Atomic Energy Education Society- Distance Learning Programme

Class IX – Mathematics

Chapter 11 – Constructions

Hand Out Module 2/2

Constructions of Triangles

So far, some basic constructions have been considered. Next, some constructions of triangles will be done by using SAS, SSS, ASA and RHS rules & the congruency of two triangles. Therefore, a triangle is unique if :

(i) two sides and the included angle is given,

(ii) three sides are given,

(iii) two angles and the included side is given and,

(iv) in a right triangle, hypotenuse and one side is given.

You have already learnt how to construct such triangles. Now, let us consider some more constructions of triangles. You may have noted that at least three parts of a triangle have to be given for constructing it but not all combinations of three parts are sufficient for the purpose. For example, if two sides and an angle (not the included angle) are given, then it is not always possible to construct such a triangle uniquely

Construction: To construct a triangle, given its base, a base angle and sum of other two sides.

Given the base BC, a base angle, say ∠B and the sum AB + AC of the other two sides of a triangle ABC, you are required to construct it.

Steps of Construction :

1. Draw the base BC and at the point B make an angle, say XBC equal to the given angle.

2. Cut a line segment BD equal to AB + AC from the ray BX.

3. Join DC and make an angle DCY equal to ∠BDC.

4. Let CY intersect BX at A (see Fig.)

Then, ABC is the required triangle.

Justification:

Base BC and ∠B are drawn as given. Next in triangle

ACD,

∠ACD = ∠ ADC (By construction)

Therefore, AC = AD and then

AB = BD – AD = BD – AC

AB + AC = BD

Alternative method :

Follow the first two steps as above. Then draw

perpendicular bisector PQ of CD to intersect BD at

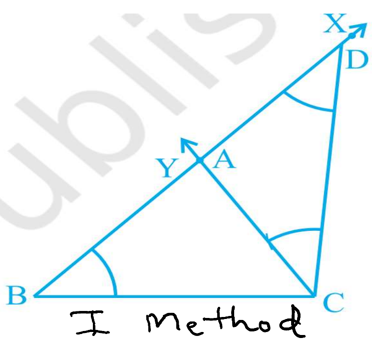
a point A (see Fig). Join AC. Then ABC is the

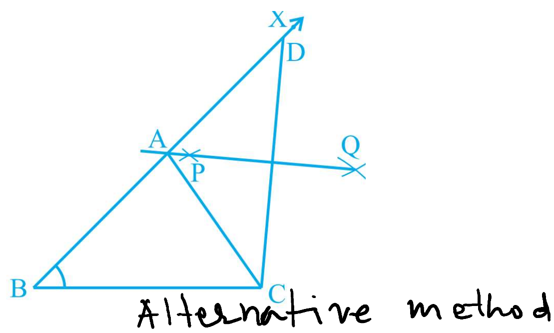
required triangle. Note that A lies on the perpendicular

bisector of CD, therefore AD = AC.

Remark : The construction of the triangle is not

possible if the sum AB + AC $\leq$ BC.





Construction 2: To construct a triangle given its base, a base angle and the difference of the other two sides.

Given the base BC, a base angle, say $\angle$B and the difference of other two sides AB – AC or AC – AB, you have to construct the triangle ABC. Clearly there are following two cases:

Case (i) : Let AB > AC that is AB – AC is given.

Steps of Construction :

1. Draw the base BC and at point B make an angle say XBC equal to the given angle.

2. Cut the line segment BD equal to AB – AC from ray BX.

3. Join DC and draw the perpendicular bisector, say PQ of DC.

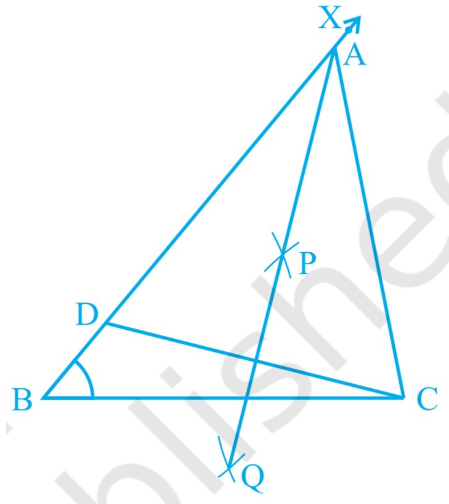
4. Let it intersect BX at a point A. Join AC (see Fig.).

Then ABC is the required triangle.

Justification:

Base BC and $\angle$B are drawn as given. The point A lies on the perpendicular bisector of DC. Therefore,

AD = AC So, BD = AB – AD = AB – AC.



Case (ii) : Let AB < AC that is AC – AB is given.

Steps of Construction :

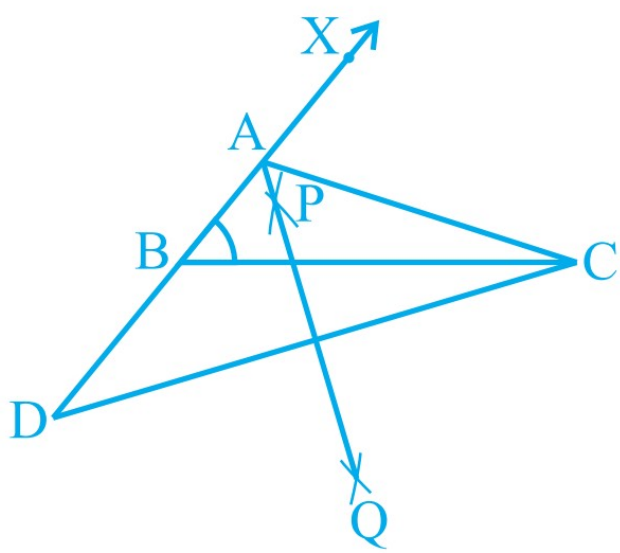
1. Same as in case (i).

2. Cut line segment BD equal to AC – AB from theline BX extended on opposite side of line segment BC.

3. Join DC and draw the perpendicular bisector, sayPQ of DC.

4. Let PQ intersect BX at A. Join AC (see Fig.)

Then, ABC is the required triangle.



Let us discuss some examples to understand the concepts .

Q1. Construct a triangle ABC in which BC = 7 cm, ∠B = 75° and AB + AC = 13 cm.

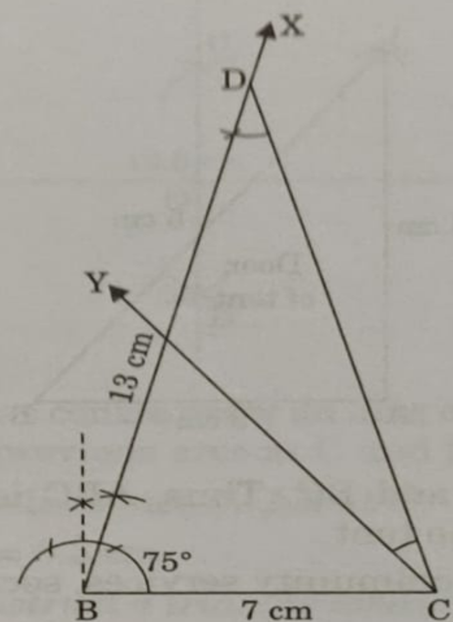
Sol. Given: In ΔABC, BC = 7 cm, ∠B = 75° and AB + AC = 13 cm.

Required: To construct the triangle ABC.

Steps of construction:

(1) Draw the base BC = 7 cm.

(2) At the point B make an angle XBC = 75°.



(3) Cut a line segment BD equal to AB + AC = 13 cm from the ray BX.

(4) Join DC.

(5) Make an ∠DCY = ∠BDC.

(6) Let CY intersect BX at A.

Then, ABC is the required triangle.

Q2 Construct a triangle PQR in which QR = 6 cm, ∠Q = 60° and PR – PQ = 2 cm.

Sol. **Given:** In ΔPQR, QR = 6 cm, ∠Q = 60° and PR – PQ = 2 cm.

Required: To construct the ΔPQR.

Steps of construction:

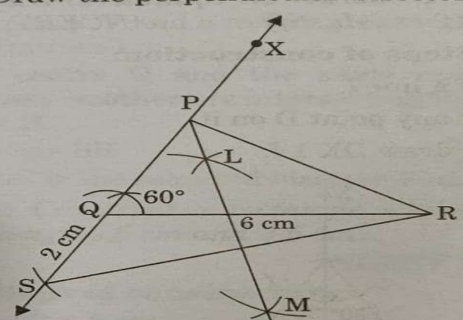
(1) Draw the base QR = 6 cm.

(2) At the point Q make an ∠XQR = 60°.

(3) Cut the line segment QS = PR – PQ (= 2 cm) from the line QX extended on opposite side of line segment QR.

(4) Join SR.

(5) Draw the perpendicular bisector LM of SR.



(6) Let LM intersect QX at P.

(7) Join PR.

Then, PQR is the required triangle.

Example 3 *Construct ΔABC such that BC = 6 cm, ∠B = 45° and AB – AC = 3 cm.*

Solution: Steps of construction:

(*i*) Draw BC = 6 cm and ∠CBX = 45°.

(*ii*) On BX cut BD = 2 cm.

(*iii*) Join CD.

(*iv*) Draw perpendicular bisector PQ of CD.

(*v*) PQ intersects BX at A.

(*vi*) Join AC.

ΔABC is the required triangle.