THIRD TERM E-LEARNING NOTE

SUBJECT: MATHEMATICS **CLASS: JS1**

REFERENCE TEXTBOOKS

- New General Mathematics, Junior Secondary School Book 1
- Essential Mathematics for Junior Secondary School Book 1

WEEK ONE

WEEK	TOPIC
1.	Revision
2.	Simple Equation
3.	Geometry- Plane Shapes: (a) Types of plane shapes and their properties (b) similarities and differences between the following: Square, rectangle, triangle, trapezium, parallelogram and circle
4.	(a) Perimeter of regular polygon, square, rectangle, triangle, trapezium, parallelogram and circle. (b) Area of regular plane shapes such as squares, rectangles, parallelograms, etc
5.	Three Dimensional Shapes: (a) Identification of three dimensional or 3 D-Shapes (b) Basic properties of cubes and cuboids (c) Basic properties of cylinders and spheres (d) volume of cubes and cuboids.
6.	Angles: Identification and properties of angles (a) vertically opposite angles (b) adjacent angles (c) alternate angles (d) corresponding angles
7.	Angles (Cont'd): Theorems: (a) sum of angles on a straight line (b) supplementary angles (c) complementary angles (d) sum of angles in a triangle
8.	Construction: (a) construction of parallel and perpendicular lines (b) bisection of a given line segment (c) construction of angles 90^o and 60^o.
9.	Statistics I: (a) Meaning, purpose and usefulness of data (b) data collection, sources and importance (c) presentation and analysis of data frequency distribution
10.	Graphical presentation of data: the use of pictogram, bar-chart, pie chart and histogram
11.	Statistics II: Measure of Average(a) the arithmetic mean (b) the median (c) the mode
12.	Revision and Examination

Revision

1. Change 321_{four} to base eight (a) 57 (b) 71 (c) 62 (d) 175
2. Simplify in base two $(1101)^2$ (a) 1011011 (b) 10101001 (c) 1101101 (d) 1110111
3. Round off 0.00057891 to 2 s.f (a) 0.0006 (b) 0.00058 (c) 0.58 (d) 0.000579
4. What is MDLXXVII in Arabic numerals? (a) 1677 (b) 1607 (c) 1577 (d) 1527
5. What is the value of 5 in number 12 752 109? (a) 50 hundreds (b) 50 thousands (c) 52 thousands (d) 5 hundredth
6. The product of 25 and 170 is (a) 425 (b) 4250 (c) 4050 (d) 4005
7. There are 805 students in a school. If 409 are boys, how many girls are in this school? (a) 396 (b) 386 (c) 286 (d) 496
8. Express 240 as a product as a product of its prime factors. (a) $2^3 \times 3 \times 5$ (b) $2^4 \times 3 \times 5$ (c) $3 \times 4^2 \times 5$ (d) $4^2 \times 5 \times 6$
9. The L. C. M of 4, 6 and 8 is (a) 8 (b) 12 (c) 18 (d) 24
10. The H. C. F of 5, 10 and 15 is (a) 10 (b) 15 (c) 5 (d) 30

11. Angle 272° is (a) an acute angle (b) an obtuse angle (c) a right angle (d) a reflex angle
12. Which of these fractions is the largest? (a) $\frac{3}{5}$ (b) $\frac{5}{6}$ (c) $\frac{5}{8}$ (d) $\frac{2}{3}$
13. Which of the following is **not**equivalent to $\frac{2}{5}$? (a) $\frac{6}{15}$ (b) $\frac{10}{50}$ (c) $\frac{26}{65}$ (d) $\frac{8}{20}$
14. If 5 $\frac{3}{8}$ is expressed as an improper fraction its numerator is (a) 43 (b) 53 (c) 40 (d) 14
15. Simplify: $\frac{9}{14} \times \frac{7}{15}$ (a) $\frac{16}{29}$ (b) $\frac{3}{5}$ (c) $\frac{3}{10}$ (d) $\frac{5}{12}$
16. Work out the answer to $\frac{2}{7} \div 1\frac{1}{2}$ (a) $\frac{3}{7}$ (b) $\frac{4}{21}$ (c) $\frac{1}{7}$ (d) $5\frac{1}{4}$
17. A man's debt of #35 000 is reduced by ¼ . How much is the debt now? (a) #8 750 (b) # 26 050 (c) #26 250 (d) #16 250
18. Simplify $4\frac{1}{2} + 2\frac{3}{4}$ (a) $6\frac{1}{4}$ (b) $7\frac{1}{4}$(c) $5\frac{1}{4}$ (d) $2\frac{1}{4}$
19. Write 15% as a fraction and a decimal. (a) $\frac{1}{20}; 0.05$ (b) $\frac{3}{20}; 1.5$ (c) $\frac{3}{20}; 0.15$ (d) $\frac{5}{20}$; 0.25
20. Calculate 0.07 x 0.9 (a) 0.630 (b) 0.063 (c) 6.300 (d) 0.0063
21. Find the cost of 54 exercise books, if 3 exercise books cost #200. (a) #3600 (b) #2600 (c) #1800 (d) #4600
22. If x + 5 = 25 is true, what does x stand for? (a) 40 (b) 35 (c) -7 (d) 7
23. Simplify 15k – 10k + k (a) 6k (b) 5k (c) -6k (d) 4k
24. Simplify $\frac{2}{9}$ of 36ab (a) 4ab (b) 72ab (c) 8ab (d) 6ab
25. If x = -2, y = -3 , evaluate $9x^{2} \div 2y$ (a) -6 (b) -3 (c) 6 (d) 12
26. What is the coefficient of x in the expression 7 – 9x? (a) 9 (b) 7 (c) -9 (d) -2
27. Simplify x- 6y – (7y- 3x) (a) 12x- 13y (b) 4x-13y (c) 2x +13y (d) 4x-y
28. If x = 3, y = 2 and z = -1, evaluate z(5x-y) (a) -13 (b) -10 (c) 15 (d) 14
29. Solve the equation $\frac{x-5}{4} = 3$ (a) 12 (b) 17 (c) 7 (d) -7
30. A man weighs 8kg more than his son. If the sum of their weight is 138kg. What is the weight of the man? (a) 57kg (b) 73 kg (c) 77kg (d) 82kg

SECTION B

Instruction: Answer all the questions in this part

1. Find the estimate and the exact cost of the following:
   (a) 54 pens at #6.82 each (b) 214 mangoes at #1.95
2. A woman decides to buy a bed costing #6 950 and a table costing #2 680. (a) By using approximations, estimate the total sum she decides to spend. (b) Calculate the accurate cost
3. Evaluate the following binary numbers: (a) 111 x (110 + 101) (b) 101 x (1000 – 111) (c) $(1100 - 111)^2$
4. Convert the following to base ten (a) 451_{eight} (b) 3032_{four}
5. Remove the brackets and simplify the following: (a) (8x + 5) + (4x – 3) (b) (7x + 5y) + (3x – 2y)
6. Solve the following equations: (a) 6m + 2 = 20 + 4m (b) 9x- 20 = 8 – 5x

WEEK TWO

SIMPLE EQUATIONS:

An algebraic equation is two algebraic expressions separated by an equal sign. The left hand side is equal to the right hand side (LHS = RHS) e.g 7 + 3 = 10, 20 -6 = 14, 4 x 5 = 20, 35/7 = 5

Translation of algebraic equations into words: Any letter of the alphabet can be used to represent the unknown number.

Translate the following equations into words:

1. X + 9 = 12; means 'a certain number plus nine is equal to twelve'
2. 15= 7 – 2x; means 'fifteen is equal to seven minus twice a certain number'
3. $\frac{4x}{5}$ = 6; means 'four-fifth of a number equal to six'
4. $3k + 8 = 20$; 'three times a certain number plus eight is equal to twenty'

Evaluation

Translate the following equations into words:

1. 16 = 9 – 2x 2. 9 + 5x = 23 3. X + 5 = seventy 4. $\frac{3x}{4} = 9$

Translation of algebraic sentences into equations:

Example: Translate the following into equations:

1. Three times a certain number plus 20 is equal to the number plus 12.
2. A woman is p years old. In seven years'time, she will be 45 years old.
3. The result of taking 10 from the product of a certain number and 7 is the same as taking 4 from twice the number.

Solution:

1. Let the number be m
   3 x m + 20 = m + 12
   i.e 3m + 20 = m + 12
2. Woman is p years old;
   7 years' time, she will be (p + 7) years
   i.e p + 7 = 45
3. Let the number be a,
   Product of a and 7 = 7a
   Taking 10 from 7a = 7a – 10
   Taking 4 from twice the number = 2a – 4
   Then, 7a – 10 = 2a – 4

Evaluation:***Translate to algebraic equations***:

1. A certain number is added to 15, the result is six minus the same number.
2. Ayo is y years old, 7 years ago, she was 15 years old.

Use of Balancing or See saw Method

This is very easy and convenient way of solving linear equations. An equation can be compared to a balance. To maintain balance, whatever is done to the LHS of the scale must be done to the RHS every time.

Examples:

Solve the following equations using the balancing method.

(a) X + 4 = 9 (b) x – 9 = 15 (c) 5x = 35 (d) $\frac{x}{3} = 7$

Solution

(a) X + 4 = 9
   To eliminate 4 from the LHS and RHS of the equation, subtract 4 from both sides
   X + 4 -4 = 9 – 4
   X = 5

(b) X - 9 = 15
Add 9 to both sides of the equation to eliminate -9
X – 9 + 9 = 15 + 9
X = 24

(c) 5x = 35
Divide both sides by 5 to balance the equation

$$\frac{5x}{5} = \frac{35}{5}$$

X = 7

(d) $\frac{x}{3} = 7$
Multiply both sides by 3 to eliminate 3 from the LHS

$$\frac{x}{3} \times 3 = 7 \times 3$$

X = 21

Evaluation: Solve the following equations using the balancing equation method

(1) 4x = 25 (2) x + 16 = -19 (3) –x -3 = -9 (4) $\frac{x}{2} = 1.4$

Solving Linear Simple Equations Involving Collection of Like Terms

Simple equations can be solved by collecting like terms. That is taking the unknown like terms to one side and the known to the other side.

Example:

Solve the following equations:

(a) 2y + 3 = y + 1 (b) 4c – 8 = 10 – 5c

Solution

(a) 2y + 3 = y + 1
Subtract y from both sides to eliminate y from RHS
2y – y + 3 = y – y + 1
y + 3 = 1
Subtract 3 from both sides to eliminate 3 from LHS
y + 3 – 3 = 1 – 3
y = -2

(b) 4c – 8 = 10 – 5c
Collect like terms by adding 5c to both sides to eliminate 5c from the RHS
4c + 5c – 8 = 10 – 5c + 5c
9c – 8 = 10
Add 8 to both sides to eliminate 8 from LHS
9c – 8 + 8 = 10 + 8
9c = 18
Divide both sides by 9

$$\frac{9c}{9} = \frac{18}{9}$$

C = 2

Evaluation: Solve the following equations by using the balancing method:

(1) 17a – 11 = 10a + 3 (2) 7d – 6 = 30 – 2d (3) -6 – 2x = 5 – 7x

Solving Linear Simple Equations Involving Fractions

To solve equations involving fractions, the first thing is to clear the fractions and then collect

like terms.
Example: Solve the following equations;

(a) $\frac{x+4}{3} = 3$ (b) $\frac{x}{2} - \frac{2}{5} = \frac{4}{5}$

Solution:

(a) $\frac{x+4}{5} = 3$

Multiply both sides by the LCM 5

$(\frac{x+4}{5})\times 5 = 3 \times 5$

X + 4 = 15

Subtract 4 from both sides

X + 4 – 4 = 15 -4

X = 9

(b) $\frac{x}{2} - \frac{2}{5} = \frac{4}{5}$

Multiply both sides by 10, the LCM

$\frac{x}{2} \times 10 - \frac{2}{5}\times 10 = \frac{4}{5} \times 10$

5x – 4 = 8

Add 4 to both sides

5x – 4 + 4 = 8 + 4

5x = 12

Divide both sides by 5

$\frac{5x}{5} = \frac{12}{5}$

X = 2.4

Evaluation

Solve the following equations using the balancing method:

(1) $\frac{x}{5} + \frac{1}{4} = \frac{17}{20}$(2) $\frac{x+7}{2} = 1$

General Evaluation:

(i) Solve using the balancing method: (a) 14 – x -5 = -5x + 3 (b) 12y – 4 = 2 (c) $\frac{y}{3} - 4 = 1$

(ii) Twice a certain numberis added to 10. If the result is minus fourteen, find the number.

(iii) Two thirds of a certain number plus five equals ten less than the same number. What is the number?

Reading Assignment

Essential Mathematics for Junior Secondary Schools 1. Page 144- 154

Weekend Assignment:

1. If 8 is added to a number, the result is 27, What is the number? (a) 25 (b) 35 (c) 19 (d) -27
2. Solve $\frac{4x}{6} = 5$ (a) 30 (b) 7.5 (c) 15 (d) 26
3. Solve 3y + 4 = 22 (a) 6 (b) $\frac{26}{3}$ (c) 18 (d) 54
4. Solve x + 0.4 = 0.6 (a) 0.10 (b) 0.2 (c) - 0.2 (d) -1.0

5. Solve -3x + 5 –x = 14 – 6x (a) 4.5 (b) -4.5 (c) 4.75 (d) 9

Theory

1. Solve the linear equations (a) x – 2 = 2x + 1 (b) 19x – 12 = 11x + 4
2. Subtracting nine from a certain number gives thirteen.

WEEK THREE

Geometry- Plane Shapes

Plane shapes are two-dimensional shapes bounded by lines known as sides. Any shape drawn on a plane is called a two-dimensional shape (or 2-D shapes for short). When we say a figure is two- dimensional, we mean it can be measured along x and y axes i.e. it has length and width or breadth.

Types of Plane Shapes

Common plane shapes are:

1. Triangles
2. Quadrilaterals
3. Polygons
4. Circles

Triangles and quadrilaterals are examples of polygon. However, because triangles and quadrilaterals have their own special properties they are usually dealt with separately.

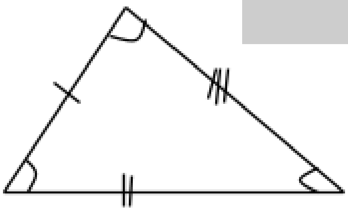
Triangles

Tri-angle means three angles. A triangle has three angles and three sides.

Types of Triangles

a. Scalene triangle: it has no sides and no angles equal. i.e. it has three sides of different lengths and three angles of different magnitudes (sizes).

z

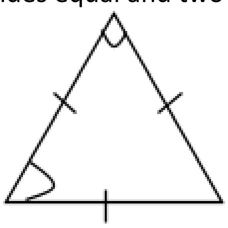


x y

b. Isosceles triangle: It has two adjacent sides equal and two angles equal

b

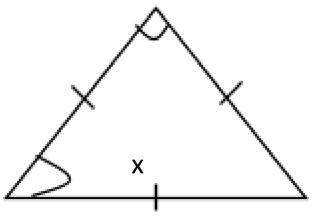
aa



c. Equilateral triangle: It has all its sides equal and all its angles equal. Each angle is 60^0.

x

x x



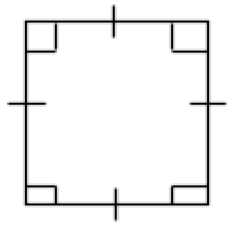
Other types of triangles are:

i. Acute-angled triangle: It has each of its angles less than 90^0 i.e. each angle is acute
ii. Obtuse-angled triangle: It has one of its angles more than 90^0.

iii. Right-angled triangle has one of its angles equal to 90^0. The side opposite the right angle is the longest side and is often called the hypotenuse.

Quadrilaterals

A quadrilateral is a four-sided plane shape with four angles



Types of quadrilateral

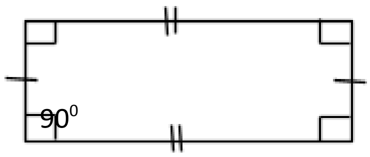
Properties

- ✔ It has all its sides equal
- ✔ Each angle is 90^0
- ✔ The opposite sides are parallel

a) Rectangle

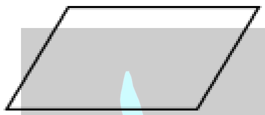
Properties

It is a quadrilateral that has opposite sides equal and each angle is 90^0.



b) Parallelogram

It has two opposite sides parallel and equal in length



c) Rhombus

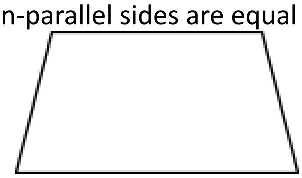
<u>Properties</u>

- ✔ It has all its four sides equal in length
- ✔ Opposite sides are parallel
- ✔ Opposite angles are equal

d) Trapezium

A trapezium is a quadrilateral with one pair of opposite sides parallel

Note: when the two non-parallel sides are equal in length, it is called an isosceles trapezium



e) Kite

A kite is a quadrilateral that has two pairs of adjacent sides equal in length and one pair of opposite angles equal.

<u>Evaluation:</u>

1. What is a plane shape?
2. With the aid of diagram, describe scalene, isosceles and equilateral triangles.
3. Write down all the quadrilaterals that have
   a. two pairs of parallel sides
   b. four sides equal
   c. two adjacent sides equal and one pair of opposite angles equal

<u>Polygon</u>

A polygon is any closed shape that has three or more straight sides. Thus, rectangles, squares and triangles are all examples of polygons.

The table below shows some special polygons and their sides.

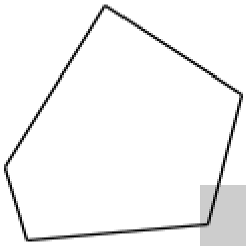
Names of Polygons	Number of sides
Triangle	3
Quadrilateral	4
Pentagon	5
Hexagon	6
Heptagon	7
Octagon	8
Nonagon	9
Decagon	10
Duo decagon	12

There are two types of polygons. They are:

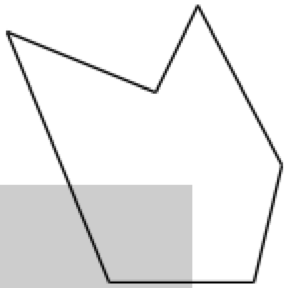
i. Regular Polygons
ii. Irregular Polygons

A. Irregular Polygons

When the sides of a polygon and the included angles are not equal it is called an irregular polygon. Examples are irregular pentagon and irregular hexagon shown below.



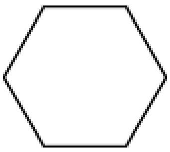
Irregular Pentagon



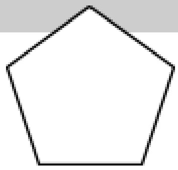
Irregular Hexagon

B. Regular Polygon

A polygon that has all its sides and angles equal is called a regular polygon. Examples of regular polygons are: equilateral triangle, square, regular pentagon, hexagon, etc



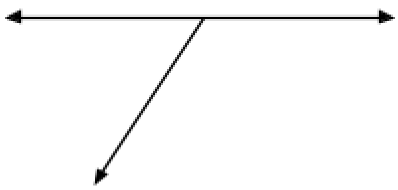
Regular Hexagon



regular pentagon

Circles

A circle is a plane shape that has set of points equidistant from a fixed point, O. The fixed point is the centre of the circle as shown in the diagram below.



Diameter
O

The parts of a circle

The **circumference** is the distance around the circle.
A **radius** (plural radii) is any straight line joining the centre of the circle to any point on the circumference.
A **chord**is any straight line joining two points on the circumference.
A **diameter**is any chord that goes through the centre of the circle.

Regions

A **sector**is the region between two radii and the circumference.
A **semicircle**is a sector between a diameter and the circumference, i.e. half a circle.
A **segment** is the region between a chord and the circumference.

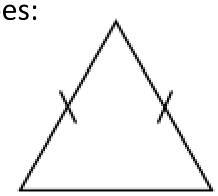
Evaluation:

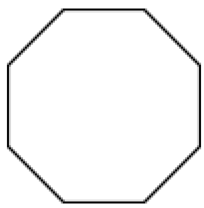
Draw a circle and include the following parts: two radii, a sector, a chord, a segment, a diameter and an arc. Label each part and shade any regions.

General Evaluation/ Revision Questions

1. A polygon with 12 sides is called ....
2. The number of sides of a polygon is not equal to the number of angles (True/False)
3. All the sides of an equilateral triangle are .... and each angle is ....
4. Write down the names of these shapes:

(i)


(ii)


(iii)


Reading Assignment

- Essential Mathematics for J.S.S 1 by A.J.S Oluwasanmi, page 167-169.
- New General Mathematics by M.F Macrae et.al, Revision test II, Numbers 1-9.

Weekend Assignment

1. A polygon with seven sides is called .... (a) pentagon (b) hexagon (c) octagon (d) heptagon
2. The simplest form of polygon is a .... (a) circle (b) rectangle (c) triangle (d) square
3. Which of the following quadrilaterals has only one pair of parallel sides? (a) Trapezium (b) rhombus (c) parallelogram (d) square
4. How many sides has a duo decagon? (a) 10 (b) 20 (c) 12 (d) 9

5. A straight line joining two points on the circumference is called .... (a) chord (b) segment (c) arc (d) sector

Theory

Write down the missing word in the following

(a) A regular polygon has all its sides .... and all its angles ....

(b) The distance around the circle is ....

WEEK FOUR

PERIMETER OF REGULAR PLANE SHAPES

The perimeter of a plane shape is the length of its outside boundary or the distance around its edges.

Irregular shape

An irregular shape does not have a definite shape. To determine the perimeter of such shape, string or thread can be used to measure it. Place the string around the edge, then straighten it out and measure it with a ruler from the mark part.

Regular Shape

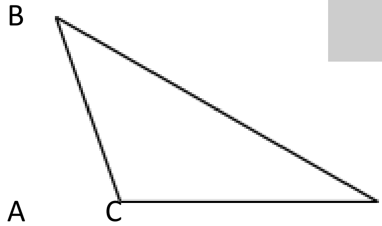
A regular shape has a well-defined edge which may be straight lines or smooth curves. Examples are regular polygon and circles

The unit of measurement

Perimeter is measured in length units. These are kilometres (km), metres (m), centimetres (cm) and millimetres (mm).

Example 1

Use a ruler to measure the perimeter of triangle ABC.



Solutions

By measurement: AB: AB = 21mm, BC = 30mm, AC = 14mm

Perimeter =Total length of sides

= AB + BC +AC

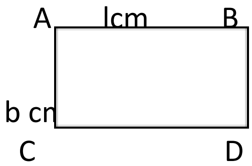
=21mm+ 30mm +14mm

= 65mm

Using formulae to calculate perimeter

Rectangles

The longer side of a rectangle is called the length and is usually represented by letter l. The shorter side is called the width or breadth and it may be represented by w (or b).



AB = DC = lcm and AD = BC = bcm

Perimeter (P) = AB + BC + CD + DA = l + b + l + b

= 2l + 2b = 2(l + b)

P = 2 (l + b)

Note: This is also used to determine the perimeter of a parallelogram

Example 1

The length of a rectangular room is 10m and the width is 6cm. Find the perimeter of the room.

Solution

Length of the room, l = 10m ; width/breadth of the room, w (or b) = 6m

Perimeter = 2(l +b) = 2 (10m + 6m)

= 2 (16m) = 32m

Example 2

Calculate the perimeter of a square whose length is 8cm.

Solution

A square has all its four sides equal, so each length is l cm.

The perimeter = l +l + l + l = 4l

= 4 × 8 = 32m

In general, perimeter of a square, P = 4l. This is also used to determine the perimeter of a rhombus

<u>Example 3</u>

A rectangle has a perimeter of 74m. Find: (a) the length of the rectangle if its breadth is 17m, (b) the breadth of the rectangle if its length is 25m.

<u>Solution</u>

Note: since perimeter of a rectangle = 2(l + b)

Length = $\frac{perimeter\ of\ rectangle}{2} - breadth$; Breadth = $\frac{perimeter\ of\ rectangle}{2} - length$

So, to find the length

(a) Length = $\frac{perimeter\ of\ rectangle}{2} - breadth$

= $\frac{74m}{2} - 17m$= 37m – 17m = 20m

(b) breadth= $\frac{perimeter\ of\ rectangle}{2} - length$

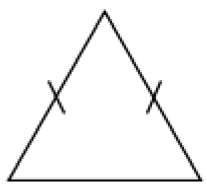
=$\frac{74m}{2} - 25m$ = 37m – 25m = 12m

Evaluation:

1. The perimeter of a square is 840cm. Find the length of the square in metres.
2. A rectangle has sides of 9cm by 7.5cm. Find its perimeter
3. Esther fences a 3m by 4m rectangular plot to keep her chickens in. The fencing costs ₦ 200 per metre. How much does it cost to fence the plot?

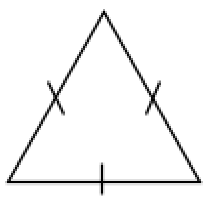
Perimeter of triangles

Isosceles triangle



The perimeter = a +a +b = 2a +b

Equilateral triangle

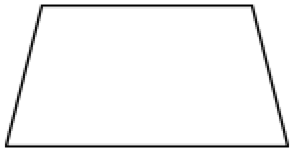


Perimeter = a + a + a = 3a

Example 4

An isosceles triangle has a perimeter of 250mm. If the length of one of the equal sides is 8cm, calculate the length of the unequal side.
Solution
First convert to the same unit of measurement
250mm = 25cm
Sum of equal sides = 8cm + 8cm = 16cm
The length of the unequal side = 25cm – 16cm = 9cm

Trapezium



The perimeter = p + q + r + s

Isosceles trapezium
The perimeter = a + b + a + c = 2a + b + c

Example 5
An isosceles trapezium has a perimeter of 50cm if the sizes of the unequal parallel sides are 12cm and 8cm. Calculate the size of one of the equal sides.
Solution
Perimeter = 50cm
Perimeter of an isosceles triangle = 2 (equal sides) + b + c = 2x + 8 + 12

$$50 = 2x + 20$$
$$50 - 20 = 2x + 20 - 20$$
$$2x = 30\ ;\ x = 15cm$$

Therefore, one of the equal sides = 15cm

Perimeter of Circles
The circumference (C) of a circle is the distance around the circle. This means that the circumference of a circle is the same as its perimeter.

AB = diameter, OA = OB = radii
But AB = OA + OB i.e. d = r + r
diameter , d = 2 radius (r) or radius, r = diameter (d)/ 2
The circumference, C of a circle is given by C =πD, where D is the diameter of the circle. If R is the radius of the circle, then C = 2πR.
Therefore, C = πD or C = 2πR
Example 6
Calculate the perimeter of a circle if its (a) diameter is 14cm (b) radius is 4.9cm (Take $\pi = \frac{22}{7}$).
Solution
(a) Diameter = 14cm
Perimeter , C = πD = $\frac{22}{7} \times 14 = 44cm$

(b) Radius= 4.9cm

Perimeter = $2\pi R$

$= 2 \times \frac{22}{7} \times 4.9 = 30.8$cm

Example 7

Calculate the perimeter of these figures. (Take $\pi = 3\frac{1}{7}$).

Solution

(a) A semicircle is half of a circle. The diameter = 3.15 cm

The perimeter of a circle = $\pi D = 3\frac{1}{7} \times 3.15$

$= \frac{22}{7} \times 3.15 = 9.9$cm

The length of the curved edge = $\frac{9.9cm}{2}$= 4.95cm

The perimeter of the shape = 4.95cm + 3.15 cm = 8.1cm

(b) A quadrant is a quarter of a circle

The perimeter of a circle = $2\pi R = 2 \times 3\frac{1}{7} \times 0.63 = 3.96$m

The length of the curved edge = $\frac{3.96m}{4}$ = 0.99m

Perimeter of the shape = 0.99m + 0.63m + 0.63m = 2.25m

Evaluation:

1. Calculate the perimeter of a circle with radius 42cm. If a square has the same perimeter as the circle, calculate the length of one side of the square. (Take $\pi = \frac{22}{7}$)
2. The three sides of a triangle are (x + 5)cm, (2x + 4)cm and (2x -3)cm.
   (a) Find the perimeter of the triangle in terms of x
   (b) If x = 10, find the perimeter of the triangle

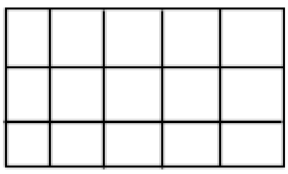
AREA OF PLANE SHAPES

The area of a plane shape is a measure of the amount of surface it covers or occupies. Area is measured in square units, e.g. square metre (m^2), square millimetres (mm^2).

Finding the areas of regular shapes

Area of Rectangles and Squares

A rectangle 5cm long by 3cm wide can be divided into squares of side 1cm as shown below.



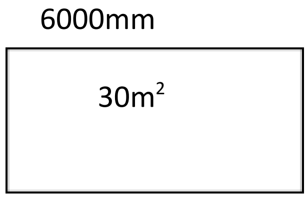
By counting, the area of the rectangle is 15cm^2. If we multiply the length of the rectangle by its width the answer is also 15cm^2 i.e. length X width = 5cm X 3cm = 15cm^2

In general, if A = area, l = length and w= width,

Area of a rectangle = length X width

Example 1

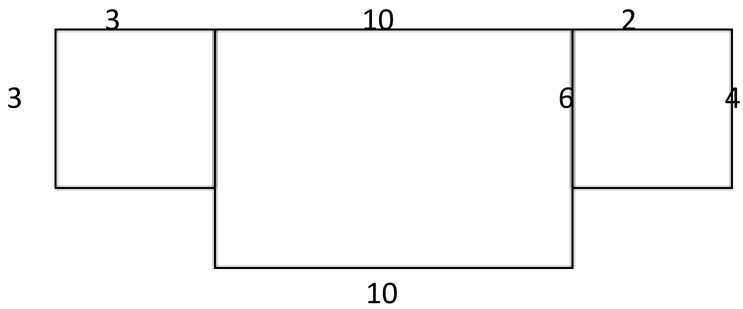
Calculate the area of a rectangle of length 6cm and width 3.5cm.
Solution
Area = length X width = 6cm X 3.5cm = 21cm^2
Example 2
The area of a rectangular carpet is 30m^2. Find the length of the shorter side in metres if the length of the longer side is 6000mm.
Solution



First convert the length i.e. 6000mm to metres
6000mm= $\left(\frac{1}{1000} \times 6000\right)m$ = 6m
If A= area, l = length and b = breadth
Using breadth = $\frac{Area}{length}$; breadth = $\frac{30m^2}{6m}$ = 5m
The length of the shorter side is 5m

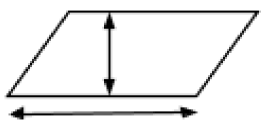
Square
A square has all its sides equal.
Area = (length of one side)^2 i.e. A = l^2
If Area, A is given then the length, l can be found by taking the root of both sides i.e. l = $\sqrt{A}$.
Example 3
Calculate the area of a square advertising board of length 5m.
Solution
Area of square board = l X l = 5m X 5m =25m^2

Area of shapes made from rectangles and squares
Example 1
Calculate the area of the shape below. All measurements are in metres and all angles are right angles.



The shape can be divided into a 3X3 square, 6X10 and 2X4 rectangle.
Area of shape = Area of square + area of 2 rectangles
= ((3X3) + (6X10) + (2 X4))m^2
= 9 + 60 + 8 = 77m^2

Area of parallelograms



Area of a parallelogram = base X height
Example2
Calculate the area of a parallelogram if its base is 9.2cm and its height is 6cm.
Solution

Area of parallelogram = base X height = 9.2cm X 6cm = 55.2cm^2

Area of Triangles

In general: Area of any triangle = $\frac{1}{2} \times$ base $\times$height i.e$\frac{1}{2} \times$ the area of a parallelogram (or rectangle that encloses it).

Example 1

Calculate the area of the triangle with base 6cm and height 4cm.

Solution

Base (b) = 6cm, Height (h) = 4cm

Area = $\frac{1}{2} \times$ base $\times$ height $= \frac{1}{2} \times 5 \times 4$ = 10cm^2

<u>Example 2</u>

Given that the area of triangle XYZ is 120cm^2 and its height YD is 12cm. Find the length XZ.

Solution

Let the base XZ be bcm; Height, YD (i.e. h)= 12cm

Area of triangle XYZ= $\frac{1}{2} \times$ base $\times$ height

120 = $\frac{1}{2} \times$ b $\times$ 12

120= 6b

b = 20cm

the length XZ is 20cm.

Area of trapezium

Area of trapezium = $\frac{1}{2}(a + b)h$

Where (a + b) is the sum of the parallel sides and h, the height of trapezium.

Example

Calculate the area of trapezium with the dimensions shown in the figure below.

Solution

Area of trapezium = $\frac{1}{2}(sum\ of\ parallel\ sides) \times height$

$= \frac{1}{2}(18 + 10) \times 12 = \frac{1}{2} \times 28 \times 12$ = 168cm^2

Area of Circles

Area, A =πr^2 or A = $\frac{\pi d^2}{4}$

Example1

Find the area of a circle with radius 4.9cm (Take $\pi = \frac{22}{7}$).

Solution

Area of a circle = = $\frac{22}{7} \times 4.9^2$ cm^2

= 75.46cm^2

The area of the circle is 75.46cm^2 $^{\pi}$r^2

Example 2

Find the area of a semicircle with diameter 20mm. (Take π= 3.14)

Solution

Diameter, d = 20mm; Radius, r = 20/2 = 10mm

Area of a semicircle = $\frac{1}{2} \times area\ of\ a\ circle = \frac{1}{2} \times \pi r^2$

$= \frac{1}{2} \times 3.14 \times 10^2 = 157mm^2$

Area of the semicircle = $157mm^2$

Evaluation:

1. A string is wound 30 times around a cylindrical object of diameter 7m. Calculate the length of the string. (Take $\pi = \frac{22}{7}$)
2. A rectangular garden is 20m by 18m. Calculate the area of a path $1\frac{1}{2}$ m wide going round the outer edge of the garden.

General Evaluation/Revision Questions

1. A regular polygon has all its sides .... and all its angles ....
2. The distance around the circle is ....
3. What is the perimeter of a rhombus if the length of one side is 8cm?
4. A circle of diameter 21cm has a perimeter of 66cm. If the circle is halved. Determine the perimeter of the half.

Reading Assignment

Essential Mathematics for J.S.S 1 by A. J. S Oluwasanmi, page 198-209.

Weekend Assignment

1. What is the perimeter of a rectangle that measures 11cm by 3cm. (a) 39cm (b) 28cm (c) 36cm (d) 26cm
2. The diameter of a circle is 13.8cm long. Find the length of its radius (a) 27.6cm (b) 7.6cm (c) 6.9cm (d) 6.4cm
3. Two sides of an isosceles triangle are 3cm and 10cm. What must be the length of the third side? (a) 10cm (b) 6cm (c) 4cm (d) 8cm
4. If the width of a rectangle is the equal to the length of a square and the rectangle measures 6cm by 4cm. What is the difference perimeter of the square? (a) 26cm (b) 16cm (c) 24cm (d) 36cm
5. What is the difference in the perimeter of the rectangle and the square in question 4 above? (a) 4cm (b) 6cm (c) 8cm (d) 2cm

Theory

1. The diameter of a car wheel is 28cm, find its circumference. How far does the car move in metres when the wheel makes 150 turns? (Take $\pi = \frac{22}{7}$)
2. (a) The longer side of a rectangle is 25cm and its perimeter is 80cm. Find the length of the shorter side. Determine its area
   (b) The area of a parallelogram is $8.5m^2$ and its base is 500cm. Find its height.

WEEK FIVE

THREE DIMENSIONAL SHAPES

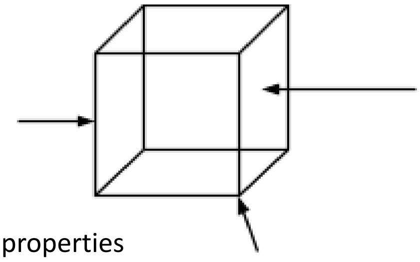
Three dimensional (3-D) shapes are also called solid shapes. They have length, breadth and height unlike 2-D shapes that have only length and breadth. Examples of 3-D shapes are cubes, cuboids, cylinders, prisms, pyramids and spheres. They are also called geometrical solids.

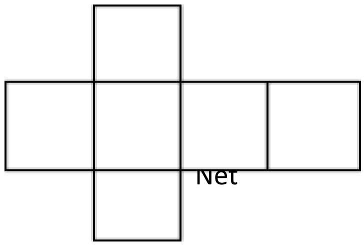
<u>Key words</u>

Face: a surface of solid shape
Edge: a line on a solid where two faces meet
Vertex (plural vertices): a point or corner on a solid, usually where edges meet
Net: a flat shape that you can fold to make a solid

Cuboids and Cubes

(a) A Cube

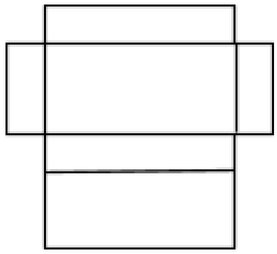


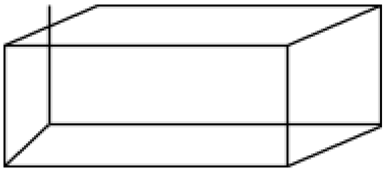


A cube has the following properties

i. It has 12 straight edges
ii. It has 8 vertices
iii. It has 6 square faces
iv. Its net consist of 6 square faces joined together

(b) A cuboid





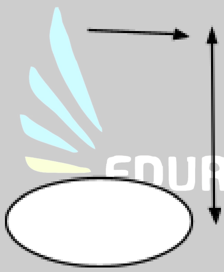
Net of cuboid

A cuboid has the following properties:

i. It has 12 straight edges
ii. It has 8 vertices
iii. It also has 6 rectangular faces
iv. Its net consist of 6 rectangular faces

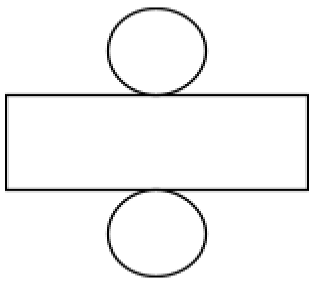
Cylinders and Prisms

A Cylinder



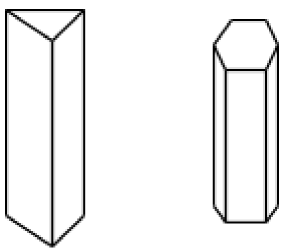
Properties:

i. A cylinder has two circular faces
ii. It has 1 curved surface
iii. It has 2 curved edges
iv. Its net consists of two circular faces and 1 rectangular face i.e. its net consist of 2 circles and 1 rectangle.
The net of a cylinder has two circles and one rectangle



Prism

The base and top faces of a prism are always the same shape. The names of prisms come from the shape of their base and top faces.

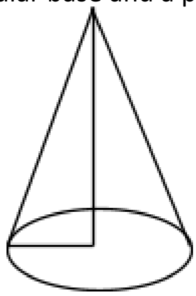


Triangular Prism Hexagonal prism

Cones and pyramids

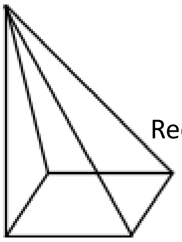
Cone

A cone is a solid shape with curved body, circular base and a pointed end.

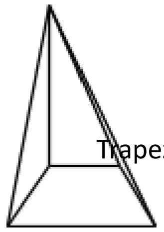


Pyramid

A pyramid is a solid shape with a flat base and triangular faces rising to meet at a common point called its vertex. There are many types of pyramid. The different types are named after the shapes of the bases they have:



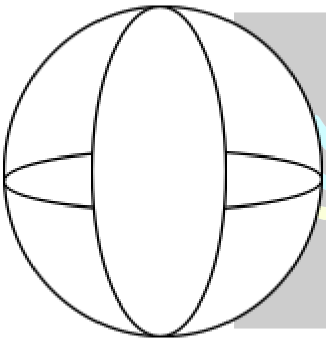
Rectangle pyramid



Trapezoid Pyramid

Sphere

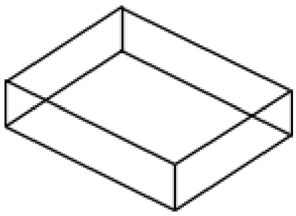
A sphere is a solid shape with perfectly round surface. Examples are orange, ball, shotput, etc.



Volumes of Solids

Volume of Cuboids

The volume of solids is a measure of the amount of space it occupies. A solid object is also called a 3-dimensional (3-D) object. The cube is used as the basic shape to estimate the volume of solid. Therefore, volume is measured in cubic unit. A cube of an edge 1cm has a volume of one cubic centimetre ($1cm^3$).



The volume of a cuboid is given by:

Volume= length x width x height i.e. V = l x w x h

In the above formula, **A = l x w** where A= base area of the cuboid

Hence: **Volume of a cuboid = base area x height**

V = A x h

Volumes of cubes

When all the edges of a cuboid are equal, it is called a cube. If one edge is l unit long, then

Volume of a cube = length x height x width

i.e V = $l \times l \times l$

$= l^3$

A cube of an edge 3cm will have a volume of 3 x 3 x 3 = 27cm^3.

The above formula can be used to find the edge of a cube when the volume is given.

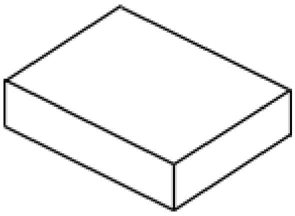
$l^3 = V$

$l = \sqrt[3]{V}$

<u>Example 1</u>

Calculate the volume of a rectangular tank with dimensions 20cm by 15cm by 12 cm.

Solution



Volume = length x width x height

V = l x w x h

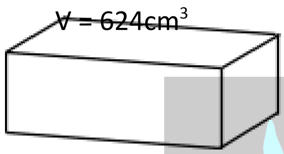
= (20 x 15 x 12) cm^3

= 3600cm^3

<u>Example 2</u>

A cuboid, 12 cm long and 8cm wide has a volume of 624cm^3. Find the height of the cuboid.

Solution



Substituting V = 624cm^3, l = 12cm, and w = 8cm

Length x width x height = volume

L x w x h = V

12 x 8 x h = 624

96h = 624

Divide both sides by 96, h = $\frac{624}{96}$ = 6.5cm

The height of the cuboid = 6.5cm

<u>Example 3</u>

A tank of water in the shape of a cuboid has a square base. If the depth of water in the tank is 3m high and the volume of the water inside the cuboid is 243m^2. Calculate the width of the tank.

Solution

Volume of a cuboid= base area x height

Since it has a square base, the base area = l^2 , i.e. l = w.

243m^3 = l^2 x 3m

$l^2 = \frac{243m^2}{3cm}$ = 81m^2

Therefore, l = $\sqrt[2]{81}$ = 9m

The width of the tank is 9m

<u>Evaluation:</u>

1. A cube volume of a cube is given as 512cm^3
   (a) What is the length of one edge of the cube?
   (b) How many small cubes of edge 2cm can be placed together to make this cube?
2. A cuboid has a base area of 35cm^2 and a height of 3.5cm. What is the volume of the cuboid?

General Evaluation/Revision Questions

1. A rectangular prism (cuboid) has a volume of $680cm^3$ and its height is 20cm. What is the area of the base of the prism?
2. The base of a swimming pool is $192m^2$. The depth of the swimming pool is 1.8m. find the volume of water the swimming pool can hold.
3. A book measures 18cm by 12cm by 3cm. Calculate its volume

Reading Assignment

- Essential Mathematics for J.S.S 1 by A. J. S Oluwasanmi, page 212-222.

Weekend Assignment

1. What is the volume of a cube of edge 5cm. (a) $15cm^3$ (b) $75cm^3$ (c) $125cm^3$ (d) $25cm^3$
2. Find the volume of air in a container whose dimensions are: length = 25cm, width = 20cm and height= 10cm (a) $5000cm^3$ (b) $2500cm^3$ (c) $4500cm^3$ (d) $500cm^3$
3. The volume of a cube is given as $512cm^3$. What is the length of one edge of the cube? (a) 10cm (b) 6cm (c) 4cm (d) 8cm
4. How many small cubes of edge 2cm can be placed together to make the cube in question 3 above? (a) 66 (b) 32 (c) 64 (d) 128
5. Calculate the volume of a cuboid with dimension 18cm by 12cm by 8cm. (a) $1728cm^3$ (b) $512cm^3$ (c) $144cm^3$ (d) $1872cm^3$

Theory

1. The base of a cuboid has one side equal to 10cm, and the other side is 5cm longer. If the height of the cuboid is 7cm, find the volume of the cuboid.
2. A cuboid measures xcm by 3xcm by 5xcm
   (a) Work out the volume of the cuboid in terms of x
   (b) What is the volume of the cuboid if x = 10cm?

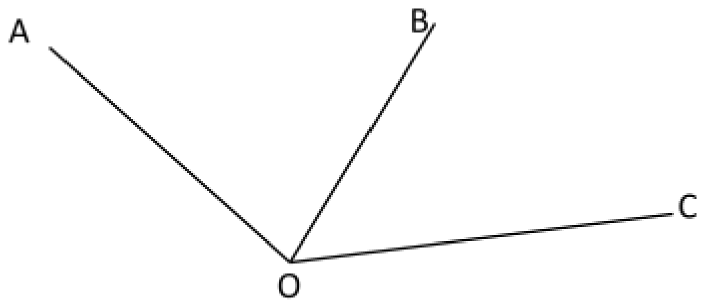
WEEK 6

TOPIC: CORRESPONDING ANGLES, ALTERNATE AND VERTICALLY OPPOSITE ANGLES

CONTENT

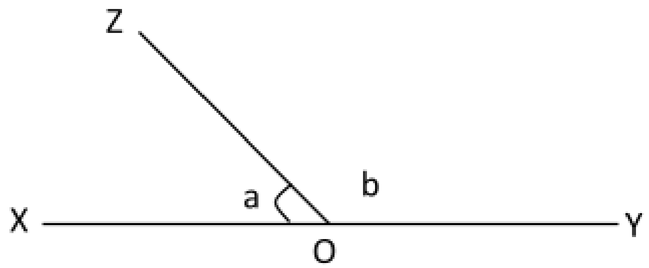
(I) Corresponding angles
(II) Alternate angles
(III) Vertically opposite angles
(i) Corresponding angles
(a) Definition
(1) Adjacent angles

When two angles lie beside each other and have a common vertex, we say they are adjacent to each other.



From above diagram, AOB is adjacent to BOC. BOC is adjacent to AOB.

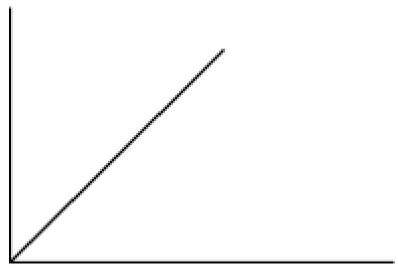
When a straight line stands on another straight line, two adjacent angles are formed. The sum of two adjacent angles is 180^0.



Since angles XOZ and YOZ lie next to each other, we say they are adjacent angles. Since the sum of angles on a straight line is 180^0 XOZ + YOZ = 180^0i.e $a + b = 180^0$. The sum of adjacent angles on a straight line is 180^0.

(2) Complementary angles

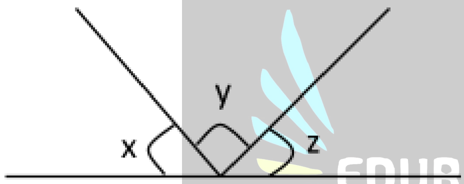
If two angles add up to 90^0, they are said to be complementary.



Since $x + B = 90^0$:- x and B are complementary angles. Therefore, complementary angles add up to 90^0.

(3) **Supplementary angles**

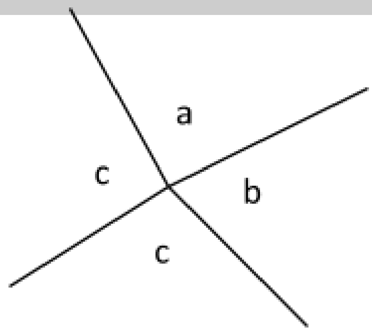
If the sum of two angles add up to 180^0, they are said to be supplementary.



$x + y + z = 180^0$ Note x, y, z are supplimentary angles. Therefore, supplimentary angles add up to 180^0. Note also that adjacent angles on a straight line are said to be supplimentary.

(4) **Angles at a point**

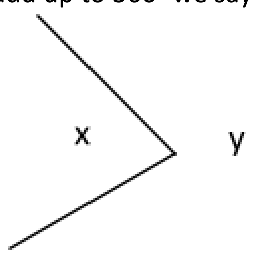
The sum of the angles at a point is 360^0



$a + b + c + d = 360^0$

Therefore, angles at a point add up to 360^0

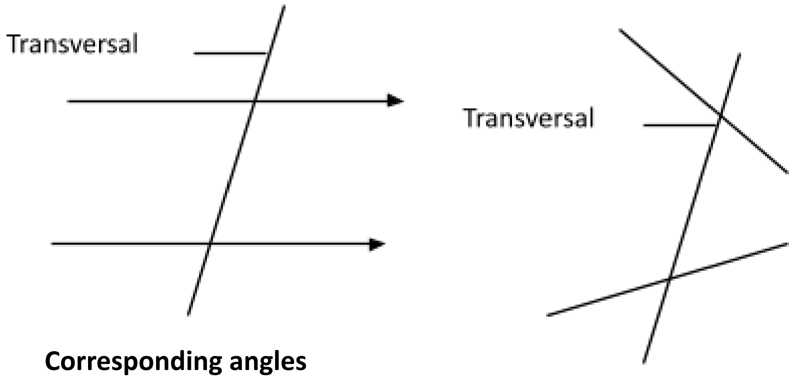
(ii) conjugate angles add up to 360^0 we say that they are conjugate angles



$x + y = 360^0$, therefore x and y are called conjugate angles

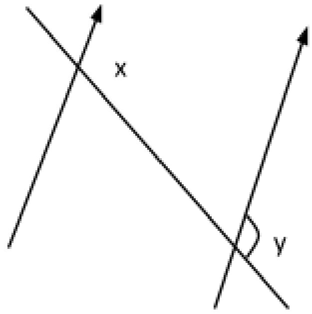
(5) **Transversal**

A line cutting a pair of lines (whether parallel or not is called a transversal.



(b) **Corresponding angles**

When a transversal cut parallel lines corresponding angles formed are equal.

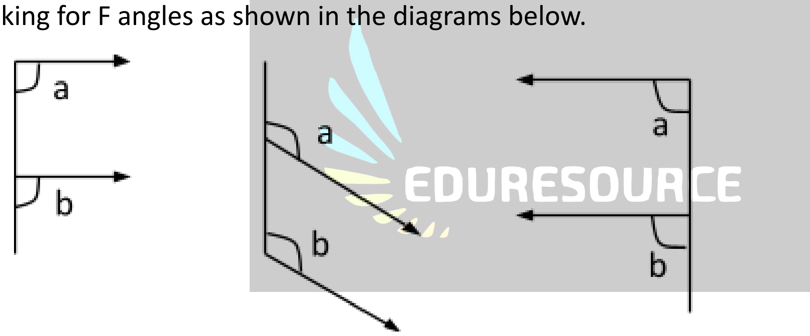


Note: x = y

Angles x and y are called

corresponding angles.

Corresponding angles are sometimes called F angles. You can easily recognise corresponding angles by looking for F angles as shown in the diagrams below.

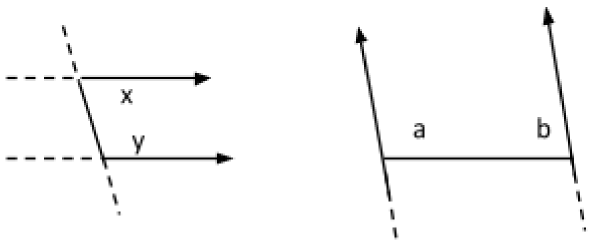


a = b

Angles a and b are called corresponding angles.

(ii) **Co-interior angles**

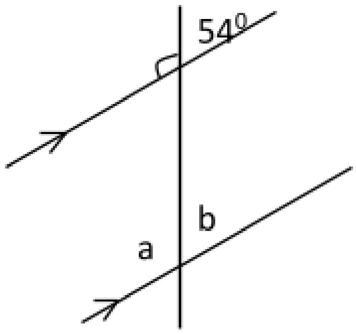
Co-interior angles are supplimentary angles because they add up to 180^0



In the diagram above:- x + y = 180^0 (complimentary angles). Similarly a + b = 180^0 Note that the shape of the diagrams look like letter C and U, hence co-interior angles are sometimes called C or U angles

Example

Calculate angles a and b shown in this diagram



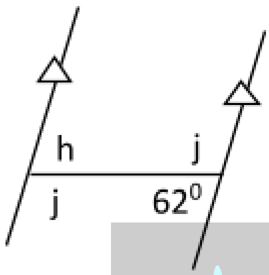
Solution

A = 126^0 (corresponding angles)

B = 54^0 (corresponding angles)

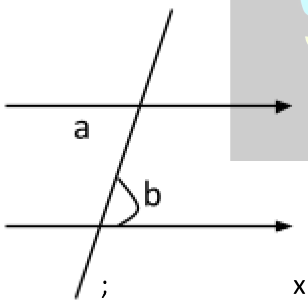
EVALUATION QUESTION

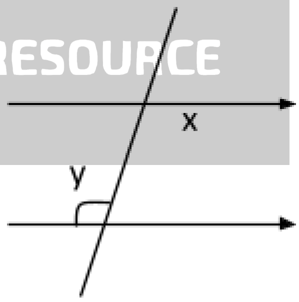
In this diagram, find the sizes of the lettered angles, give reasons.



II ALTHERNATE ANGLES

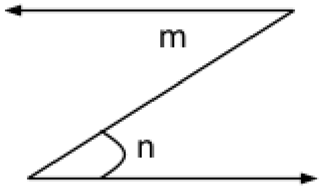
When a transversal cut parallel lines alternate angles formed are equal.

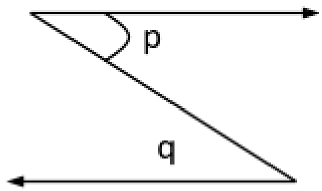




a = b ; x = y

Angles a and b are called alternate angles also angles x and y are called alternate angles. You can quickly recognize alternate angles by looking for angles formed by letter Z as shown in the diagram below.



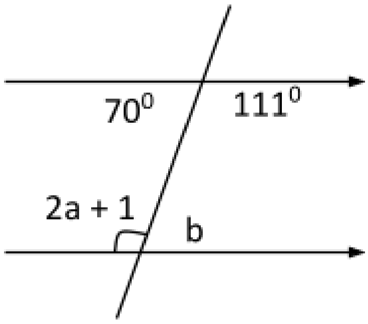


In the above figures m = n, p = q.

Note, alternate angles are sometimes called Z angles.

Example

Fined the values of a and b in the diagram



Solution

$2a + 1 = 111^0$ (alternate angles)

collect like terms

$2a = 111^0 - 1^0$

$:.\ 2a = 110^0$

$:.\ \frac{2a}{2} = \frac{110^0}{2}$

1.e. $a = 55^0$

Also $b = 70^0$ (alternate angles)

III VERTICALLY OPPOSITE ANGLES

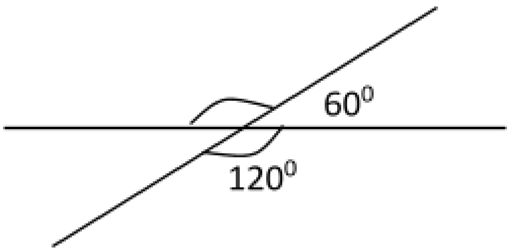
When two straight lines intersect as shown in the figure below, then the vertically opposite angles are equal. They are also called X angles.

A = b (vertically opposite angles)

X = y (vertically opposite angles)

Therefore, vertically opposite angles are equal.

Example



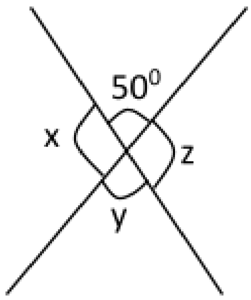
Find and

Solution

$X = 120^0$ (vertically opposite angles)

$B = 60^0$ (vertically opposite angles)

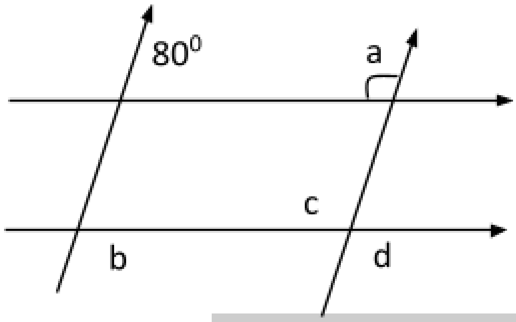
EVALUATION QUESTION



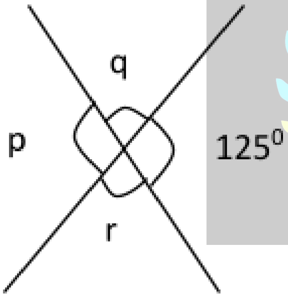
Find angles x, y and z in the above diagram

GENERAL EVALUATION QUESTION

1. Find the size of the following angles marked with letters



2. Find angles p, q and r in the diagram below



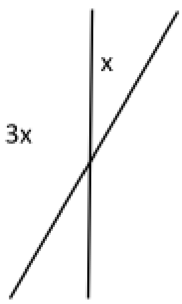
READING ASSIGNMENT

1. New General Mathematics for JSS I by JB Channon and others. Pages 139 - 141
2. Essential Mathematics for JSS I by AJS Oluwasanmi. Pages 205 - 208
3. STAN Mathematics for JSS I Page 191.

WEEKEND ASSIGNMENT
OBJECTIVE

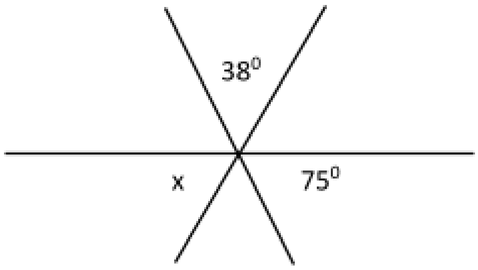
(1) <AOB and <COB are complimentary if <COB = 40^0, the <AOB is (a) 50^0 (b) 140^0 (c) 320^0 (d) 60^0 (e) 120^0

(2) Find the value of x in the diagram below



(a) 135^0 (b) 180^0 (c) 35^0 (d) 45^0 (e) 360^0

(3) In the diagram below find the value of x



(a) 38^0 (b) 75^0 (c) 80^0 (d) 113^0 (e) 67^0

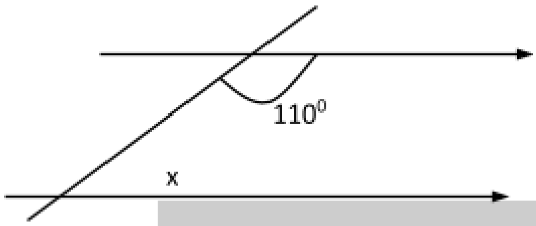
(4) X0Y and Y0Z are adjacent on a straight line X0Z. If X0Y = 58^0 then Y0Z is _________ (a) 32^0 (b) 122^0 (c) 132^0 (d) 238^0 (e) 302^0

(5) Complete the following sentence correctly. Vertically opposite angles (a) are alternate (b) add up to 180^0 (c) are corresponding (d) are equal (e) add up to 360^0

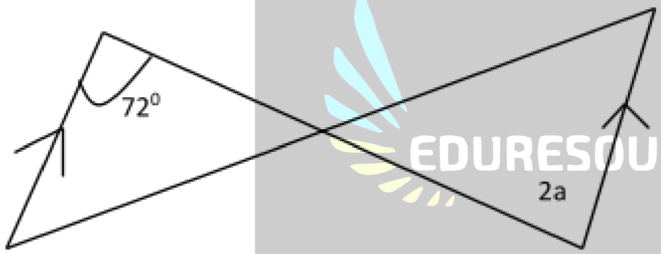
THEORY

(1) Find the angles marked with letters in the following diagrams

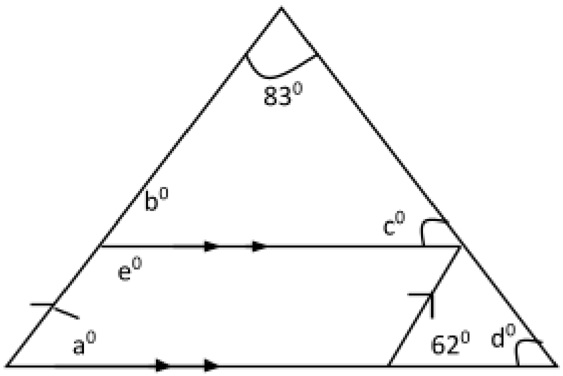
(a)



(b)



(2) In the diagram below find a,b,c,d,e.



WEEK SEVEN

TOPIC: ANGLE SUM OF A TRIANGLE, ANGLE ON A STRAIGHT LINE, ANGLE AT APOINT

CONTENT

(1) Angle sum of a triangle

(2) Angles on a straight line

(3) Angles at a point

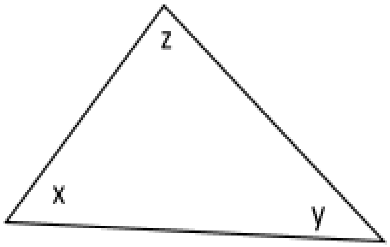
Angle sum of a triangle

(a) **Definition:** A Triangle is a three-sided plane figure with three angles.

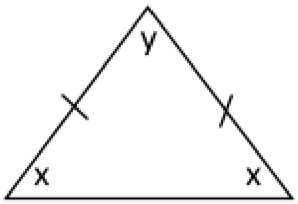
(b) **Types of triangles**

(i) Scalene triangle

This triangle has no sides and no angles square.

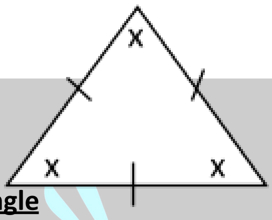


(ii) **<u>An Isosceles Triangle:</u>** This type of triangle has two adjacent sides equal and two angles equal.



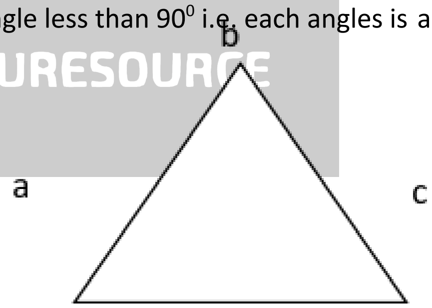
(iii) **<u>An Equilateral Triangle</u>**

This type of triangle has all its sides equal and all its angles equal each angle is 60^0.



(iv) **<u>An Acute angled triangle</u>**

This type of triangle has each of its angle less than 90^0 i.e. each angles is acute.



a, b, c are acute angles

(v) **<u>An Obtuse angled triangle</u>**

This type of triangle has one of its angles more than 90^0.

(vi) **<u>A right – angled triangle</u>**

This triangle has one of its angles equal to 90^0. The side opposite the right angle is the longest side and is often called hypotenuse.

(c) **Angle sum of a triangle**

The sum of the three angles of a triangle is equal to 180^0 proof:
To prove that the sum of angle of a triangle is equal to 180^0, draw triangle ABC. Draw line LM through the top vertex of the triangle, parallel to the base BC.

Label each angle as shown in the diagram. From the above diagram
b = d (alternate angles)
c = e (alternate angles)
But d + a + e = 180^0 (sum of angles on a straight line).
:. a + b + c = d + a + e = 180^0.
Hence, the sum of angles of a triangle = 180^0.

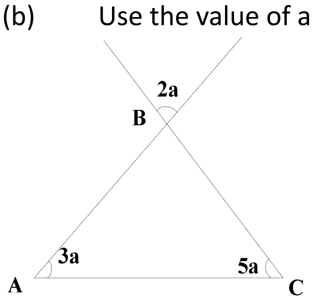
Examples:

(i) Find the size of angle x in this triangle.

<u>Solution</u>

x + 64^0 + 88^0 = 180^0 (sum of angle of a triangle)
:. X + 152^0 = 180^0
Collect like terms:.
:. X = $180^0 – 152^0$
:. X = 28^0

(ii) From the diagram below
(a) Find the value of a
(b) Use the value of a to find the actual values of the interior angles of the triangle.



<u>Solution</u>

(a) <ABC = 2a (vertically opposite angles)
Now 2a + 3a + 5a = 180^0 (sum of angles of a triangle).
:. 10a = 180^0
:. 10a = 180 = 18^0

10 10

i.e. a $= 18^0$

(b) If a $= 18^0$

:. $2a = 2 \times 18^0 = 36^0$

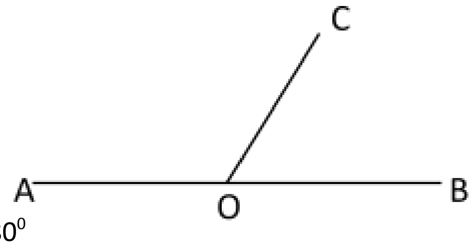
Again $3a = 3 \times 18^0 = 54^0$

Also $5a = 5 \times 18^0 = 90^0$

:. The angles are 36^0, 54^0 and 90^0.

II **Angles on a straight line**

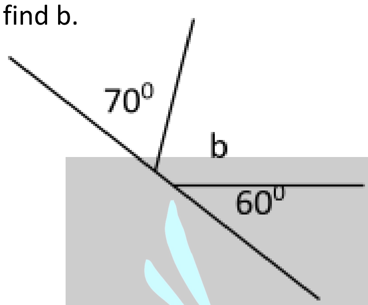
Definition: When a straight line stands on another straight line two adjacent angles are formed. The sum of the two adjacent angles is 180^0.



:. $\hat{AOC} + \hat{BOC} = 180^0$

Examples

(i) In this figure, find b.



Solution

$70^0 + b + 60^0 = 180^0$ (supplementary angles)

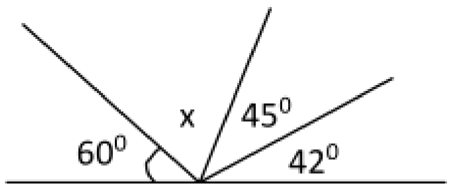
:. $B + 130^0 = 180^0$

Collect like terms

:. $B = 180^0 - 130^0$

:. $B = 50^0$

(2) In the diagram, find the value of x.



SOLUTION

Since $60^0 + x + 45^0 + 42^0 = 180^0$ (sum of angles on a straight line)

:. $X + 60^0 + 45^0 + 42^0 = 180^0$

:. $X + 147^0 = 180^0$

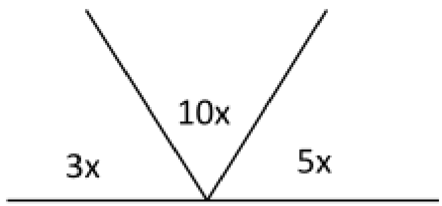
Collect like terms

:. $X = 180^0 - 147^0$

:. $X = 33^0$

EVALUATION QUESTION

Calculate the labelled angle in this diagram.

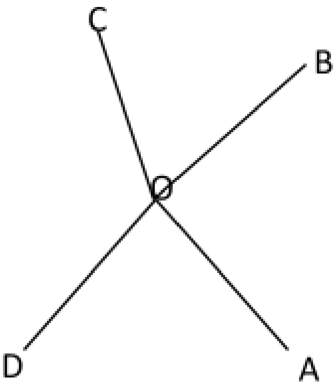


READING ASSIGNMENT

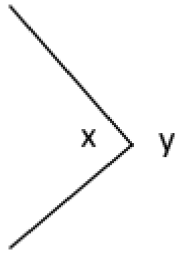
(1) New general mathematics for JSS 1 by JB Channon and others pages 136 - 138
(2) Essential mathematics for JSS 1 by AJS Oluwasanmi
(3) MAN mathematics book 1 pages 199.

(iii) **Angles at a point**

(a) Example: When a number of lines meet at appoint they will form the same number of angles. The sum of the angles at a point is 360^0



Note



$x + y = 360^0$

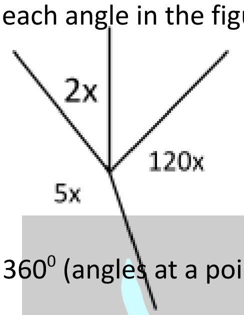
x and y are conjugate

called conjugate angles.

$\hat{AOB} + \hat{BOC} + \hat{COD} + \hat{DOA} = 360^0$

(b) Examples:

(1) Find the value of each angle in the figure.



Solution

Since $x + 2x + 5x + 120^0 = 360^0$ (angles at a point)

$8x + 120^0 = 360^0$

Collect like terms

$8x = 360^0 – 120^0$

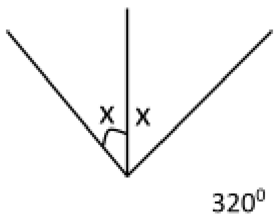
$8x = 240^0$

$\frac{8x}{8} = \frac{240^0}{8}$

:. $X = 30^0$

Hence $2x = 2 \times 30^0 = 60^0$

Also $5x = 5 \times 30^0 = 150^0$



From the diagram find the value of X

Solution

Since $320^0 + x + x = 360^0$ (angle at a point)

$320^0 + 2x = 36^0$

Collect like terms

$2x = 360^0 - 320^0$

$2x = 40^0$

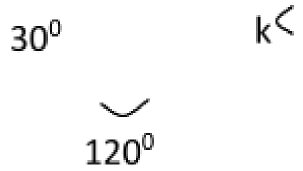
$X = 40^0 = 20^0$

2

:. $X =20^0$

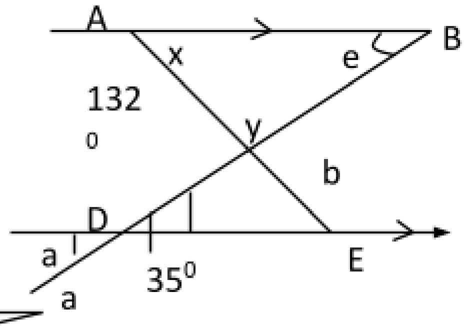
EVALUATION QUESTION

1. In a triangle, one of the angles is three times the other. If the third angle is 48^0, find the sizes of the other two angles.
2. Find the value of k in the diagram below

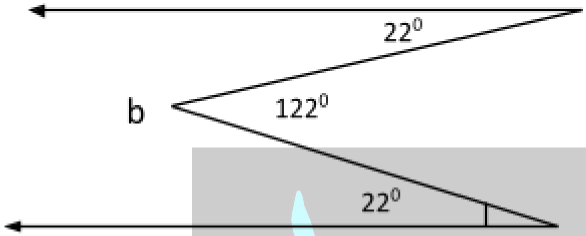


GENERAL EVALUATION QUESTION

1. Find the angles marked with letters in this figure



From the diagram, find the angle marked with alphabet



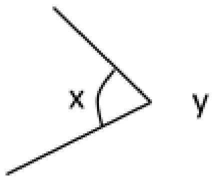
READING ASSIGNMENT

1. Essential Mathematics for JSS 1 by A.J.S. Oluwasanmi Pages 202 – 207
2. New general mathematics for JSS 1 by J.B. Channon and other pages 135 – 144

WEEKEND ASSIGNMENT

Objective

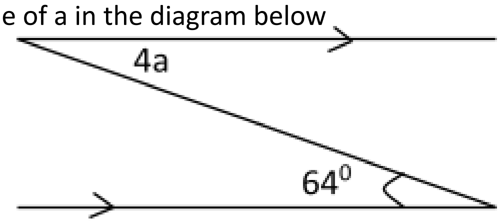
1. In this diagram angles x and y are called.



(a) Complementary angles (b) Supplementary angles (c) Conjugate angles (d) vertically opposite angles (e) alternate segment angles

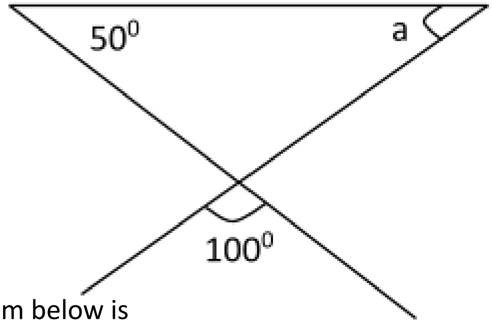
(2) The sum of adjacent angles on a straight lines is ___________ (a) 360^0 (b) 90^0 (c) 3 right angles (d) 150^0 (e) 2 right angles

(3) Find the value of a in the diagram below



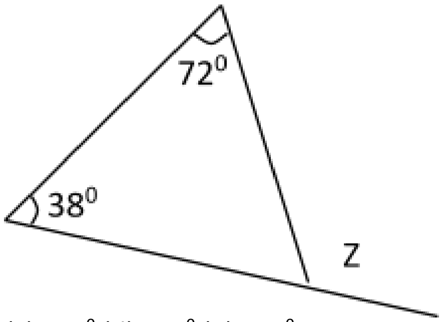
(a) 64^0 (b) 16^0 (c) 32^0 (d) 45^0 (e) 50^0

(4) Find the value of a in the diagram below



(a) 100^0 (b) 40^0 (c) 80^0 (d) 50^0 (e) 30^0

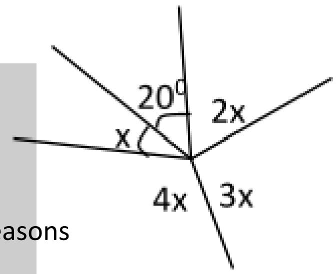
(5) The value of angle z in the diagram below is



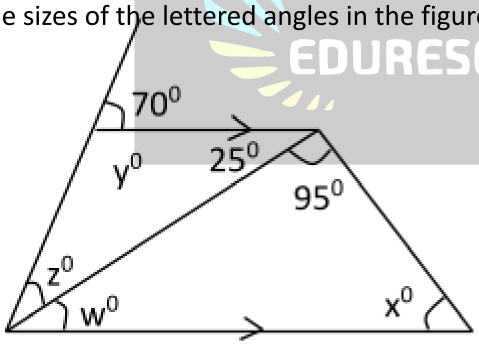
(a) 72^0 (b) 70^0 (c) 150^0 (d) 120^0 (e) 110^0

Theory

1. Find the value of x and hence find the size of each angle



2. State the sizes of the lettered angles in the figure below, give reasons



WEEK EIGHT

TOPIC:CONSTRUCTION OF PARALLEL LINES USING RULER AND SET SQUARE ONLY

CONTENT

i. To draw parallel lines (Horizontally) using a ruler and set-square only.
ii. To draw parallel lines (Non-horizontal) using a ruler and set-square only.
iii. Application of construction. Plane figure.
i. <u>Drawing parallel lines (Horizontally using a ruler and set-square only.</u>
<u>(a) Guidelines for constructions.</u>

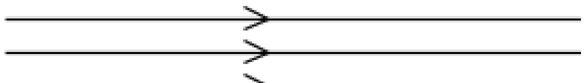
In geometry, to construct a figure means to draw it accurately. Accurately construction depends on using measuring instruments properly.

Generally, to carry out a construction, you require a sharp pencil, compasses, protractor and a good ruler, set-square and dividers are also necessary.

When making constructions, the following guidelines should be followed.

(1) A short pencil of about 6cm should be fixed on the fixed on the pair of compasses when constructing to avoid any obstruction when turning your compass round to draw arcs.

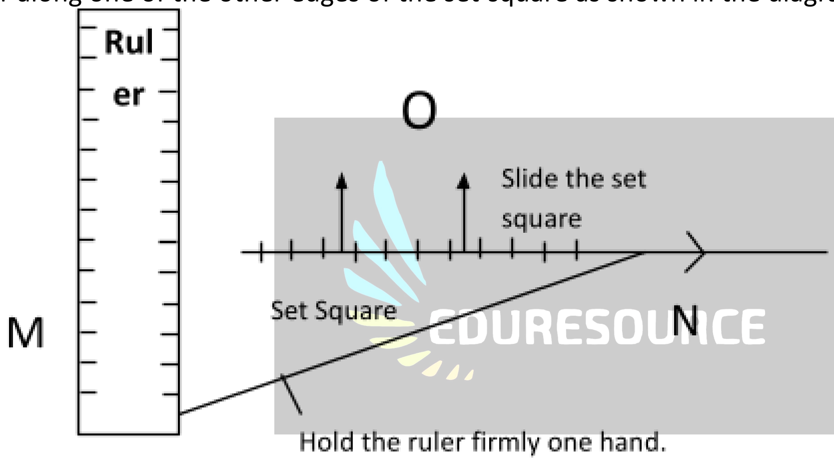
(2) Ensure that the pivot of your pair of compasses is tight to avoid unwanted shift when carrying out your construction.
(3) To ensure that your lines and points are as fine and accurate as possible make use of a hard pencil with a sharp point.
(4) Before making the actual construction, make a rough sketch of the problem under consideration. This will make the construction of the actual problem easy.
(5) Leave all your arcs and construction lines visible. Do not clean any arc that leads you to your final result.
(6) Double lines and arcs in constructions are not allowed, hence clean up all double arcs and lines neatly and re-draw.
(b) <u>To draw parallel lines</u>
(i) Definition: Parallel lines are lines that do not meet. They always have the same distance apart and are in the same direction.



(ii) Example
Draw accurately a line through 0, parallel to line MN.

Solution

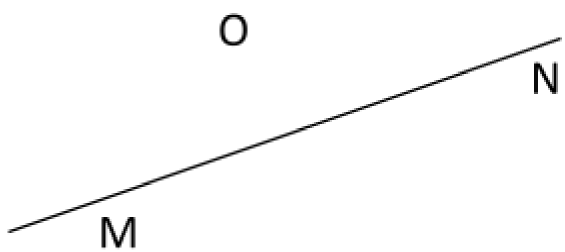
Using a ruler and –square (i) Place one edge of the set-square along the given line MN. (ii) Place a ruler along one of the other edges of the set-square as shown in the diagram below.



(iii) Hold the ruler firmly with one hand and then slide the set- square with the second along the edge of the ruler until you reach point O.
(iv) Draw the line with a sharp pencil

EVALUATION QUESTION

Use a ruler and set square to draw four lines that are parallel to each other.
(ii) **To draw parallel lines (Non- horizontal) using a ruler and set square.**
Example
Draw a line through point O, Parallel to line MN.

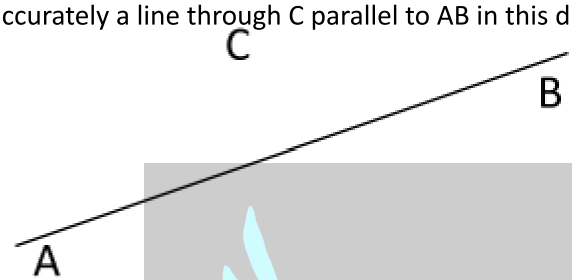


Solution
The set square and ruler are placed accordingly as shown in the diagram.

EVALUATION QUESTION

(i) Use ruler and Set Square to construct a pair of parallel lines that are 3cm apart.

(ii) Draw accurately a line through C parallel to AB in this diagram using ruler and set square.



CONSTRUCTION OF PERPENDICULAR LINE USING RULER AND SET SQUARE ONLY

Definition

(a) **TYPES OF LINES**

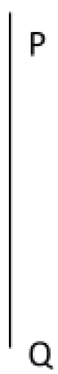
(i) **POINT:** A point is used to denote a position of an object in space and it has a negligible size or magnitude. It is usually represented by a dot (.) or a cross (x)

(ii) **A LINE:** A line is made up a set of points. The arrows at both ends show that line Mn continues forever on both directions.

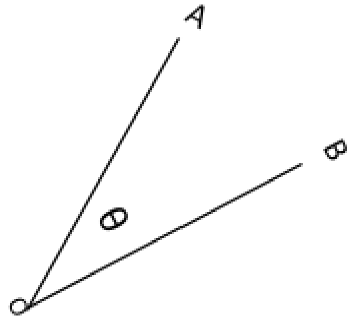
(iii) **STRAIGHT LINE:**A straight line is the shortest distance two points such as points m and n

(iv) **HORIZONTAL LINE:** A line drawn straight across the page is called a horizontal line

(v) **VERTICAL LINE:** A line drawn straight up or down a page is called a vertical line.

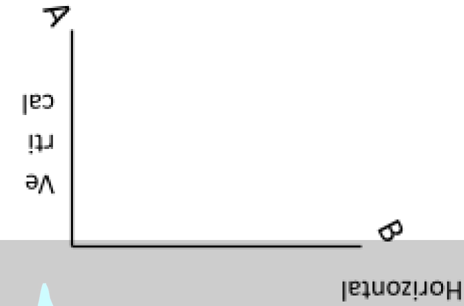


(vi) **ANGLES:** When two lines meet at a point, an angle is formed. Angle are measured in degrees. The symbol for degrees is O. Therefore an angle may be describe as a measure of the degree of rotation between two lines that intersect a point. For example in the diagram below the point where lines AO and BO meet is O. the angle formed is θ (theta).



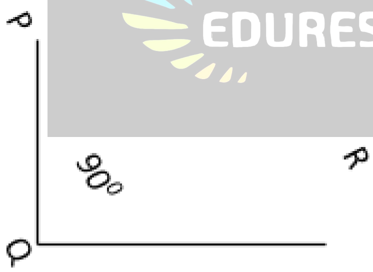
AO and BO are called the arms of the angle θ and point O is called the vertex.

(vii) **PERPENDICULAR LINES:** When a horizontal line meets (intersects) a vertical line, both lines are said to be perpendicular to each other.

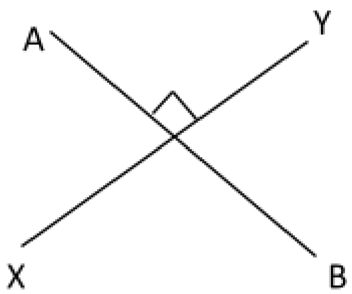


The symbol for perpendicular lines is ⊥ i.e. AO ⊥ BO

That is: Two lines are perpendicular to each other if they intersect at right angles (i.e. 90^0) example:



PQ ⊥ RQ i.e. line PQ is perpendicular to line RQ



AB ⊥ XY
Line AB is perpendicular to line XY.

<u>Evaluation question</u>

Give a brief definition and a sketch diagram to explain them. (a) a straight line (b) perpendicular line

<u>READING ASSIGNMENT</u>

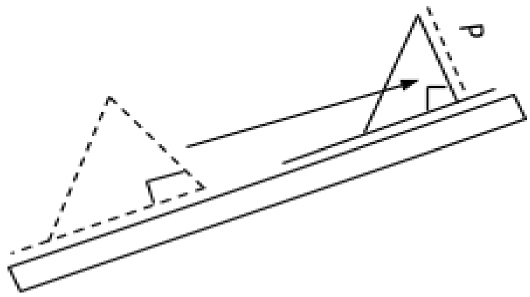
Essential Mathematics for JSS 1 by AJS Oluwasanmi page 102 – 103.

II CONSTRUCTION OF PERPENDICULAR LINES EXPLANATION

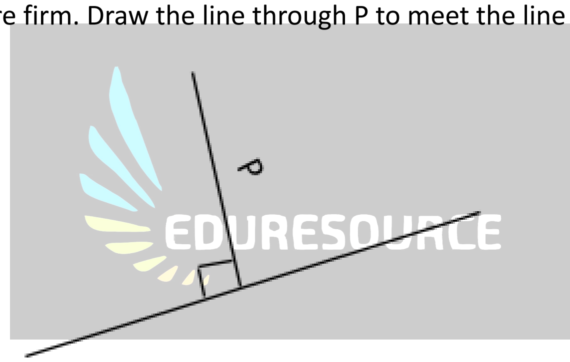
To construct a perpendicular from a point to a line using ruler and set square.

(1) Place a ruler along the lines.

(2) Use the two edges of a set square which are the arms of its right angle. Place one of these edges along the ruler. Slide the set square along the ruler until the other edge reaches P.



(3) Hold the set square firm. Draw the line through P to meet the line perpendicularly.



Example

Draw a perpendicular line to PQ at R

Solution

(i) Place one edge of the right angle of the set square along the given line (i.e. PQ)

(ii) Place a ruler along the hypotenuse as show below.

(iii) Hold the ruler firmly with one hand and then slide the set square with the second hand along the edge of the ruler until the required position R is reached as shown in the diagram below. Draw a line through R.

Evaluation Question

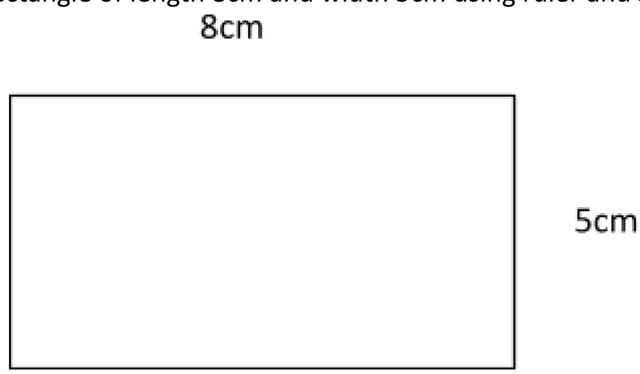
From This pentagon, draw perpendicular line from P to the five sides using ruler and set square.

(iii) **APPLICATION OF CONSTRUCTIONS: DRAWINGPLANE FIGURE E.G. (RECTANGLE)**

Example:

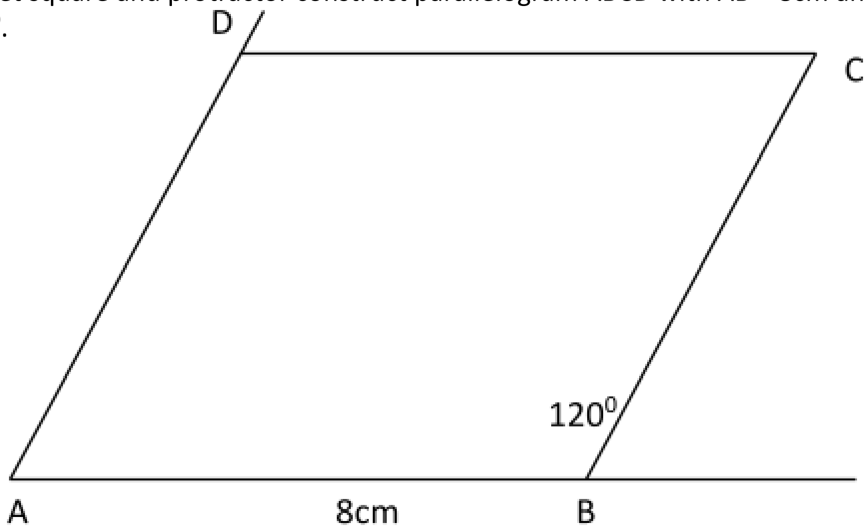
Draw accurately a rectangle of length 8cm and width 5cm using ruler and set square.

Solution



EVALUATION QUESTION

Use ruler set square and protractor construct parallelogram ABCD with AB = 8cm and BC = 5cm and ABC = 120^0.



GENERAL EVALUATION

1. use ruler and set square to construct a pair of parallel lines that are 5cm apart
2. Draw accurately a line through D parallel to BC in this diagram using ruler and set square.

READING ASSIGNMENT

1. New general mathematics for JSS 1 by JB Channon and others pages 151
2. Essential mathematics for JSS 1 by AJS Oluwasanmi

WEEKEND ASSIGNMENT

1. In construction, __________ is an instrument for drawing lines and measurement of length. (a) compass (b) dividers (c) ruler (d) protractor
2. The angles between two lines that are perpendicular is (a) 70^0 (b) 90^0 (c) 80^0 (d) 100^0
3. In construction __________ is an instrument for constructing and measuring angles (a) set square (b) compass (c) protractor (d) ruler
4. These instruments are necessary for construction except _________ (a) compass (b) ruler (c) block (d) protractor
5. In construction you must be __________ (a) careful (b) careless (c) untidy (d) unprepared

THEORY

1. In construction, name five basic instruments that are very important
2. Use ruler and set square construct a rectangle of length 6cm by 3cm.

WEEK NINE

TOPIC: DATA STATISTICS REPRESENTATION

CONTENT: **1. Definition**
2. Method of collecting data
3. Classification of data

DEFINITION

i. **Statistics:** is the branch of study of data. It involves (a) Gathering (i.e. collecting) data (b) sorting and tabulating data (c) presenting data visually by means of diagrams.
ii. **Data:** (SINGULAR DATUM) means information which are usually given in the form of meaningful. Data may be categorized into quantitative and qualitative

iii. **Quantitative data:** a numerical data, which is usually given in the form of a number or measurement is called quantitative data e.g. number of cars, height, number of towns etc. quantitative dateis either discrete or continuous.
iv. **Discrete data:** are data which can be obtained by counting (not by measurement). Discrete data can only exact values such as whole numbers. E.g. 2 boys, 3 houses etc. hence discrete data have definite or exact values
v. **Continuous Data:** are data that can be obtained by measurement (not by counting). Continuous data can take any values within a given range. E.g. height 1.6cm, height 40.56cm etc.
vi. **Qualitative Date:** this is a non-numerical value which is concerned with qualities such as names, places, color, taste, opinions, brightness etc.

Evaluation
Explain briefly with an example (i) Discrete data (ii) Continuous data

METHOD OF COLLECTING DATA
There are two discrete ways of collecting data. These are (a) by carrying out experiment (b) by survey

a. **By Carrying out Experiments:** Data can be obtained from experimental work carried out in the laboratories by students or scientist for example, various measurements, such as temperature, pressure, weight and height of an object can be obtained by setting up an experiments.
b. **By Survey:** This collection of information or data on a subject. A survey may be carried out by using the existing published data, making observation and asking questions.
   (i) **Using existing published data:** Existing data may be obtained from libraries, schools, newspaper, and government's publications such as annual abstract of statistics, stake statistics, employment gazettes, books journals and other publications.
   (ii) **Making Observation:** This method involves collecting data by observation e.g. you can do a round traffic survey by counting and recording the various types of vehicles that ply a particular road.
   (iii) **Asking questions:** You can ask other people questions to obtain their views or vital information in two ways: i. by interviewing them ii. By giving those questionnaires to fill in their response.
      - **By Interviewing:** This involves asking other people questions in order to obtain vital information or strict pattern or information, in which the questions asked only general formal but the order or the way the questions are presented can vary. It must be noted that the interviewers must avoid bias, misleading ambiguous and offensive questions.
      - **Questionnaires:** This is the most popular method of collecting data. Questionnaires are list of questions designed to obtain or discover particular information in a survey. In questionnaires, everyone is asked the same questions. The questionnaires may be given directly to an individual or sent to them by post to fill in their response. The main advantage of postal questionnaires is that it can be sent to many people in another towns or cities.

Evaluation
Mention two major ways that data can be collected.

Reading Assignment

Essential mathematics for JSS 1 by AJS Oluwasanmi pages 253 – 255

CLASSIFICATION OF DATA

Data can be obtained either by direct collection from respondents or form a data bank of a data collection agency. Data collected directly from information's are called

1. **Primary Data:** are those from data banks are called secondary data.
2. **Secondary Data:** these are obtained from data collection agencies, engaged in routine data collection for research and planning some of these agencies include:
   i. Federal Office of Statistics (FOS) Principal agency
   ii. Central Bank of Nigeria
   iii. Statistics units of Ministries/Parastatals
   iv. Commercial Companies/ Industries.

GENERAL EVALUATION

1. Name two broad ways of classification of data
2. Mention two agencies we can collect secondary data

REVISION QUESTION

Michael obtained the following scores in a Basic Technology examination:
65, 72, 58, 82, 74, 64, 78, 70, 80, 75, 68
Arrange these scores:

1. In ascending order
2. In descending order

READING ASSIGNMENT

Essential Mathematics for JSS 1 by AJS Oluwasanmi chapter 23 pages 255 – 260.
Exercise 23.2 No 1&2 page 258

WEEKEND ASSIGNMENT

1. Which one of the following is a discrete data A. 1.25 B. $\frac{42}{5}$ C. $\frac{83}{4}$ D. 5
2. Data that is written in random order is called A. qualitative data B. raw data C. quantitative data D. discrete data E. continuous data
3. Which of the following must a questionnaires be? A. simple B. misleading C. ambiguous D. irrelevant E. offensive
4. We can represent data by _____________ A. line B. dist C. number D. picture E. double lines
5. Statistics deals majorly on ___________ A. building B. dancing C. data D. fish E. animals

THEORY

1. Mention 3 things you must avoid when designing a questionnaires
2. In carrying out a survey, mention two ways, you can obtain information from people.

WEEK 10

TOPIC: GRAPHICAL PRESENTATION OF DATA USING PICTOGRAM, PIE CHARTS AND BAR CHARTS

CONTENT: i) The Pictogram

ii) The bar charts
iii) The pie charts

INTRODUCTION

A frequency table is a numerical presentation of data in an organized summary from. Diagrams, symbols and pictures sometimes catch the eye more quickly than the number. They also tell stories more easily than numbers. It is also observed that it is easier to understand frequency table than the raw data, another method of presenting data, which most graphical find easier than table, is observe method. Graphs help us to observe any patterns easily. Examples of these graphs are pictogram, bar chart, line graph and pie chart.

THE PICTOGRAM

This uses pictures to represent statistics information or data. The pictogram is also called an ideograph. A pictogram uses pictures or drawings to give a quick and easy meaning to statistical data. A pictogram is a simple way of representing data in which a number of indentical drawings or pictures and used to show the data. It is useful to use pictures which can easily be divided into halves, quarters and do on. A pictogram must have a key to show that each picture stands for. Also you need to give the diagram a title

Example: The following table shows the favorite sports of 75 students
Represent the data in the form of a pictogram.

Favourite sports	Frequency
Football	25
Wrestling	10
Boxing	5
Table Tennis	15
Swimming	20

Evaluation Question

The following table shows the number of students in JSS 1 in different houses at a certain school.
Represent the data in the form of a pictogram

House	Blue	Yellow	Green	Purple
Students	16	14	11	21

Reading Assignment

1. Essential mathematics for JSS 1 by AJS Oluwasanmi page 262-273
2. New general mathematics for JSS 1 by AJS Channon other. Page 145-151
3. MAN mathematics for JSS 1 page 211

THE BAR CHARTS

Bar chart is very like a pictogram. The bars have the same width and usually have equal spaces between them. Instead of using pictures as in case of the pictogram, we must use a bar to represent the frequency of each of the item. In drawing a bar chart, we must take the following features into consideration.

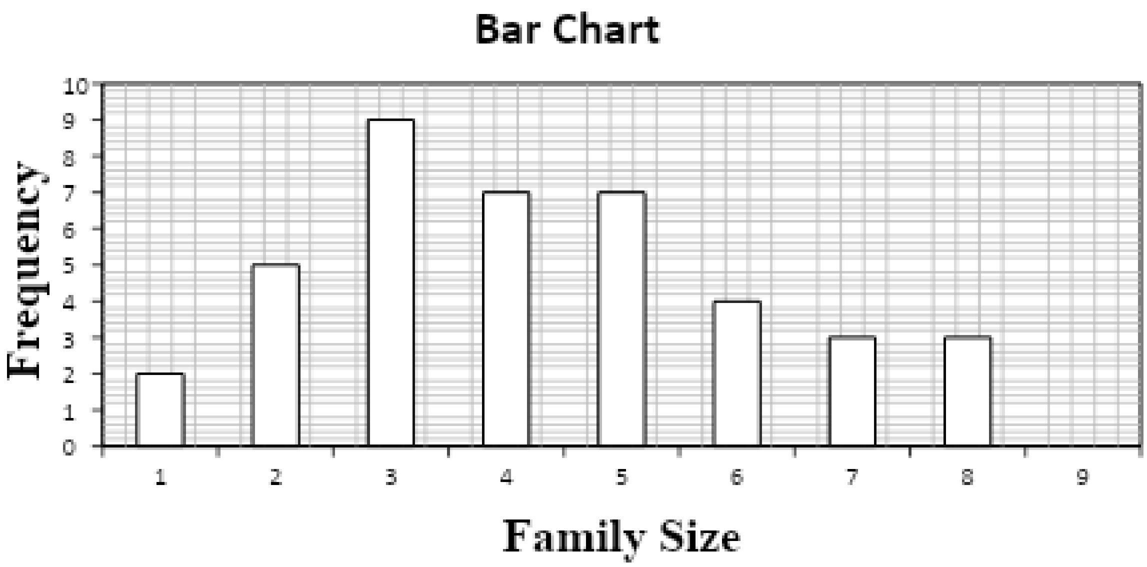
i. The charts consists of bars
ii. The bars must be of equal width
iii. The lengths of the bars are in proportion of the frequencies being represented. The bars may be vertical or horizontal

Example
The following figures show the number of children per family in a sample of 40 households
1, 2, 4, 3, 4, 3, 8, 3, 2, 2, 3, 2, 5, 6,
5, 4, 2, 1, 3, 2, 4, 5, 3, 8, 7, 6, 5,
4, 5, 7, 6, 3, 8, 6, 3, 5, 7, 5, 4, 3
(a) Prepare a frequency table for this data
(b) Draw a bar chart to illustrate the above data

Solution
(a) Frequency table

No of children per family	1	2	3	4	5	6	7	8
frequency	2	5	9	7	7	4	3	3

(b)



Evaluation Question
The table below shows different colours of cars found in a company's car park. Draw a bar chart for this data.

Colour of cars	White	Blue	Red	Grey	black
Frequency	20	17	10	8	15

Reading Assignment
Essential Mathematics for JSS 1 by AJS Oluwasanmi page 262

THE PIE CHART
A pie chart is a circle, which is divided into slices (i.e sectors) whose angles are used to display data.
The size of an angle of each sector gives the frequency of each value. The major advantage of a pie chart is that it enables us to see clearly how the size of parts are compared in relation to one another and to the overall total. It is important to label each sector according to the given items and also give pie chart a little.
Example: A student was given ₦600.00 in June as a pocket money. He spent the money as follows:

Food = ₦200.00
Transport = ₦100.00
Books = ₦120.00
Rent = ₦150.00
Miscellaneous = ₦30.00

Draw a pie chart to illustrate the data.

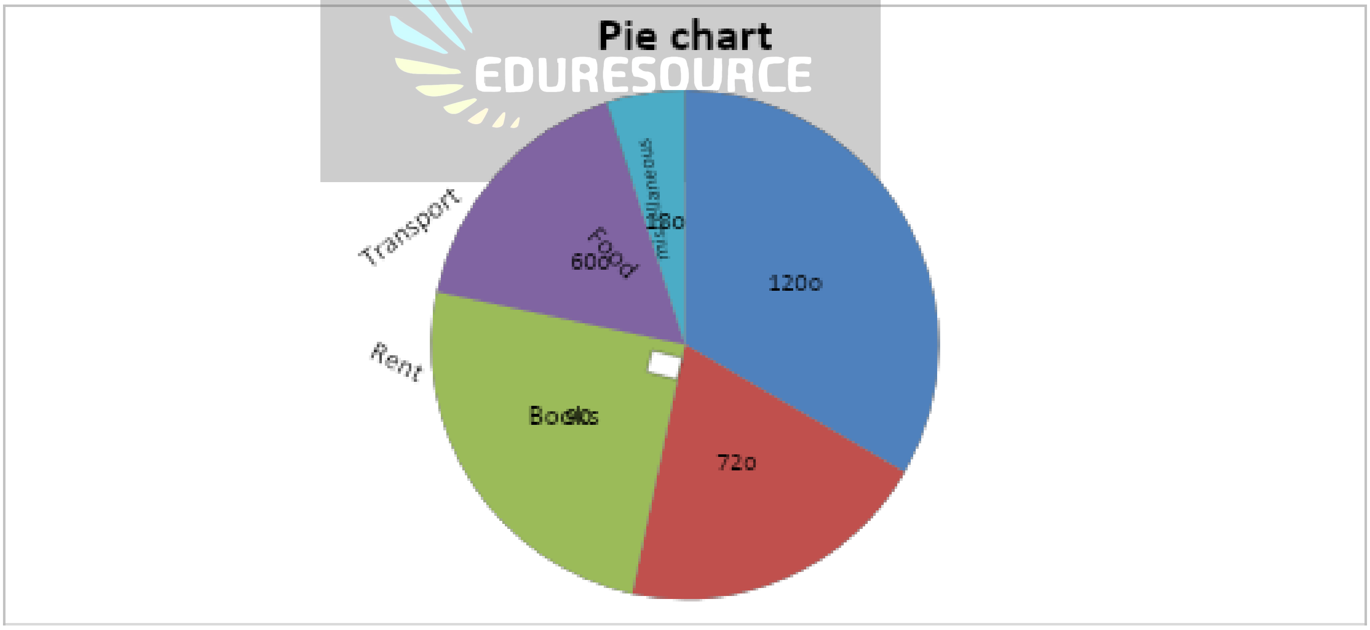
Solution

There are 360° in a full circle and the total amount spent was N600.00 this means N600.00 is represented by 360°; N1 is represented by $\frac{360^\circ}{600}$ = 0.6

= 200 x 0.6
= 120°

Items	Amount Spent in Naira (₦)	Angle
Food	200	200 x 0.6 = 120°
Transport	100	100 x 0.6 = 60°
Books	120	120 x 0.6 = 72°
Rent	150	150 x 0.6 = 90°
Miscellaneous	30	30 x 0.6 = 18°
TOTAL	600	360°

120° + 60° + 72° + 90° + 18° = 360°



GENERAL EVALUATION QUESTION

400 students were asked whether they liked yam, cornflakes, bread, rice or some other type of food for breakfast, the following data was recorded.

Type of Food	Yam	Cornflakes	Bread	Rice	Other	**Total**
Frequency	65	110	80	120	25	400

Draw a bar and a pie chart to represent this information

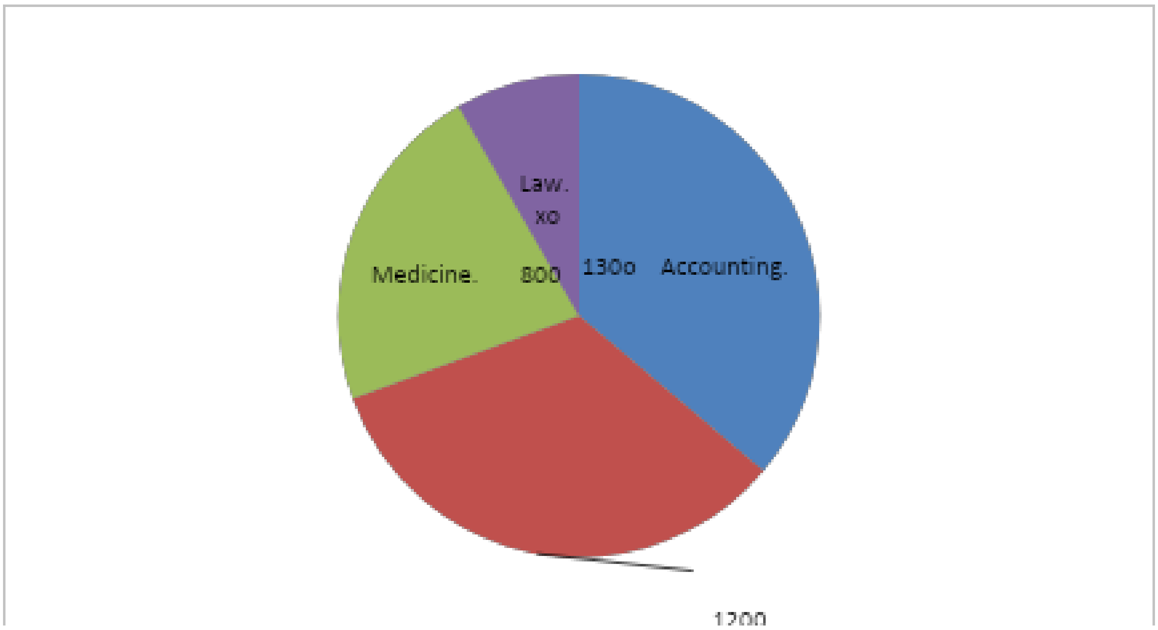
READING ASSIGNMENT

Essential Mathematics Bk. 1 pages 261 – 273. Exercise 25.4 No 1-5

WEEKEND ASSIGNMENT

1. Which of the following is not a pictorial form of presenting data?A. Bar chart   B. Pie chart   C. Frequency distribution   D. Line graph

The pie chart below shows the course which a group of students are doing. Use the pie chart to answer questions 2 to 5



2. What is the value of angle x^o? A. 20^o B. 30^o C. 40^o D. 35^o
3. Which course most students doing? A. Engineering B. Accounting C. Law D. Medicine
4. Which course has the least number of students? A. Engineering B. Accounting C. Law D. Medicine
5. What fraction of the students are doing Engineering? A. $\frac{2}{3}$ B. $\frac{1}{4}$ C. $\frac{1}{3}$ D. $\frac{1}{6}$

THEORY

1. 40 youths who were admitted into a mental hospital due to drug abuse were asked to name the types of drugs they often take. The table shows how they replied.

Indian hemp	35%
Morphine	20%
Heroine	15%
Cocaine	30%

   i. Represent this information in a pie chart

Find the number of youths in each category

WEEK ELEVEN

TOPIC: STATISTICS II

CONTENT: **i) The Mean**
ii) The Median
iii) The Mode

INTRODUCTION

Average is the most used word to describe measure of a set of numbers. It is a single value used to represent a set of numbers (i.e. all values in a set of data).

For example, the average age of students in JSS1 in Good Shepherd Schools is 10yrs. This does not mean that every student in JSS1 is 10yrs, but 10 yrs is used to represent the age of all students in JSS1.

The most commonly used statistical averages are arithmetic mean, median and mode.

The Mean

The mean, sometimes called the arithmetic mean, is the most common average. The mean of a set of numbers or values is found by simply adding all the values together and then divide by the number of the values.

i.e. Mean $= \frac{sum\ of\ values}{number\ of\ values}$

Example 1

Find the mean of the following numbers 4, 5, 6, 7, 8.

Solution

Sum of all the numbers = 4 + 5+ 6+ 7+ 8 =30

There are 5 numbers, so divide by 5

Mean = $\frac{sum\ of\ values}{number\ of\ values} = \frac{30}{5} = 6$

Example 2

In five tests, a student's marks were 13, 17, 18, 8 and 10. What is the average mark?

Solution

Average (mean) mark $= \frac{13+17+18+8+10}{5}$

$= \frac{66}{5} = 13.2$

Example 3

A hockey team has played eight games and has a mean score of 3.5 goals per game. How many goals has the team scored?

Solution

Mean score = $\frac{total\ number\ of\ goals}{number\ of\ games}$

$3.5 = \frac{total\ number\ of\ goals}{8}$

Multiply both sides by 8

Total number of goals = 3.5 x 8

Total number of goals scored = 28

Evaluation

The ages of 10 pupils in a certain class are: 9, 9, 8, 12, 11, 11, 12, 10,9,9

(a) Calculate the mean age of the pupils.
(b) How many pupils are less than the mean age?
(c) How many pupils are above the mean age?

The Median

The median of a set of values or data is the middle value when the data is arranged in order of magnitude or size.

Example 4

Find the median of the following numbers 13, 10, 6, 8, 7, 9, 11

Solution

Arrange the numbers in order of increasing size

6,7,8, **9,** 10, 11, 13

The middle value is the fourth number from LHS, i.e. 9 is the median

Note: The result is the same if the numbers are arranged in order of decreasing size

Example 5

Find the median of these numbers: 13, 15, 14, 12, 13, 15, 16, 10, 12, 14

Solution

Arrange the set of numbers in order of increasing size

10, 12, 12, 13, **13, 14,** 14, 15, 15, 16

We have even number of values, so there is no middle number. Tp obtain the median, we add the two middle numbers and then divide by 2.

Median = $\frac{sum\ of\ the\ two\ middle\ numbers}{2}$

$= \frac{13+14}{2} = 13\frac{1}{2}$

Evaluation

A dice was thrown 14 times, and the scores were : 1,6,6,4,3,5,5,2,4,6,3,2,1,4. Find the median score

The Mode

The mode is the value that occurs most frequently in a set of data. A set of data may have more than one mode. When all values occur only once then there is no mode.

Example 6

Find the mode of these numbers 3, 4, 3, 2, 4, 3, 2, 3, 5, 3, 2

Solution

3 occurs 5 times, 4 occurs 2 times, 2 occurs 3 times, 5 occurs 1 time

3 occurs most frequently, so **the mode is 3**

Note: if there are two modes in a data, the data is said to be bimodal and when there are more than two modes, the data is said to be multimodal.

Evaluation

Find the mode of these numbers

(a) 14, 18, 12, 10, 18, 20,19,14,18,10
(b) 1,5,6,3,5,7,10,8,4,9

General Evaluation

The table below shows the marks obtained in a Mathematics test by JSS1 students.

Mark	5	6	7	8	9	10
Frequency	2	3	5	7	4	2

Find the

(a) Modal mark
(b) Median mark
(c) Mean mark of the distribution to 1 d.p

Reading Assignment

1. Essential Mathematics for JSS1 by A.J.S Oluwasanmipg 270-275
2. NGM for JSS1 by MF Macrae, et. al pg179-184

Weekend Assignment

1. A student obtained 50, 80, 60 and 70 marks in 4 different tests in Mathematics. Find the mean score. A. 60 B. 65 C. 70 D. 75
2. Find the median of these numbers: 6, 3, 5, 7, 8. A. 3 B. 5 C. 6 D. 5.5
3. What is the mode of these numbers: 4,6,8,7,3,1,3,7,1,8,1. A. 7 B. 2 C. 8 D. 1
4. The length of 20 metal rods is 1860cm when added together. Find the average length of the rods. A. 91cm B. 90.5 cm C. 93cm D.92cm
5. If there are two modes in a data, the data is said to be .... A. single modal B. multimodal C. bimodal D. none of the above

Theory

1. Zainab did 10 tests in English dictation and her marks were as follows: 70, 50, 60, 75, 30, 65, 60, 40, 78, 80 (a) Find her mean mark (b) Find her median mark (c) Find her modal mark
2. Tolu obtained an average of 70 marks in 8 tests. He then scored 65 and 80 marks in another two tests. Find his new average mark.