

7

Angles

By studying this chapter you will be able to get a good understanding of,

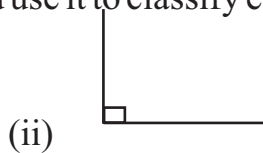
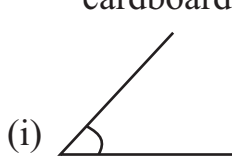
- ✱ the concept of an angle
- ✱ drawing angles, naming angles and measuring the magnitude of angles (using the protractor)

7.1 Can you remember what you have learned?

Do the following exercise to revise what you have learned about angles in the former grade.

Exercise 7.1

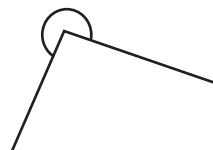
- (1) Classify the angles formed in each of the following instances.
Angle,
 - (i) in one of the four corners of the teacher's table.
 - (ii) in one of the four corners of a door.
 - (iii) when the speedometer of a car records 60 kilometres per hour.
 - (iv) formed where the edges of the walls and the floor of a room meet.
 - (v) formed when a student facing North, turning clockwise to the West.
 - (vi) formed when the minute hand moves to 3 from 12.
- (2) Prepare a right angular lamina using a piece of paper or cardboard and use it to classify each of the following angles.



(iv)



(v)



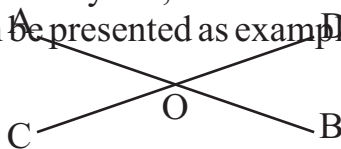
Number of the figure	Type of angle
(i)	
(ii)	
(iii)	
(iv)	
(v)	

7.2 Introduction of angles

Even though you have gained some knowledge of the concept of the angle from what you have learned in Grade 6, it is very useful to know the meaning of words such as "point", "line segment" and "plane" when defining it in the standard form.

(a) Point

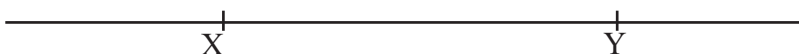
A point is an elementary concept in geometry. All the geometrical shapes can be mentioned as sets of points. Among what we can see in the day-to-day life, a corner of a box, the tip of a pen, tip of a pointed object can be presented as examples of a point.



A point has no magnitude. That is, it has no length, area or volume. It is represented as, \cdot or \times .

(b) A Line segment

A line is a set of points spread straight across two opposite directions.



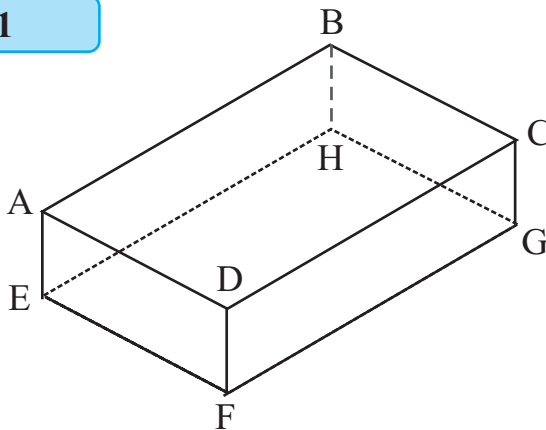
All the points between X and Y including X and Y are known as the line segment XY. Here X and Y are the starting and the ending points.

(c) Plane

A plane is also known as a set of points. Here, the points spread in all directions without a limit; further a plane is a flat surface. The cover of a book, a wall of a house, the floor of a house are examples for planes.

A plane can be named by three points on it which are not collinear.

Example 1



Accordingly a few points, line segments and planes of the figure can be given as:

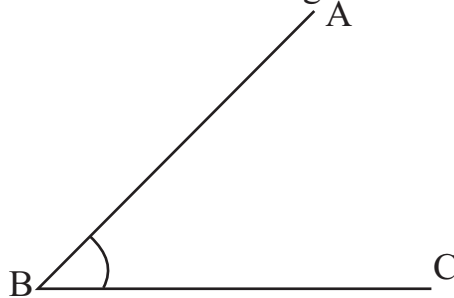
- Points : A, B, C, D, E, F, G, H
- Line segments : AB, BC, CD, EF
- Planes : ABCD, ADFE, BCGH

Exercise 7.2

- (1) Classify each of the following as points, line segments and planes.
- (i) A tightly pulled thread
 - (ii) A tip of a pen
 - (iii) The boundary of meeting of the floor and a wall of a room
 - (iv) The tip of a needle
 - (v) A page of a book
 - (vi) A table plank
 - (vii) An edge of a box

(d) Angle

An angle is formed by a common starting point and two line segments on a plane. This common point is called the vertex and the line segments are called the arms of the angle.



The angle between the line segments \widehat{BA} and \widehat{BC} , with the vertex B given in the figure is named as ABC or CBA. When an angle is named with letters as above the letter in the middle is relevant to the vertex.

Angles can be divided mainly as dynamic angles and static angles.

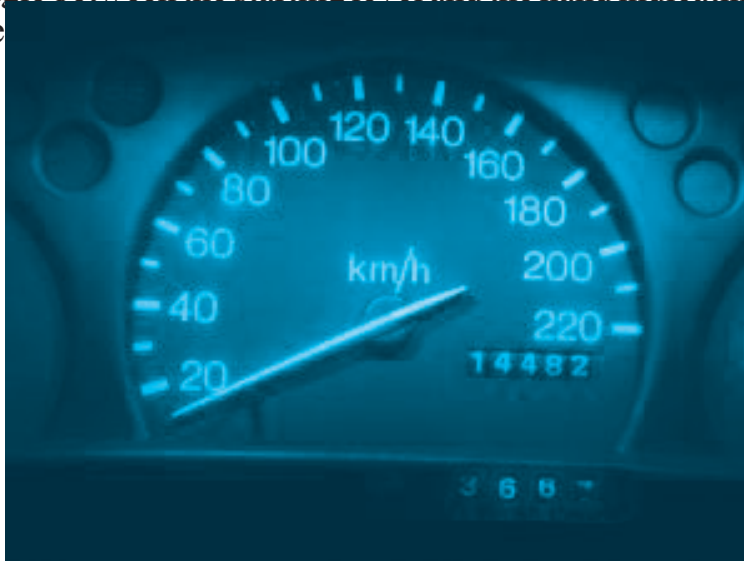
Example 2

(a) Dynamic Concept of angles

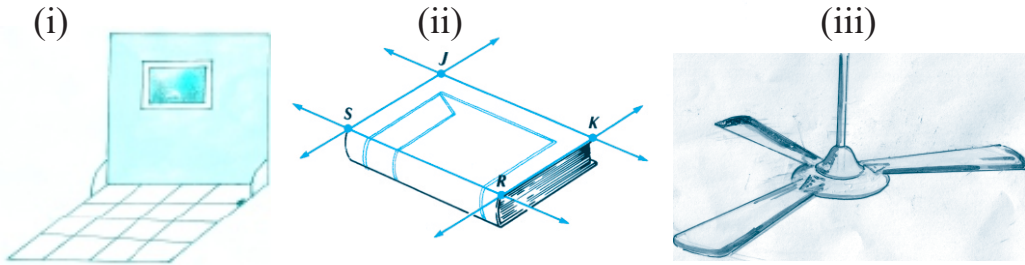
- (i) The angles between the hour hand and the minute hand of a clock.



- (ii) Angle between the starting level and the hand indicating the speed.



(b) Static Concept of angles

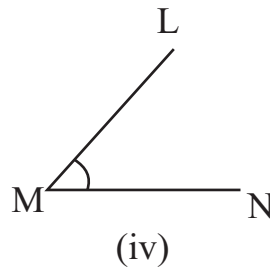
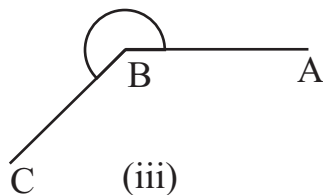
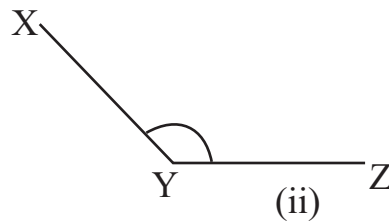
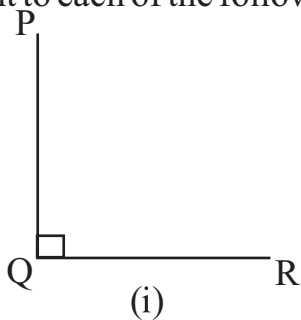


The angles shown in (i), (ii) and (iii) above do not change with time.

Exercise 7.3

- (1) Name the angle between the line segments AX and BX with the vertex X.
- (2) Name the,
 - (a) line segments
 - (b) vertex
 - (c) angle

relevant to each of the following.



(3) Name the vertices and line segments of each of the following angles.

(i) \hat{PQR}

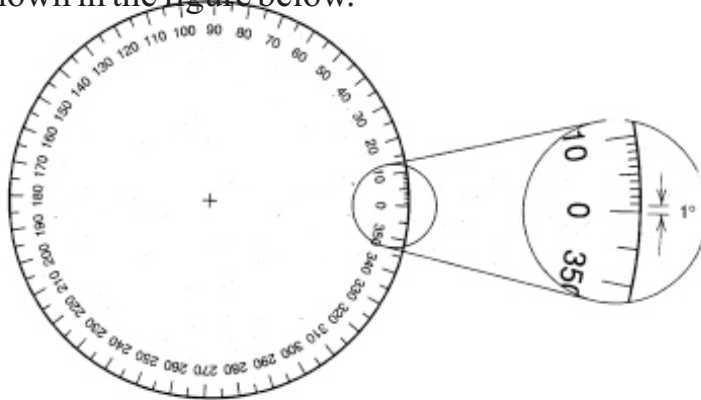
(ii) \hat{LMN}

(iii) \hat{EFG}

(iv) \hat{STU}

7.3 Measuring angles

Just the way that the temperature can be measured by a thermometer, length by a ruler and mass by a balance, there is an instrument to measure the angle. It is called the protractor and the unit of measure of the angle is a degree. A degree is one part of a circle which is divided into 360 equal parts as shown in the figure below.

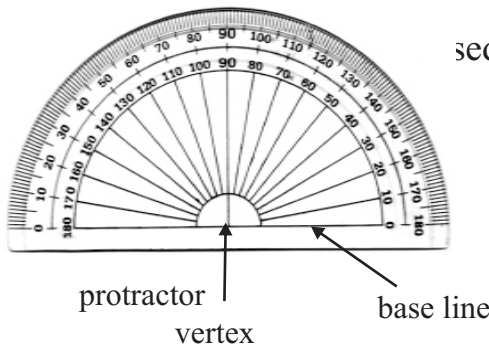


A degree is $\frac{1}{360}$ written as 1° and according to the figure above,

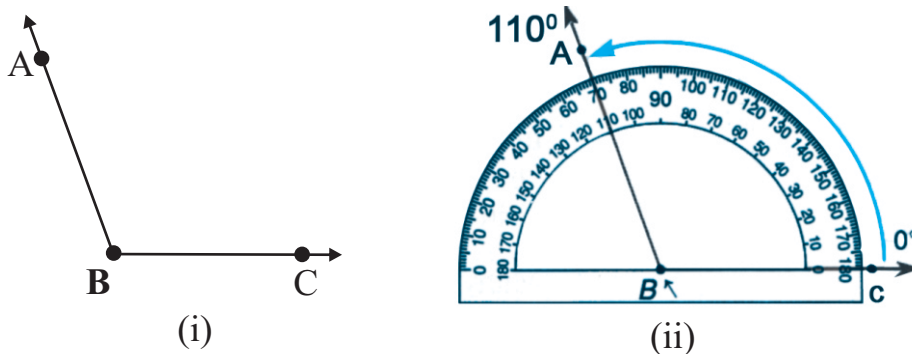
1° is $\frac{1}{360}$ of the circle.

A protractor

is used to measure angle.



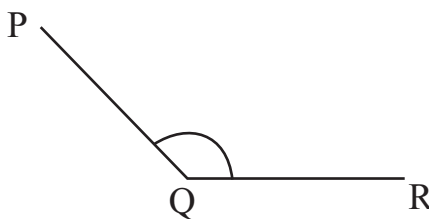
Measuring an angle using a protractor can be explained as given below. Let us assume that the following angle has to be measured.



It can be seen that when the protractor is placed to coincide BC with the base line and the mid point of the base line with the point B (figure (ii)) the line segment BA passes the edge of the protractor. Accordingly get the relevant measurement from the scale of degrees. This is the measurement of $\angle ABC$.

The part obtained by dividing a degree into 60 equal part is called 1 minute and the part obtained by dividing a minute into 60 equal parts is called a second. Dividing the hour used to measure time today, into minutes and seconds is the same as dividing a degree into minutes and seconds.

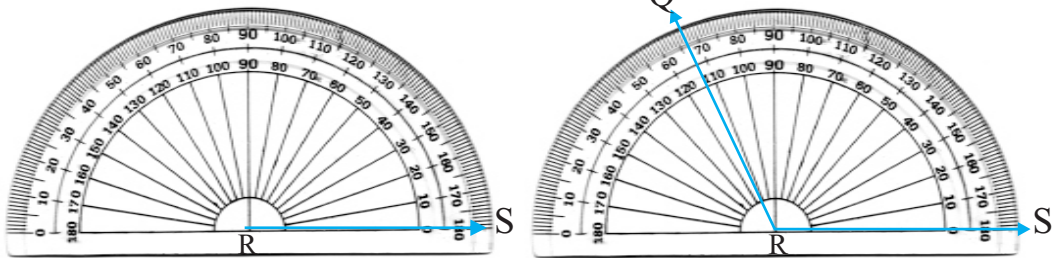
Activity 7.1



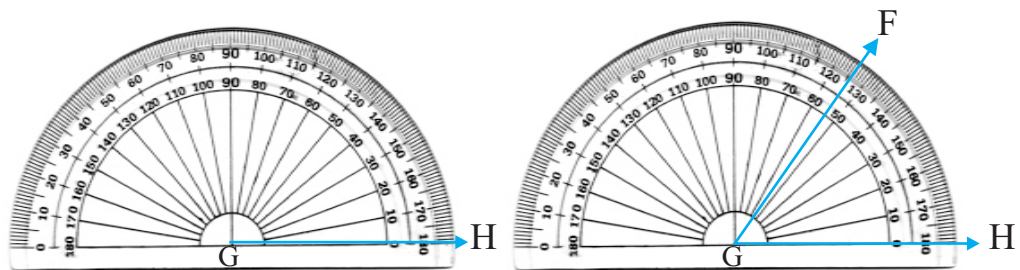
- (i) Keep the protractor so that the base line coincides with QR and the mid point of the base line coincides with the point Q.
- (ii) Find at which point QP passes the edge of the protractor.
- (iii) What is the measurement relevant to the line QP on the degree scale?
- (iv) Get the magnitude of \hat{PQR} in degrees.

Example 3

- (i) Draw \hat{QRS} such that it is 115°



- (ii) Draw an acute angle \hat{FGH}

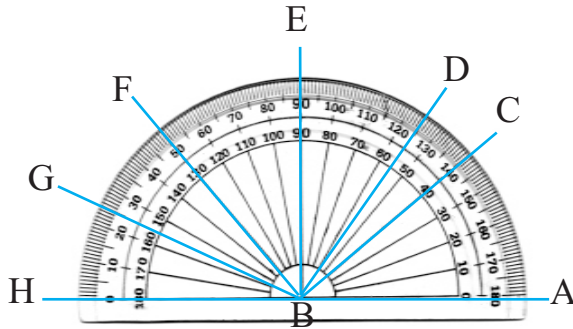


Exercise 7.4

- (1)
 - (i) Draw any line segment MN.
 - (ii) Keep the protractor in such a way that its base line coincides with MN and its mid point coincides with M.
 - (iii) Name the point relevant to the measurement 45° as 'O'.
 - (iv) Draw the line segment MO.
 - (v) What is the magnitude of \widehat{NMO} ?

- (2) Find the following angles seen in the given figure and classify them.

- | | |
|-----------------------|------------------------|
| (i) \widehat{ABC} | (vi) \widehat{ABD} |
| (ii) \widehat{GBH} | (vii) \widehat{FBH} |
| (iii) \widehat{FBA} | (viii) \widehat{GBA} |
| (iv) \widehat{CBH} | (ix) \widehat{ABE} |
| (v) \widehat{EBH} | (x) \widehat{DBH} |



- (3) Draw each of the angles with the values given below using a protractor and classify them as acute angles, right angles and obtuse angles.

- | | | | |
|------------------|------------------|-------------------|-----------------|
| (i) 30° | (iv) 90° | (vii) 80° | (x) 105° |
| (ii) 15° | (v) 60° | (viii) 71° | |
| (iii) 45° | (vi) 130° | (ix) 49° | |

- (4) Draw the following angles using a protractor and write the magnitude of them.

- (i) a right angle.
- (ii) two acute angles different from each other.
- (iii) two obtuse angles different from each other.

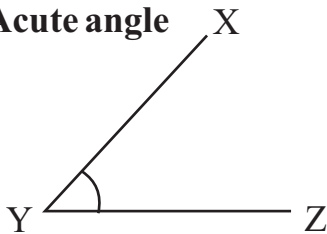
(5) Draw a triangle and name it as ABC.

- (I) Measure the, magnitude of $\hat{A}BC$, $\hat{B}CA$, $\hat{C}AB$ of that triangle.
 (ii) What is the magnitude of $\hat{A}BC + \hat{B}CA + \hat{C}AB$?

(6) In problem (2) among the angles what is the value of \hat{HBE} ? Find from that figure all the pairs of angles the sum of which is 90° .

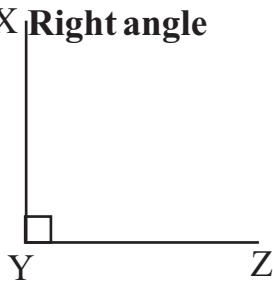
7.4 Classification of angles

(i) **Acute angle**



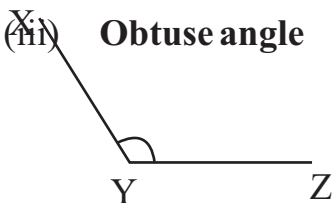
All the angles less than 90° are acute angles. Accordingly $\hat{X}YZ$ is an acute angle.

(ii) **Right angle**



An angle of 90° is a right angle. Accordingly $\hat{X}YZ = 90^\circ$. Hence it is a right angle.

(iii) **Obtuse angle**



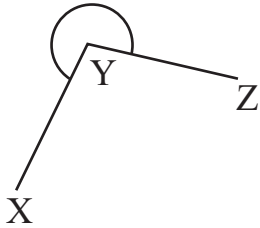
Angles of magnitude between 90° and 180° are obtuse angles. Accordingly $\hat{X}YZ$ is an obtuse

(iv) **Straight angle**



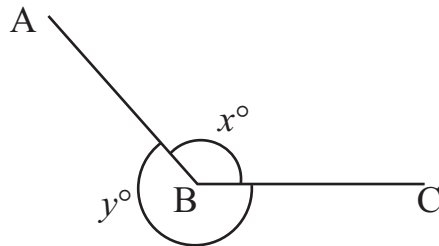
An angle of 180° is a straight angle. Accordingly $\hat{XYZ} = 180^\circ$. Hence it is a straight angle.

(v) **Reflex angle**



Angles between 180° and 360° are reflex angles. Accordingly XYZ is a reflex angle.

7.5 Finding the value of a reflex angle using the protractor



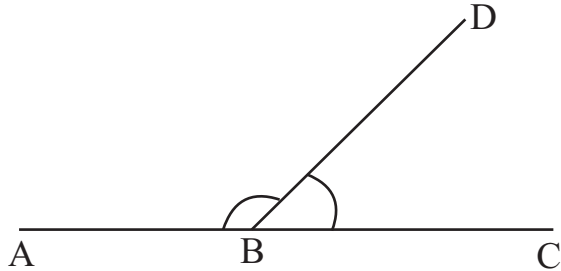
Let us assume that the value y° of the reflex angle in the figure has to be found. The value of x° can easily be measured by using a protractor.

Accordingly,

$$\text{Value of the reflex angle } (y^\circ) = (360^\circ - x^\circ)$$

As an example, when measured by the protractor if the value of x° is 130° , then the value of the reflex angle $= 360^\circ - 130^\circ = 230^\circ$

Activity 7.2



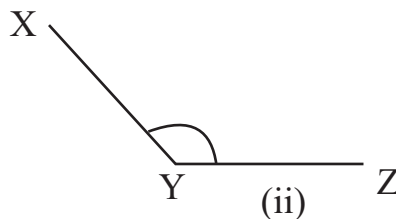
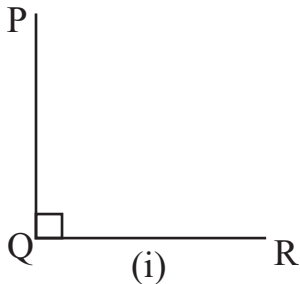
- Measure the magnitude of \widehat{ABD} .
- Measure the magnitude of \widehat{DBC} .
- To what kind do the angles in (i) and (ii) belong?
- What can you say about $\widehat{ABD} + \widehat{DBC}$?

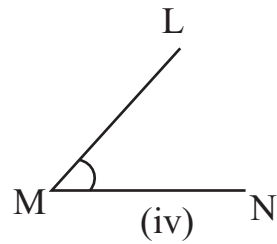
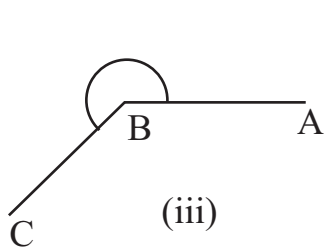
Activity 7.3

- Draw a line segment on a sheet of paper of which the starting and ending points are N and M.
- Keep the protractor so that its base line coincides with NM and the mid point of the base line coincides with N.
- What is the value of the angle relevant to the line NM?
- Name the point indicating 60° as 'O'.
- What is the value of \widehat{ONM} ?

Exercise 7.5

- Copy each of the following angles and name them. Write the vertex and the line segments of each angle. Measure the magnitude of each angle using a protractor and write the value.





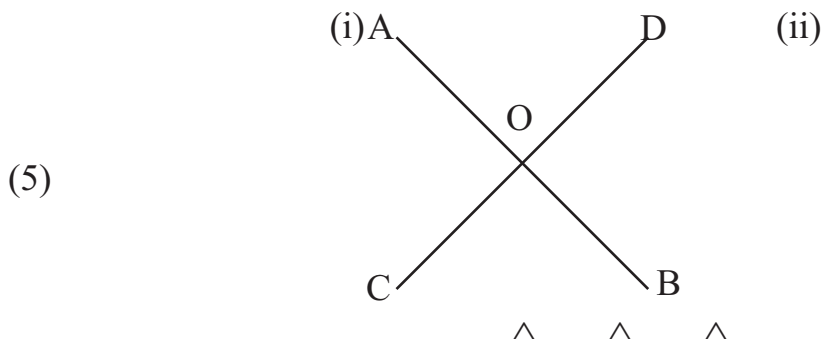
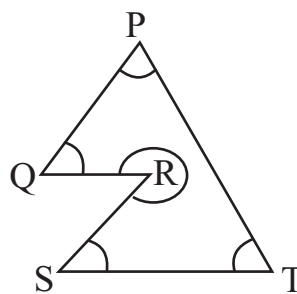
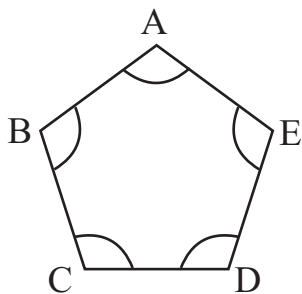
(2) Draw each of the following angles using a protractor and name them.

(i) $\hat{A}BC = 50^\circ$ (ii) $\hat{P}QR = 100^\circ$ (iii) $\hat{X}YZ = 30^\circ$

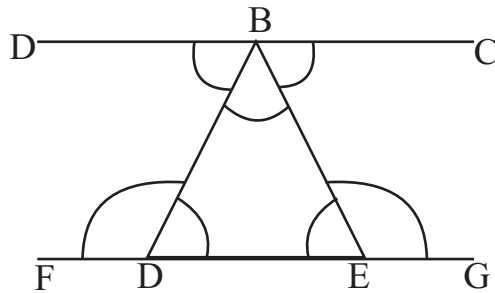
(iv) $\hat{L}MN = 160^\circ$ (v) $\hat{M}NO = 190^\circ$ (vi) $\hat{D}EF = 290^\circ$

(3) Classify the angles in (2) above.

(4) Classify the angles of the following figures.



- (6) Measure the magnitude of each of the angles marked in the following figure using a protractor.



Write the relations among the above angles.

- (7) Answer the given questions using a clock similar to the one given below.



- (a) (i) When the time in the clock is 8.00, what is the magnitude of the obtuse angle between the hour hand and the minute hand?
- (ii) When the time changes from 8.00 to 10.00, what is the magnitude of the angle of rotation of the hour hand?
- (iii) When the minute hand rotates through 60° how many minutes will be changed in the clock?

- (b) (i) What is the type of the angle through which the minute hand rotates with the time of 8.00 to 8.20?
- (ii) How many hours pass when the hour hand rotates through 150° ?
- (iii) What is the magnitude of the angle between the hour hand and the minute hand when the clock indicates the time 3.00?

Summary

- ✿ An angle is formed by two line segments and a common point. This common point is the vertex. Two straight lines are the arms of the angle.
- ✿ Angles are of two forms as dynamic and static.
- ✿ A protractor can be used to measure and draw angles.
- ✿ Angles can be classified as acute angles, right angles, obtuse angles, straight angles and reflex angles.