Chapter 5

Understanding Elementary Shapes

Introduction to Understanding Elementary Shapes

In our day to day life, we come across various shapes like curves,

lines, triangles and various shapes.

We organize them into line segments, angles, triangles, polygons and circles.

Measuring Line Segments

We know that a line segment is a fixed portion of a line.

Every fixed thing has a possibility that it can be measured. So, this makes it possible to measure a line segment.

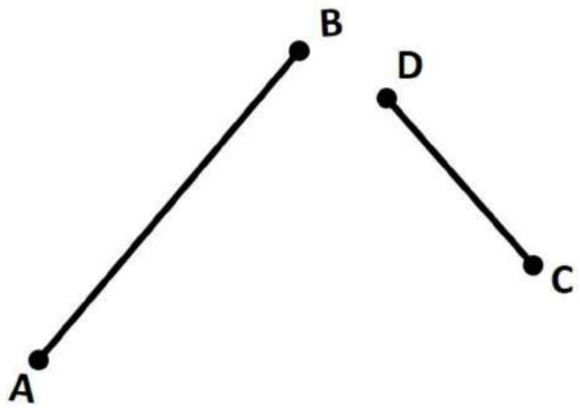
The measure of line segment is a "number". This numerical value is called "length of line segment."

Measurement can be done in various ways.

- Comparison by observation

By just looking at the line segments we can tell which one is longer.

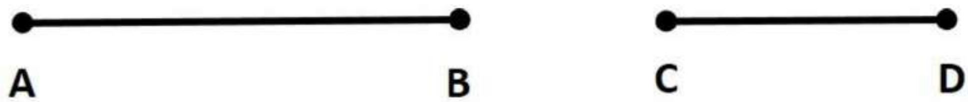
Here we see that line segment AB is longer than CD.



But we can't tell how much longer so other methods were deduced.

- **Comparison by tracing**

Here, we have to compare AB and CD.



We will use tracing paper this time.

Trace line segment CD onto the paper and place it over the line segment on AB.

Now, we will be able to decide which is longer.

This method depends on the accuracy in tracing the line segment.
But if we want to compare with another line segment you have to trace another line segment.
You cannot trace every time you want to compare. So, yet another method was used.

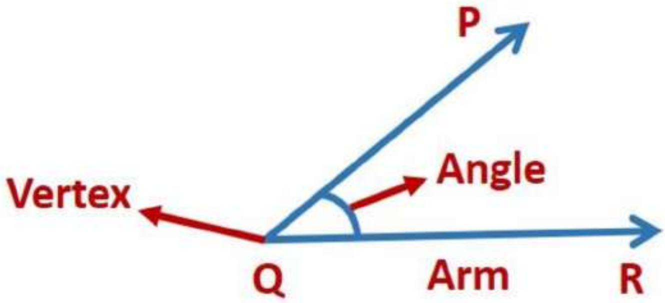
- Comparison using ruler and a divider

Place the zero mark of the ruler at A. Read the mark against B. This gives the length of AB.

Suppose the length is 5 cm, we may write, Length AB = 5 cm or more simply as AB = 5 cm.
Open the divider. Place the endpoint of one of its arms at A and the the endpoint of the second arm at B.

Angles

When two rays originate from a common point then the turn between two rays around the common point or vertex is called the angle between the two rays.

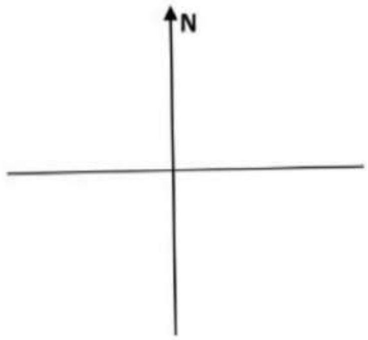


The two rays joining to form an angle are called arms of an angle and the point at which two rays meet to form an angle is called the vertex of the angle.

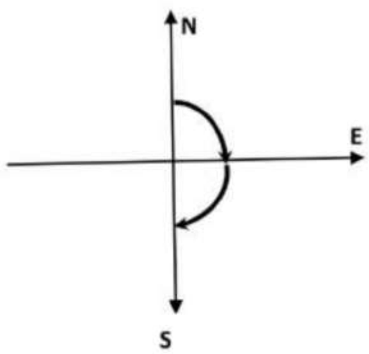
In the above figure, two rays $\overrightarrow{QP}$ and $\overrightarrow{QR}$ are the arm of an angle which meets at common initial point Q (vertex) and form an ∠PQR.
The measure of the angle PQR is written as m∠PQR but instead of writing this we can simply write it as ∠PQR.

Study the following positions:

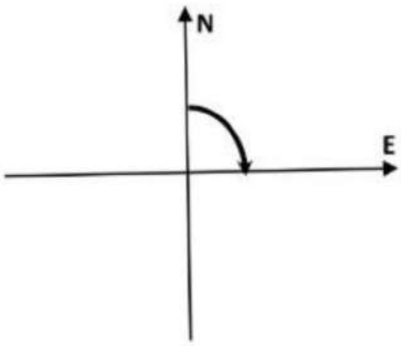
You stand facing north.



By a 'right-angle-turn' clockwise, you now face east.



By another 'right-angle-turn' you finally face south.



The turn from north to east is by a right angle.
The turn from north to south is by two right angles; it is called a straight angle. (NS is a straight line).

Turning by two straight angles (or four right angles) in the same direction makes a full turn. This one complete turn is called one revolution.
The angle for one revolution is a complete angle.
An angle smaller than a right angle is called an acute angle.

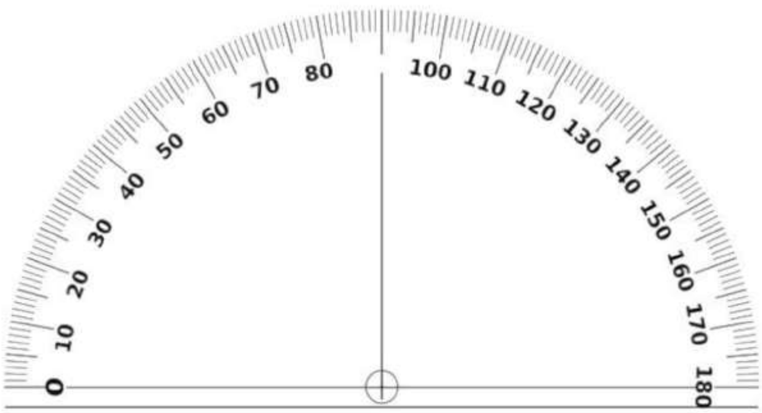
If an angle is larger than a right angle, but less than a straight angle, it is called an obtuse angle

Measuring Angles

The last example was helpful to compare angles with a right angle.We classified the angles as acute, obtuse or reflex.

It cannot be useful if we have to find which one among the two obtuse angles is greater.
So in order to be more precise in comparison, we need to 'measure' the angles.

We can do it with a 'protractor'.

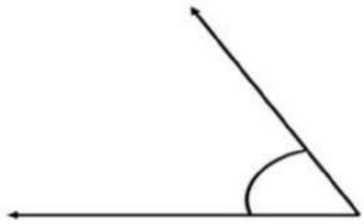


The curved edge is divided into 180 equal parts. Each part is equal to a 'degree'.

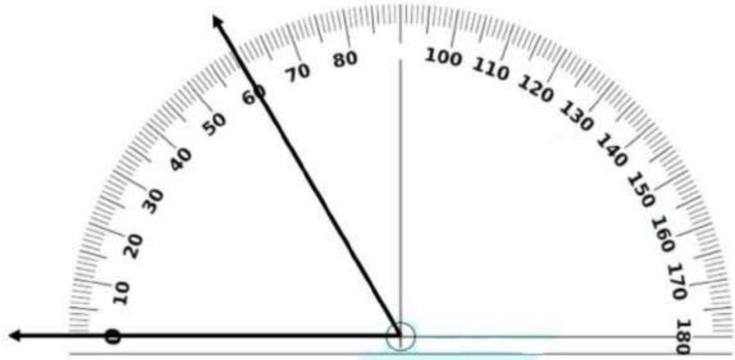
We call our measure, 'degree measure'. One complete revolution isdivided into 360 equal parts. Each part is a degree.

Let us see how to measure the given angle using protractor.

Example:



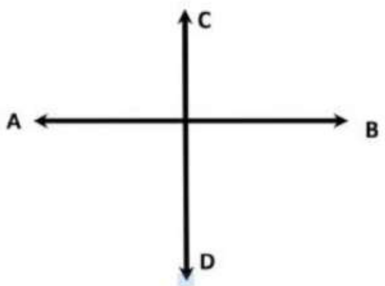
Put the protractor over the angle and you will be get the accurate measure of angle.



Here, the measure of angle is 60°.

Perpendicular Lines

When two lines intersect and the angle between them is a right angle, then the lines are said to be perpendicular.



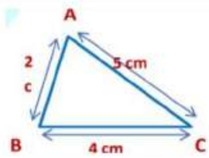
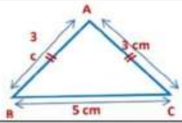
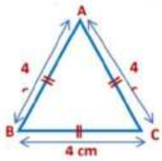
If a line AB is perpendicular to CD, we write AB ⊥ CD.

Classification of Triangles

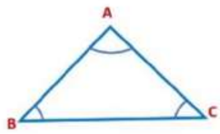
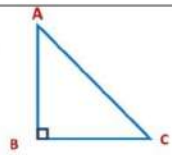
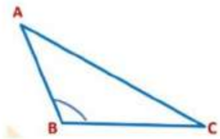
Triangles can be classified on the basis of:

- Sides
- Angles

Classification of Triangles on the Basis of Their Sides

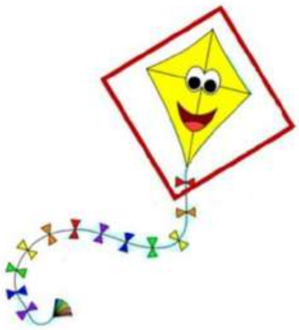
(i) Scalene triangle: In a scalene triangle, all the three sides are unequal. Adjacent figure shows a scalene triangle where AB ≠ BC ≠ AC	
(ii) Isosceles triangle: An isosceles triangle is a triangle whose any two sides are equal. Adjacent figure shows a isosceles triangle where AB =AC	
(iii) Equilateral triangle: An equilateral triangle is a triangle whose all three sides are equal. Adjacent figure shows a equilateral triangle where AB =BC = AC	

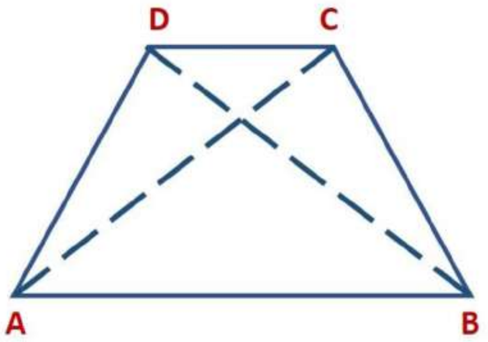
Classification of Triangles on the Basis of Their Angles

(i) Acute-angled triangle: If all the three angles of a triangle are less than 90° it is called an acute-angled triangle. In the adjacent figure, ∠ABC, ∠BCA, ∠CAB all are acute-angled triangle.	
(ii) Right-angled triangle: If the measure of one of the angle of a triangle is 90° , it is called a right-angled triangle. In the adjacent figure, ΔABC = 90°. Therefore, ΔABC is a right-angled triangle.	
(iii) Obtuse-angled triangle: If the measure of one of the angle of a triangle is greater Than90°, it is called a obtuse-angled triangle. In the adjacent figure, ΔABC > 900 Therefore, ΔABC is an obtuse-angled triangle.	

Quadrilaterals

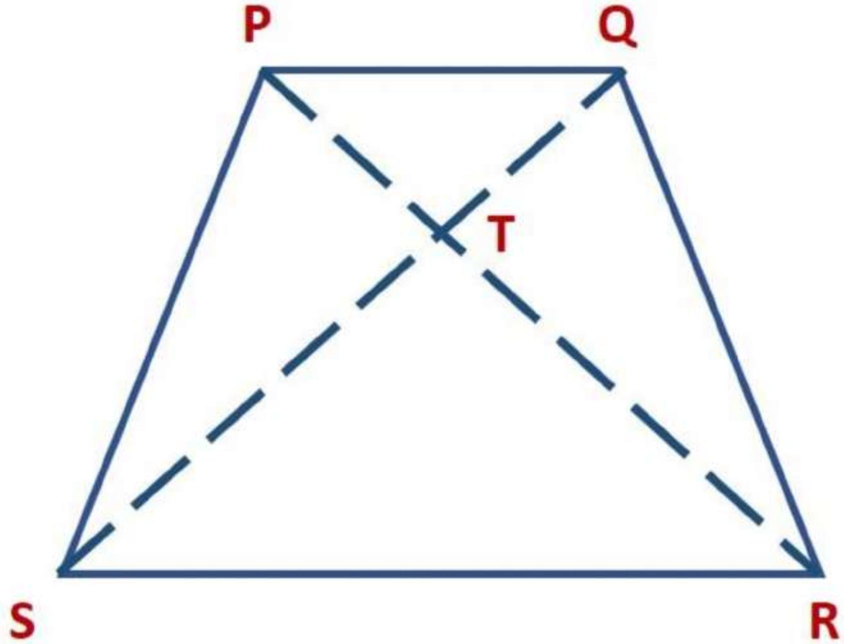
A four-sided polygon is a quadrilateral. It has 4 sides and 4 angles.





Sides	$\overline{AB}$, $\overline{BC}$, $\overline{CD}$ and $\overline{DA}$
Angles	$\angle A$, $\angle B$, $\angle C$ and $\angle D$
Opposite Sides	$\overline{AB}$ and $\overline{DC}$, $\overline{BC}$ and $\overline{AD}$
Opposite Angles	$\angle A$ and $\angle C$, $\angle B$ and $\angle D$
Adjacent Sides	$\overline{AB}$ and $\overline{BC}$, $\overline{BC}$ and $\overline{CD}$, $\overline{CD}$ and $\overline{DA}$, $\overline{DA}$ and $\overline{AB}$
Adjacent Angles	$\angle A$ and $\angle B$, $\angle B$ and $\angle C$, $\angle C$ and $\angle D$, $\angle D$ and $\angle A$

Example: Draw a rough sketch of a quadrilateral PQRS. Draw its diagonals. Name them. Is the meeting point of the diagonals in theinterior or exterior of the quadrilateral?



The two diagonals are PR and QS.

Diagonal PR and diagonal QS meet at point T which is in the interior of the quadrilateral PQRS.

Polygons

A polygon is a closed figure formed of three or more line segments.

• Polygons are two dimensional.

• They are bounded by straight lines and the shape is closed.

• Minimum three line segments are required to make a closed

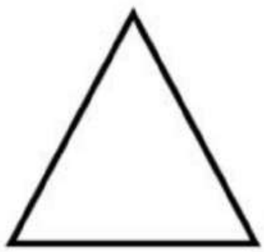
figure, thus a triangle is a polygon with a minimum of three sides.

We may classify polygons according to the number of their sides.
Let us see some of them:

Number of sides: 3

Name of polygon: Triangle

Illustration:



Number of sides: 4

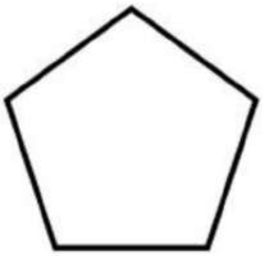
Name of polygon: Quadrilateral

Illustration:

Number of sides: 5

Name of polygon: Pentagon

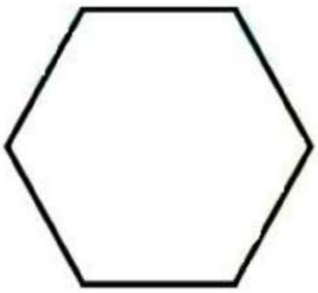
Illustration:



Number of sides: 6

Name of polygon: Hexagon

Illustration:



And the list goes on,

For 7 sides its heptagon

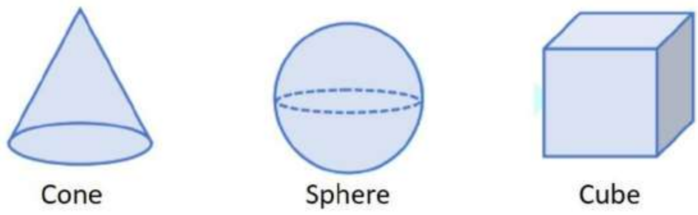
For 8 sides its octagon

For 9 sides its nonagon

For 10 sides its decagon

3D shapes

They have three dimensions like length, breadth and height or depth. They are also called Three dimensional Figures(3-D).
Examples: Cone, Spheres, Cubes, Cylinders etc.



Faces

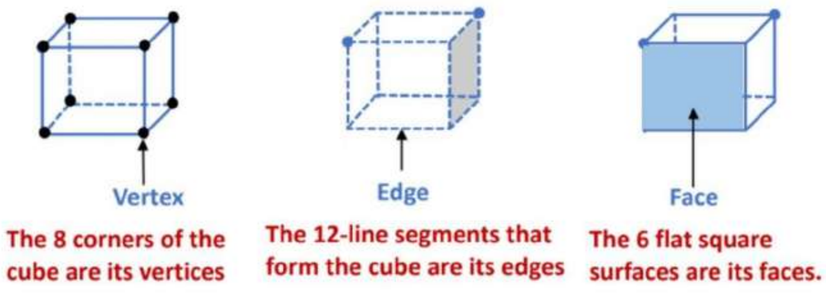
The flat surfaces of any solid called faces.

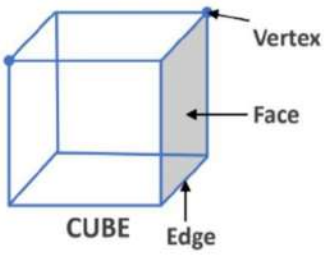
Edges

Line segments common to intersecting faces of a polyhedron are known as its edges. Line segments that form the solid are called edges.

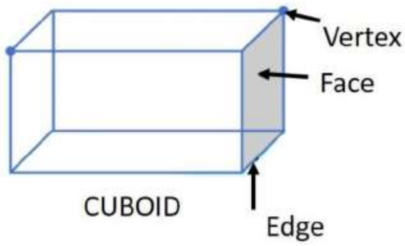
Vertices

Points of intersection of edges of a polyhedron are known as its vertices. Corners of the solid are its vertices.

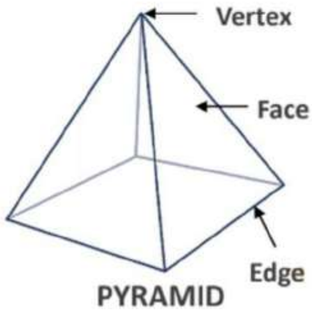




F = Number of Faces = 6
E = Number of Edges = 12
V = Number of Vertices = 8
Clearly, F + V = E +2



F = Number of Faces = 6
E = Number of Edges = 12
V = Number of Vertices = 8
Clearly, F + V = E +2



F = Number of Faces = 5
E = Number of Edges = 8
V = Number of Vertices = 5
Clearly, F + V = E +2

Shapes			
Faces(F)	6	5	10
Edges(E)	12	8	16
Vertices(V)	8	5	9