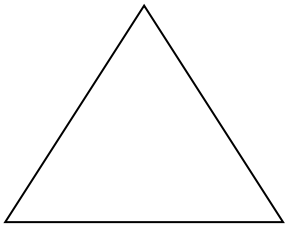
MATHEMATICS

JSS 2

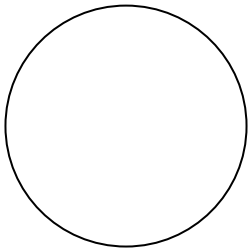
PLANE SHAPES

Definition:

A Plane shape is a two dimensional shape made from line segments enclosing a region. Examples are Triangle, Quadrilaterals. Circles and other polygons.



A Rectangle

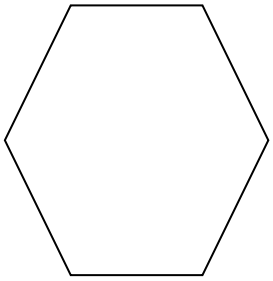


A Circle

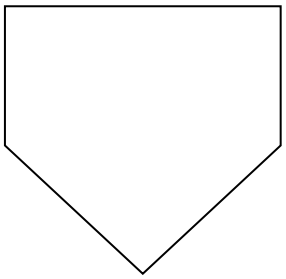
Polygons

Any Plane shape bounded by straight lines segments with no hole inside is called a polygon.

Triangles and rectangles are polygons with three and four sides respectively. Other polygon shapes are shown below;



Hexagon (6 Sided Polygon)

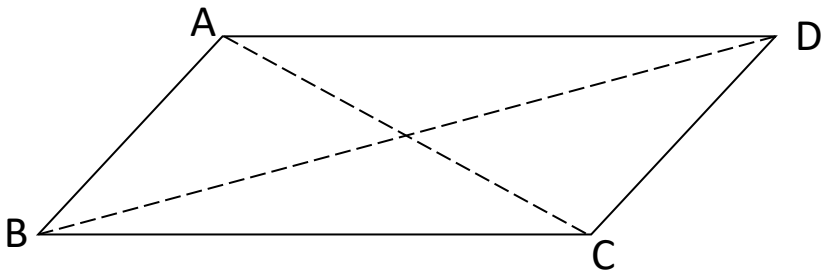


Pentagon (5 Sided Polygon)

Parallelogram

Definition:

A Parallelogram is a quadrilateral that has opposite sides equal and parallel.



Properties of a parallelogram:

1. The opposite sides are parallel

2. The opposite sides are equal

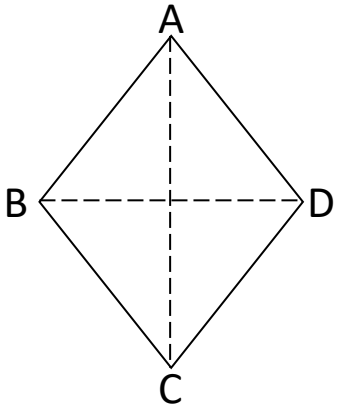
3. The opposite angles are equal

4. Each Diagonal (AC or BD) divides it into two triangles with the same shape.

5. The Two Pairs of Triangles formed by the diagonals have the same shape

Rhombus

Definition: A Rhombus is a Quadrilateral having its four sides equal.



Properties of Rhombus

1. All the sides are equal (i.e. AB = BC = CD =DA)

2. Opposite sides are equal in length and are Parallel (i.e. AB||DC and AD||BC)

3. Opposite angles are equal, i.e. A = C and B = D

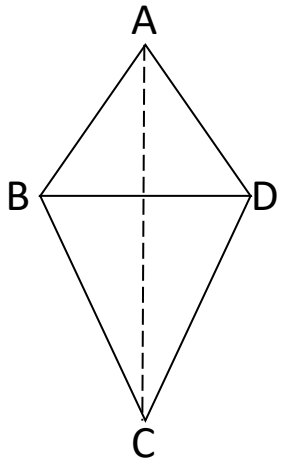
4. Diagonals bisect each other at Right Angles

5. Diagonals are line of Symmetry i.e. A Rhombus has two lines of Symmetry (Dividing into equal Halves)

KITE

Definition

A Kite is a Quadrilateral in which only one of its diagonal is a line of symmetry



Properties of Kite

1. The Adjacent sides are equal i.e. AB=AD and BC=DC

2. One pair of the opposite angles are equal i.e. B=D

3. The shorter diagonal divides it into Two Unequal Isosceles Triangle

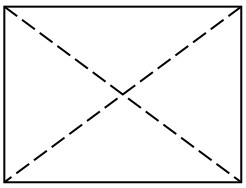
4. The Longer Diagonal is the only line of Symmetry.

Quadrilaterals

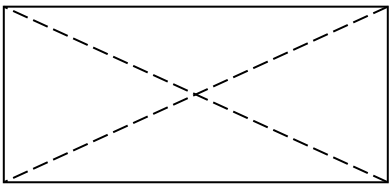
Any plane shapes bounded by four straight lines is known as a Quadrilateral. Examples includes; Square, Rectangle, Parallelogram, Rhombus and Kite.

Similarities and Differences between Quadrilaterals

Square and Rectangle:



Square



Rectangle

Similarities:

1. They have equal diagonals (2 diagonals)

2. Both have equal numbers of angles (4 angles)

3. Diagonals bisect each other.

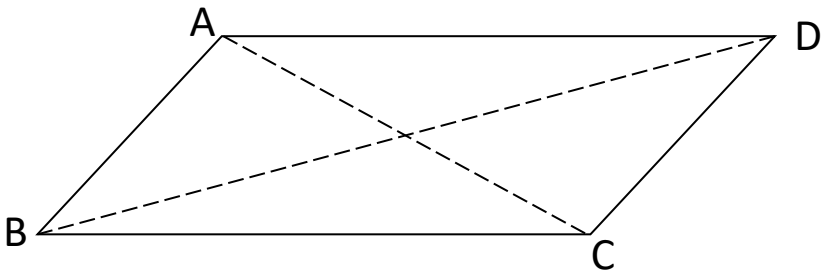
Differences:

1. All the sides of a Square are equal while the opposite sides of a rectangle are equal

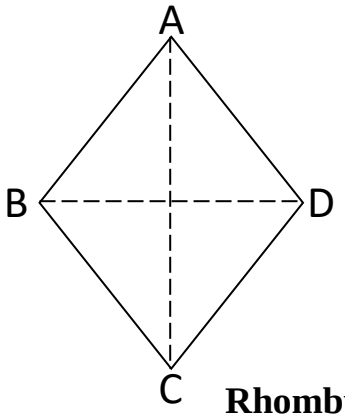
2. All the Angles in a square are equal, but only opposite angles of a Rectangle are equal.

3. Diagonal Bisect the angles in a square but not in a rectangle

Parallelogram and Rhombus



Parallelogram



Rhombus

Similarities:

1. Opposite sides of both shapes are parallel to each other

2. Opposite angles of both shapes are equal to each other

3. Diagonals of both shapes bisect each other

Differences:

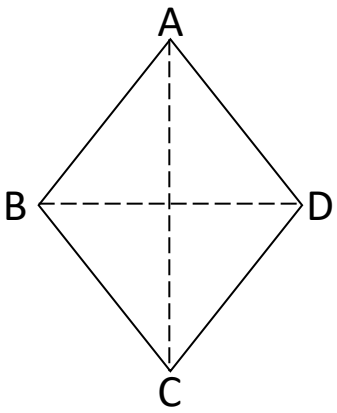
1. All the sides of the Rhombus are equal, while only the opposite sides of a Parallelogram are equal

2. Diagonals of Rhombus meet at Right angles but not in a Parallelogram

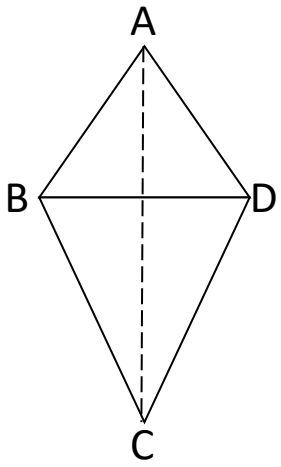
3. The Diagonals of a Rhombus Bisect the Angles, but not in a Parallelogram

4. A Rhombus has Two Lines of Symmetry but a parallelogram has none

Rhombus and Kite



Rhombus



Kite

Similarities:

1. The Diagonals of the Rhombus and Kite meets at Right angles

2. The Diagonals bisect the angles

Differences:

1. Rhombus has all four sides equal, but a kite has pairs of the same length

2. A kite has one pair of opposite angles equal, while a Rhombus has two pairs of opposite angles equal

3. A Rhombus has two line of Symmetry, while a Kite has One Line of Symmetry.

POLYGON

The Word Polygon is a Greek word. “Poly” meaning “many” and “gon” means “Angles”. Literally, Polygon means many angles.

A Polygon is a closed figure made up of line segments. Polygons are classified according their number of sides.

Examples of Polygons are given in the table below:

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

ANGLES

Definition of Angles:

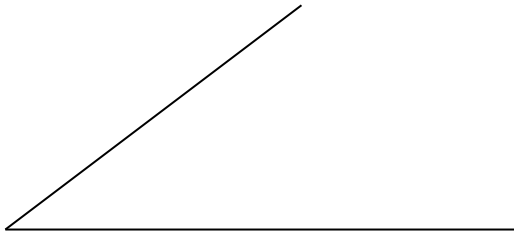
An Angle is the amount of distance between the direction of two lines or surfaces where they meet.

Hence, an angle is formed where do lines meets.

Classifications of Angles:

Angles are classified according to their sizes as follows;

1. Acute Angles:

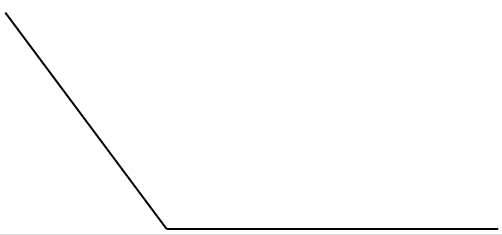


These are angles that are less than 90^0

2. Right Angle:

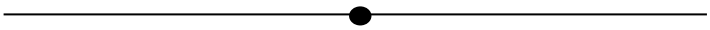
This is an angle that is equal to 90^0

3. Obtuse Angle:



This is an angle that is greater than 90^0 but less than 180^0

4. Straight Line Angle:



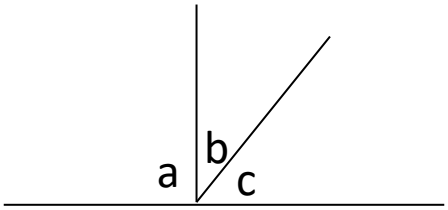
This angle is half of a turn. It is equal to 180^0

5. Reflex Angle:

This is an angle that is greater than 180^0 but less than 360^0

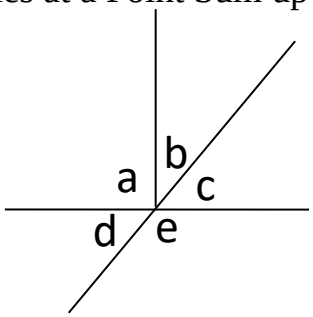
Properties of Angles

1. Angle on a straight line sum up to 180^0



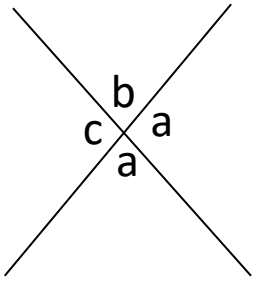
$a + b + c = 180^0$ (Angles on a straight line)

2. Angles at a Point Sum up to 360^0



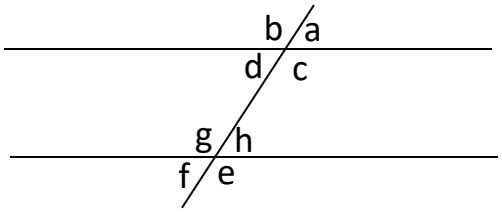
$a + b + c + d + e = 360^0$

3. Vertically opposite angles are equal



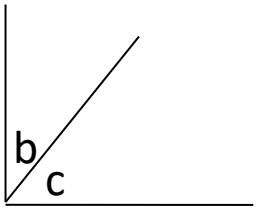
a = b and c = d

4. When a transversal cuts parallel lines, the following are true;



a) Corresponding angles are equal (a = h and d = f)
b) Alternate angles are equal (c = g and d = h)

5. Complementary Angles:

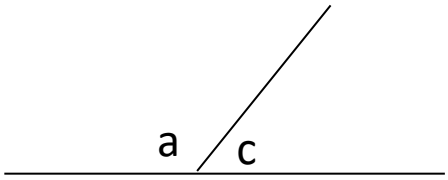


Two angles are complementary to each other if their sum is 90^0

$b + c = 90^0$

6. Supplementary Angles:

Two angles are said to be Supplementary to each other if their sum is equal to 180^0

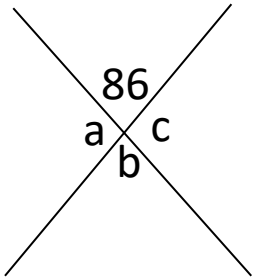


$a + c = 180^0$

Solved Examples

Example 1:

Find all the marked angles in the Figure below;



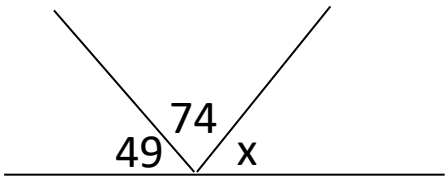
$b = 86^0$ (Vertically Opposite angles are equal)

$a + 86 = 180$ (Angles on a straight line)

$a = 180 – 86$

$a = 94^0$

Example 2:



$49+74+x = 180^0$ (Angles on a straight line)

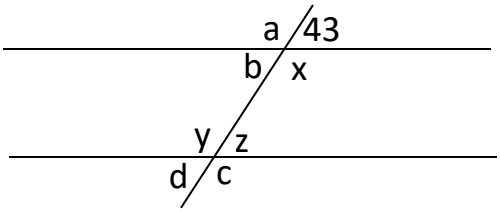
$123 + x = 180$

$x = 180 – 123$

$x = 57^0$

Example 3:

Find the lettered angles, giving reasons for your answers;



$z = 43^0$ (Corresponding angles)

$x + 43 = 180$ (Angles on a straight line)

$x = 180 – 43$

$x= 137^0$

$y = x = 137^0$ (Alternate angles)

$b = z = 43^0$(Alternate angles)

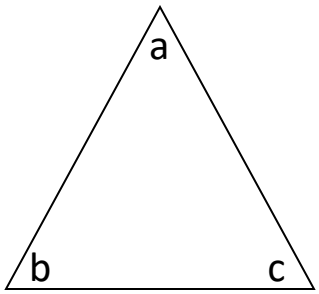
$d = z = 43^0$ (Vertically opposite angles)

$a = x = 137^0$ (Vertically opposite angles)

$c = y = 137^0$ (Vertically opposite angles)

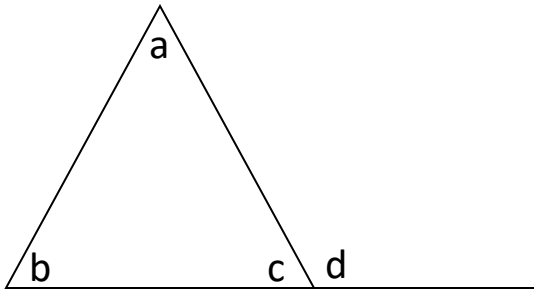
ANGLES IN TRIANGLES

The sum of angles in a Triangle is equal to 180^0



a + b + c = 180 (Sum of angles in a Triangle)

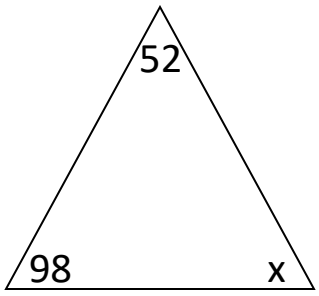
NB: The Exterior angle of a triangle is equal to the sum of the opposite interior angles;



d = a + b (Exterior angles equals sum of two opposite interior angles)

Example 1:

Find the value of angle x in the figure below;



Solution:

$52+98 + x = 180^0$ (Sum of angles in a Triangle)

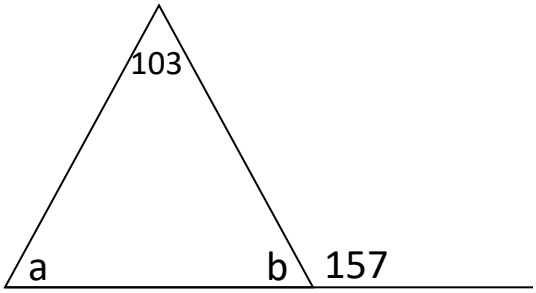
$150 + x = 180$

$x = 180 – 150$

$x = 30^0$

Example 2:

Find the marked angles giving reasons for your answers;



$a + 103 = 157^0$ (Exterior angle equals the sum of opposite interior angles)

$a = 157 – 103$

$a = 54^0$

To find b:

$a + b + 103 = 180^0$ (Sum of Angles in a Triangles)

$54 + b + 103 = 180$

$b + 157 = 180$

$b = 180-157$

$b = 23$

ANGLES IN POLYGON

Names of Polygons	Number of Sides	Number of Triangles	Sum of Angles
Triangle	3	1	180^0
Quadrilateral	4	2	$2 \times 180^0 = 360^0$
Pentagon	5	3	$3 \times 180^0 = 540^0$
Heptagon	6	4	
Hexagon	7	5	
Octagon	8	6	
Nonagon	9	7	
Decagon	10	8	
n-gon	n sides	(n-2)	(n-2) x 180

From the above table, we have that;

1. The Sum of the Interior Angles in an n-sided polygon is:
   $(n-2) \times 180^0$
   Where;
   n = number of sides.
2. The Sum of Exterior angles of an n-sided polygon is:
   360^0

Example 1

Find the sum of the interior angles of a Pentagon.

Solution:

A Pentagon has 5 sides, therefore n = 5.

Sum of Interior angles = $(n-2) \times 180^0$

$= (5-2) \times 180$

$= 3 \times 180$

$= 450^0$

Example 2

The Sum of angles in a polygon is 1980^0. How many sides have the polygon?

Solution:

Sum of angles in a polygon = $(n-2) \times 180$

$(n-2) \times 180 = 1980$

$n-2 = \frac{1980}{180}$

$n-2 = 11$

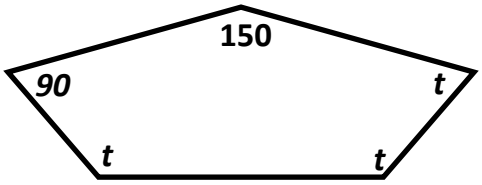
$n=11+2$

$n = 13.$

Therefore, the polygon has 13 sides

Example 3:

What is the value of ***t*** in the figure below?



Solution:

The Figure is a five sided polygon (Pentagon)

Sum of angle of Pentagon = (n – 2) x 180

= (5-2) x 180

=3 x 180 = 540^0

Therefore,

150 + 90 + t + t + t = 540^0

240 + 3t = 540

3t = 540 – 240

3t = 300

$t = \frac{300}{3}$

t = 100^0

STATISTICS

Data Presentation

Definition:

Statistics is a branch of science that is concerned with the methods of collection. Organizing, presenting and analyzing of data for a specific purpose. Data is collected from a population.

A population is the totality of individual or object in which inference or conclusions are to be drawn. For example, the number of people in Nigeria who are infected with COVID-19 virus or the number of houses in Ichi could be the population of interest.

We collect data for certain purposes. The central purpose of gathering data is to educate and inform people being investigated.

Examples of data collected from JSS 2A class is shown below;

Age	Number of Students
10	3
11	5
12	3
13	1

Date collected can be processed into information.

Frequency Table

Frequency refers to the number of times a particular number or scores occurs in a given set of data. For example, giving a set of numbers;

1,3,2,1,4,2,3,2,3,4.

It is easy to say that No. 1 occurs Two Times, No. 2 and 3 occur Three Times each and No. 4 occurs Two times. Thus, the frequency of No. 1, 2, 3 and 4 are; 2, 3, 3 and 2 respectively.

These data can be summarized in frequency table has shown below;

Number	1	2	3	4
Frequency	2	3	3	2

Therefore, A frequency table is a Tabulation of a given set of data with their individual corresponding number of occurrence. Or a Table showing a given set of data with their corresponding frequencies.

Rank Order List

One of the ways of making sense of given raw data s to arrange the data in a certain order. Data can be arranged in increasing or decreasing order of magnitude. This is often refer to as Rank Order.

Therefore, Rank order simply means arranging data in order of magnitude.

Rank order makes it easier to observe at a glance the highest and lowest grades of scores.

Example 1:

a) Arrange the following scores in ascending order of magnitude;
   18, 1,17,5,6,12,4,1,0
b) Which is the highest Score?
c) Which is the Lowest Score?
d) How many scores are above 6?

Solution:

a) 0,1,1,4,5,6,12,17,18
b) The Highest Score is 18
c) The Lowest score is 0
d) The number of scores above 6 is 3.

Use of Tallies

A Tally is a mark or stroke (/) used to represent the number of times each score or thing or object occurs in a given set of data.

When constructing a frequency table for a large set of data, it is often useful to use a Tally.

Example 2

Consider the score of 30 Students in a Mathematics test;

2,1,0,4,2,3,4,5,1,2,0,5,4,3,3,0,3,2,3,1,3,4,5,3,1,5,2,3,5,4.

a) Prepare a frequency Table for the Data
b) How Many Students Scored;
   i) 3 marks
   ii) 4 marks
c) The Percentage of students that scored above 3
d) If the Pass score is 3, how many students failed the test
e) Calculate the percentage of students that failed the test
f) Calculate the percentage of students that passed the test.

Solution:

a) Frequency Table

Score	Tally	Frequency
0	///	**3**
1	////	**4**
2	~~////~~	**5**
3	~~////~~ ///	**8**
4	~~////~~	**5**
5	~~////~~	**5**

b)
i) 8 Students Scored 3 marks
ii) 5 Students scored 5 marks

c) Percentage of Students that scored above 3
i.e. Number of students that scored 4 and 5; which is 5 + 5 = 10
$\% = \frac{10}{30} \; x \frac{100}{1} = \frac{100}{3}$
= 33.33%

d) Number of students that failed the Test;
Since the pass mark is 3, Students that scored below 3 failed;
Hence, 5 + 4 + 3 = 12 Students

e) Percentage of Students that failed
i.e. Number of students that scored below 3; which is = 12 Students
$\% = \frac{12}{30} \; x \frac{100}{1}$
= 40%

f) Number of students that passed = 8 + 5 + 5 = 18 Students

% of students that passed = $\frac{18}{30} \; x \frac{100}{1}$

= 60%

PICTORIAL REPRESENTATION OF DATA

In most cases, pictures give a visual impression of the statistical data more quickly than the frequency table. This is because they tell stories more clearly than the frequency table.

There are many ways of presenting data in a diagrammatic or graphical form. These includes; Pictogram, Bar Chart and Pie Chart.

Pie Chart

A Pie Chart is a circular chart which is divided into sectors, such that the angle at the center is proportional to the frequency represented by the different parts.

The total frequency makes up the whole Pie of 360^0, and each sectorial angle is calculated as a percentage of 360^0.

Thus, to draw a Pie chart, each score with frequency $\boldsymbol{f}$ is represented by a sectorial angle;

$$\frac{f}{N} x \frac{360}{1}$$

Where;

$\boldsymbol{N}$ = Sum of all the frequencies

$\boldsymbol{f}$ = The Individual frequencies

Example 1

The number of students in a school who play football, Hockey, Basket Ball and Table Tennis are shown in the Table below;

Games	Football	Hockey	Basket Ball	Table Tennis
Number of Students	70	60	30	20

Prepare a Pie chart for this Table;

Solution:

Games	**Number of Students**	**Sectorial Angles**
Football	70	$\frac{70}{180}\ x\frac{360}{1} = 140^0$
Hockey	60	$\frac{60}{180}\ x\frac{360}{1} = 120^0$
Basket Ball	30	$\frac{30}{180}\ x\frac{360}{1} = 60^0$
Table Tennis	20	$\frac{20}{180}\ x\frac{360}{1} = 40^0$
TOTAL	**180**	**360^0**

Using the Sectorial angles in the table above, we now draw a circle and divide the angle at the center, which is 360^0 into angles 140^0 , 120^0, 60^0 and 40^0

Games	Sectorial Angles
Football	140^0
Hockey	120^0
Basket Ball	60^0
Table Tennis	40^0