrival and departures at an airport, examination results etc.

A data may be discrete or continuous. A continuous data may have values like16.3, 3.13, 6.08 etc. for example finding the height of a pupil in a class.

A discrete data however cannot have values of decimal part or fractional part. Only whole numbers are possible. For example the number of patients treated at a health centre.

To introduce statistics to children

a) Lead pupils with real examples to appreciate importance of statistics in everyday life, for example keeping records of

i.rainfall for farming purpose ii.goods sold in a shop to determine what customers buy most.

b).let children collect data using the school or class as a source of data collection. For example they may be asked to find;

- The day of month on which the birth of each person in the class occurs
- The height of pupils in the class
- The ages of pupils in the class etc.

(c).when the children have collected the data,they will need to make decisions about the data.how it will be used,how it may be presented and finally what it means.

Sources and Collection of Data.

Lead pupils to identify the various areas where data can be collected eg.

- Election results in the school
- Sales of commodities on the market
- Height of pupils in the school or class

- Imports and exports
- Ages of pupils in the class.
- Examination marks in a class.

Method of Collecting Data.

Data may be collected by the following methods

- **Experi**mentation
- Questionnaire
- Survey

To collect information, the first thing to do is to decide what type of information is to be collected. After this you think of the appropriate method to be used. An information like ages of pupils in a class, the day of birth of pupils may be collected using questionnaire if the data is huge but if small data we can use interview.

Organization of Data.

When data is collected,it is often difficult to analyse or even understand the data unless it is sorted out or organized in a table form.

- This table is what we called frequency distribution table

Presentation of Data.

Data can be presented in graphs and in charts form.these are

- Pictogram
- Block graph
- Bar chart
- Histogram
- Pie chart
- Cumulative frequency curve or Ogave

Collection of raw data.

This is the data which has not been organized but presented in the form as it was collected e.g the test scores (out of 10) collected for 40 pupils in class.3 4 7 5 6 9 4 2 7 6 5 4 6 9 10 5 6 6 7 7 0 5 5 3 8 9 1 2 7 5 6 2 7 6 5 4 9 9 5 6.The above data can be organized in frequency distribution table

Scores	Tally	Frequency
0	/	1
1	/	1
2	//	2
3	//	2
4	////	4
5	~~////~~ //	7
6	~~////~~ ~~////~~	10
7	~~////~~ /	6
8	//	2
9	////	4
10	/	1

Stem-and –leaf plot

For a stem and lesf plot,we break the data into two.usually the last digit of the data becomes the leaf and the first digit is the stem.a key is made to show how the number is broken.

Example

Make a stem and leaf plot to represent the data below.

12 23 14 35 29 25

34 31 16 27 25 16

26 25 19 20 21 18

Solution

1	2 4 6 6 9 8
2	3 9 5 7 5 6 5 0 1
3	5 4 1

Key 1 | 2 means 12

Example

Make a stem –and –leaf –plot to represent the data below

112 123 114 135 129 125

134 131 116 127 125 116

127 125 120 121 122 118

Solution

11	2 4 6 6 9
12	3 9 5 7 5 7 5 0 1 2
13	5 4 1

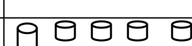
Key 11 | 2 means 112

Pictograph or Pictogram

In pictogram, we select something in the form of a symbol, picture or diagram to represent a given quantity, size or numbers of things we are measuring and then express the given data in terms of these pictograms are useful with young children since they are interesting and understanding. In using pictogram key must be given to give the meaning of the picture.

For example the following is the result of a survey conducted in a class of a J H S, to find the favorable soft drink of each people in the class.

Soft Drink	Number of pupils
Coca-cola	6
Pepsi-cola	5
Pee-cola	8
Fanta	3

Soft Drink	Number of pupils
Coca-cola	
Pepsi-cola	
Pee-cola	
Fanta	

Muscatel	5	Muscatella	⛁ ⛁ ⛁ ⛁ ⛁
Mirinda	4	Mirinda	⛁ ⛁ ⛁ ⛁
Club Cola	6	Club cola	⛁ ⛁ ⛁ ⛁ ⛁ ⛁
Sprite	3	Sprite	⛁ ⛁ ⛁

Frequency table Pictogram

The above information can be represented by a pictogram as shown ⛁ = one child

In the example above each tin represents one child but if the number of children were very large we could use one tin for say 20 children

Consider the following table which shows the distribution of voters in an election for class prefect

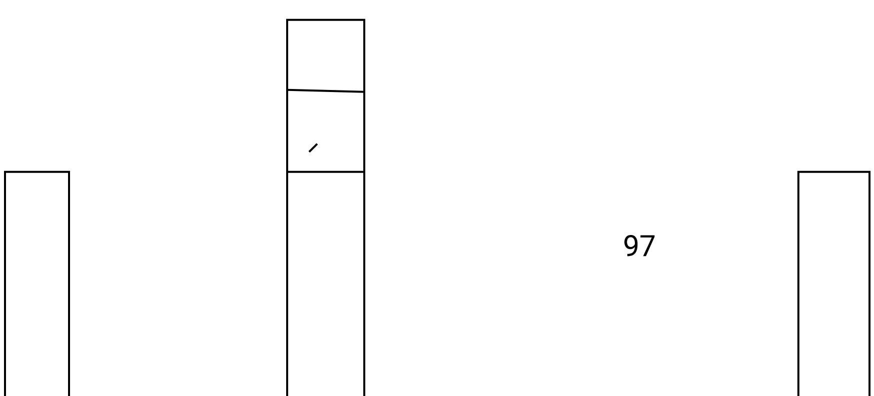
Name	Number of votes		Name	Number of votes
Ankomah	6		Ankomah	▽ ▽
Borquaye	12		Borquaye	▽ ▽ ▽ ▽
commey	18		Commey	▽ ▽ ▽ ▽ ▽ ▽
yaw	15		Yaw	▽ ▽ ▽ ▽ ▽

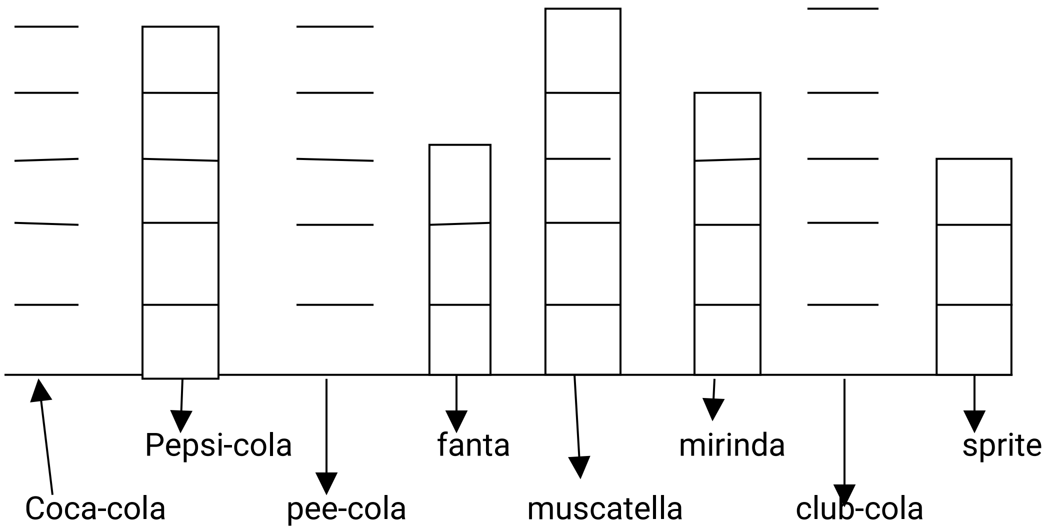
In this data we could use ▽ to represent 3 people.

Block Graphs

Like the pictogram the block graphs are very simple to construct.the block graph is made up of simple rectangles or squares.this can be constructed by pupils using concrete materials like match boxes,milk tins etc.

For example let pupils use match boxes or milk tins to build a block graph on their table using the data of soft drinks above





Let pupils see that the spaces between blocks must be of the same width since the materials used to build the blocks are of the same shape.the pupils must use the blocks themselves.from the diagram we can see that a block graph does not need a vertical axis.

Using simple data to calculate the mean,median and the mode.

AVERAGES:MODE ,MEDIAN,MEAN.

So far we have considered data collection and organization of data.once data have been collected and organized,we should be able to understand and communicate the result to the others.for example,if a pupil records the amount of time spent watching television each day for 10 days period,these 10 numbers can be replaced by 'typical' number or a 'central' number to describe the amount of time in general that pupils watch television.tn this section we shall consider some three of such numbers called mode,median,and mean (also called averages).the mode and median are introduced in primary class 5 while mean is introduced in primary 6.

Finding the mode.

Finding mode or median is introduced in primary 5.in guiding pupils to find the mode of a set of numbers,let them give you their ages,write the ages on the chalkboard as they give you.you will realize that most of the pupils are about 11 years,though few may be 10 years or 12 or even 13.the age of majority of them (the most typical age) is what we call the mode.if in the class,majority of the pupils are 11 years old,then the modal age in the class is 11 years.for example,if a class of 20 pupils,their ages are given as follows

11,12,13,11,13,12,11,11,12,11,12,13,11,13,11,12,12,11,11,13

We realize the most typical or common age is 11.so the mode of the set of numbers above is 11.

The stem-and-leaf-plot may also be used to find the mode of a set of numbers.for example,the number the occurs most is 23 in the figure below

1	1 2 6
2	2 3 3 3 8
3	2 4 5

Finding The Median.

As the name indicates,median is the central number of a set of data.however,the central number can be arrived at only when the numbers have been arranged in order of magnitude.for example,to find the median of the numbers 2,4,3,5,2,7,8,7, and 2, we first re-arrange the numbers in order of magnitude as 2,2,2,3,4,5,7,7,8.

There are nine numbers in all,four to the left of 4 and also four to the right of 4.hence the median is 4.here,the number of items is odd (ie 9) and selecting the middle number leaves equal number of items on each side of the middle one.another example is to find the median of the set of numbers:12,22,16,11,23,28,23,32,23,35,34,37,38.again,we re-arrang the numbers in order of magnitude as:

11,12,16,22.23,23 ,28,32,34,35,37,38.

Again the middle number is 23.

Note :

The arrangement of the numbers in order of magnitude can be in ascending order (as example above) or descending order.

In the above examples, the numbers of items involved are all odd. When the number of items involved is even, then we find the median as the average of the two middle numbers when the numbers are arranged I order of magnitude.

For the set of the numbers 12,22,16.11,23,28,23,32,32,35,34,37,38,39, the number of items involved is 14 (which is an even number).to find the median of these numbers we first re-arrange them in order of magnitude.

39,38,37,35,34,32 ,32,28,23,23,22,16,12,11

The median should be at the middle place where the vertical thick line is drawn. But there is no number there, hence we find the average of the two middle numbers ie 28 and 32.therefore the median=$\frac{28+32}{2} = \frac{60}{2} = 30$

Let pupils find the median age of the class.

Finding Mean of a Set of Data

in the above example we saw that the average of two numbers is given by the sum and dividing the sum by two.extend this idea by asking pupils to find the average age of 2,3,4 and 5 pupils in the class.after going through these activities children will realize that to find mean or average of a set of numbers, we first find the sum of the numbers and divide the sum by the number of items involved. For example,the mean of the st of numbers: 2,2,3,5,6,6,7,9 is given by

$$\text{mean}=\frac{2+2+3+5+6+6+7+9}{8} = \frac{40}{8}=5$$

Let children find their mean age and mean height.

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