MATHEMATICS

Class-VII

Topic-11

CONSTRUCTION

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CHAPTER 11

CONSTRUCTION

TERMINOLOGIES

INTRODUCTION

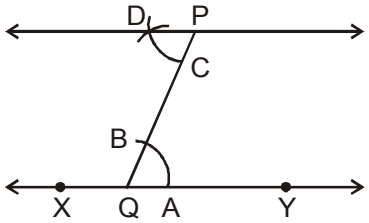
In this chapter we will learn how to draw parallel lines and some types of triangles.
If two lines are drawn in a surface of a paper such that they do not intersect even when extended indefinitely in both the directions, then such lines are called parallel lines. Also the perpendicular distance between two parallel lines is same everywhere. So we shall make use of all above facts while constructing parallel lines. Also we will learn how to construct triangle with SSS, SAS, ASA and RHS.

11.1 CONSTRUCTION

(a) Drawing a line parallel to a given line through a given point outside it:

If a transversal cuts two parallel lines, then the alternate angles are equal. Therefore, to draw a line parallel to a given line XY through a point P outside it and is proceed as follows:

Steps of construction :



Step-I Take any point Q on the given line XY.

Step-II Join PQ.

Step-III With Q as centre, draw an arc cutting XY and PQ at A and B respectively.

Step-IV With centre P and the same radius as in step-III, draw an arc on the opposite side of QP to cut QP at C.

Step-V With centre C and radius equal to AB draw an arc cutting the arc drawn in step-IV at D.

Step-VI Join PD and produce it in both directions to obtain the required line.
Since $\angle DPQ = \angle AQP$ and these are alternate angles. Therefore, PD || XY and PD contains P.

(b) Construction of triangle

(i) SSS triangle construction:
In order to construct a triangle when the lengths of its sides are given, follows the following steps of construction.

Step-I Draw a line segment of length equal to one of the sides, say BC of the triangle.

Step-II With centre B and radius equal to the length of side AB, draw an arc.

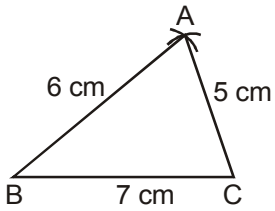
Step-III With centre C and radius equal to the length of side AC, draw an arc cutting the arc drawn in step-II at A.

Step-IV Join AB and AC to obtain the desired triangle ABC.
The following examples will illustrate the above procedure.

Illustration 11.1

Construct a triangle ABC if the lengths of its sides are given by AB = 6 cm, BC= 7 cm and AC = 5 cm.

Sol.



To construct the ΔABC, we follow the following steps of construction :
Step-I Draw a line segment BC = 7 cm.

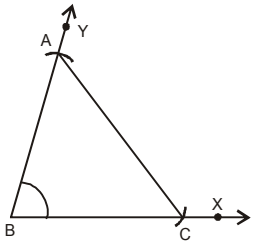
Step-II With centre B and radius AB = 6 cm, draw an arc of the circle.

Step-III With centre C and radius AC = 5 cm, draw another arc intersecting the arc drawn in step-III at A.

Step-IV Join AB and AC to obtain the desired triangle.

(ii) SAS triangle construction:

In order to construct a triangle when two of its sides, say AB and BC and the included angle $\angle B$ are given, follow the following steps of construction :



Step-I Draw $\angle XBY$ of measure equal to that of $\angle B$.

Step-II From ray BX, cut off line segment equal to BC.

Step-III From ray BY, cut off line segment equal to BA.

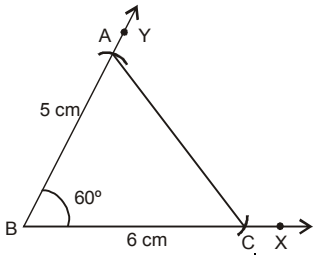
Step-IV Join AC to obtain the triangle ABC.

Following examples will illustrate the above procedure.

Illustration 11.2

Construct ΔABC in which $\angle B = 60°$; AB = 5 cm and BC = 6 cm.

Sol.



In order to construct the ΔABC, we follow the following steps of construction :

Step-I Draw ∠XBY of measure 60°.

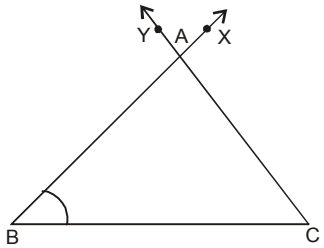
Step-II From ray BX, cut off line segment BC of length 6 cm.

Step-III From ray BY, cut off line segment BA of length 5 cm.

Step-IV Join AC to obtain the required triangle ABC, where ∠B = 60°, AB = 5 cm and BC = 6 cm.

(iii) ASA triangle construction:

To construct a triangle when two of its angles, say B and C, and the included side BC are given, proceed as follows :



Step-I Draw line segment BC.

Step-II Draw ∠CBX of measure equal to that of ∠B.

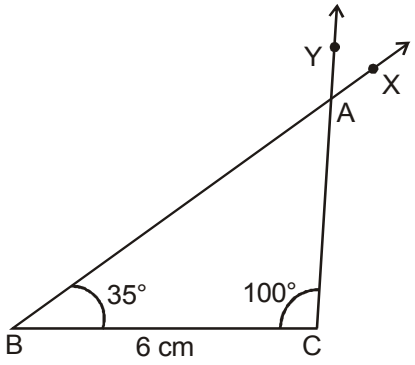
Step-III Draw ∠BCY with Y on the same side of BC as X, such that its measure is equal to that of ∠C. Let BX and CY intersect at A. Then, ΔABC is the required triangle.

Following examples will illustrate the above procedure.

Illustration 11.3

Draw ΔABC in which BC = 6 cm, ∠B = 35° and ∠C = 100°. Measure ∠A.

Sol.



To draw the ΔABC, we follow the following steps of construction :

Step-I Draw a line segment BC = 6 cm.

Step-II Draw ∠CBX, such that ∠CBX = 35°.

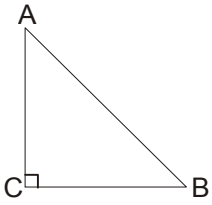
Step-III Draw ∠BCY with Y on the same side of BC as X, such that ∠BCY =100° .

Step-IV Let BX and CY intersect at A. Then ΔABC is the required triangle.
By measurement we find that ∠A = 45°.

(iv) RHS triangle construction:

A triangle is said to be a right triangle or a right angled triangle, if one of its three angles is a right angle.

In figure, Δ ABC is a right triangle with $\angle C$ as right angle. In a right triangle, the side opposite the right angle is called the **hypotenuse** of the triangle. Each of the other two sides is called a leg or simply, a side of the triangle.



In the above right triangle ABC, $\angle C$ is a right angle. Therefore, AB is the hypotenuse and AC, BC are the sides (or legs) of the right triangle.

From the angle sum property of a triangle, we have

$\angle A + \angle B + \angle C = 180°$

$\Rightarrow \quad \angle A + \angle B + 90° = 180°$

$\Rightarrow \quad \angle A + \angle B = 180° - 90°$

$\Rightarrow \quad \angle A + \angle B = 90°$

$\Rightarrow \quad \angle A$ and $\angle B$ are acute angles.

Thus, each of the other two angles of a right triangle is acute.

To construct a right triangle ABC right angled at C when its hypotenuse AB and one side BC are given, we follow the following steps of construction :

Step-I Draw a line segment BC of given length.

Step-II Draw $\angle BCX$ of measure 90°.

Step-III With centre B and radius equal to the hypotenuse AB, draw an arc of the circle to intersect ray CX at A.

Step-IV Join BA to obtain the required triangle ABC.

Following examples will illustrate the above procedure.

Illustration 11.4

Draw triangle ABC with $\angle C$ a right angle, AB = 6.2 cm and BC = 4.5 cm.

Sol. To construct the ΔABC, we follow the following steps of construction :

Step-I Draw a line segment BC of length 4.5 cm.

Step-II Draw $\angle BCX$ of measure 90°.

Step-III With centre B and radius AB = 6.2 cm, draw an arc of the circle to intersect ray CX at A.

Step-IV Join BA to obtain the desired triangle ABC.

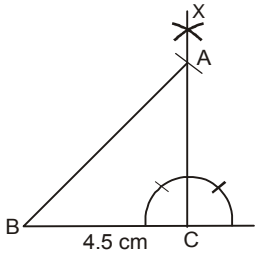


Illustration 11.5

Draw a right triangle having hypotenuse of length 5.4 cm, and one of the acute angles of measure 60°.

Sol. Let ΔABC be a right triangle, right angled at C, such that hypotenuse AB = 5.4 cm. Further, let $\angle A = 60°$. Then by the angle sum property of ΔABC, we have

$\angle A + \angle B + \angle C = 180° \Rightarrow 60° + \angle B + 90° = 180°$

$\Rightarrow 150° + \angle B = 180° \Rightarrow \angle B = 180° - 150° = 30°$

To draw ΔABC, we follow the following steps of construction :

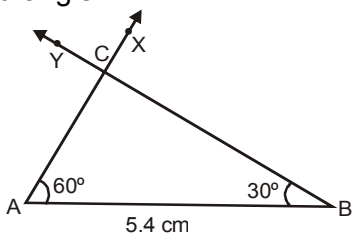
Step-I Draw a line segment AB = 5.4 cm.

Step-II Draw $\angle BAX$ of measure 60°

Step-III Draw $\angle ABY$ of measure 30° with Y on the same side af AB as X.

Let AX and BY intersect at C.

Then, ΔABC is the required triangle.



Ask yourself

1. Construct a right angled triangle whose hypotenuse measures 5 cm and one of the other sides measures 3.2 cm.
2. Draw two parallel lines at a distance of 2.2 cm apart.
3. Draw a triangle whose sides are of length 4 cm, 5 cm, 7 cm.
4. Construct an equilateral triangle ABC of side 6 cm.
5. Draw an isosceles triangle with each of equal sides of length 3 cm and the angle between them as 45 degree.

Summary

1. Let a line "l" and a point not lying on it be given. By using properties of a transversal and parallel lines, a line which passes through the point P and parallel to "l" can be drawn.

2. A triangle can be drawn if any one of the following sets of measurements are given :
   - **(i)** Three sides (SSS)
   - **(ii)** Two sides and the angle between them (SAS)
   - **(iii)** Two angles and a side (AAS) or (ASA)
   - **(iv)** The hypotenuse and a leg in the case of right-angled triangle (RHS)

EXERCISE 01

SECTION -B (FREE RESPONSE TYPE)

SHORT ANSWER TYPE

1. Draw two parallel lines at a distance 5 cm apart.

2. Draw a right triangle whose hypotenuse is of length 4 cm and one side is of length 2.5 cm.

3. Draw a right triangle having hypotenuse of length 5.4 cm, and one of the acute angles of measure 30°.

4. Draw Δ ABC in which AC = 6 cm, $\angle A = 90^\circ$ and $\angle B = 60^\circ$.

5. Draw a triangle ABC in which BC = 4 cm, AB = 3 cm and $\angle B = 45^\circ$. Also draw a perpendicular from A on BC.

6. Draw a triangle ABC with AB = 3 cm, BC = 4 cm and $\angle B = 60^\circ$. Also, draw the bisector of angles C and A of the triangle, meeting in a point O. Measure $\angle COA$.

7. Draw a right triangle with hypotenuse of length 5 cm and one side of length 4 cm.

8. Draw ΔDEF such that DE = DF = 4 cm and EF = 6 cm. Measure $\angle E$ and $\angle F$.

9. Construct a right angled triangle in which sides containing the right angles are 8 cm and 6 cm. Measure the hypotenuse.

10. Construct ΔPQR in which PR = 7cm and PQ = QR = 5 cm. Measure $\angle P$ and $\angle R$. What type of triangle is this ?

11. Construct ΔPQR in which PQ = 5.3 cm $\angle P = 60^\circ$ and $\angle Q = 30^\circ$. Measure $\angle R$. What kind of triangles is this ?

12. Construct a right angled triangle in which base is 4.5 cm and hypotenuse is 6 cm. Measure its other side. What type of triangle is this according to sides?

13. Construct ΔABC in which BC = 6.2 cm, $\angle B = 45^\circ$, $\angle A = 35^\circ$. Measure $\angle C$. What kind of triangle is this ?

14. Draw triangle ABC with $\angle C$ a right angle, AB = 6.2 cm and BC = 4.5 cm.

15. Draw a right triangle having hypotenuse of length 5.4 cm, and one of the acute angles of measure 60°.