12 ▶ Practical Geometry

You have already learnt how to draw a line segment of given length, perpendicular to a given line segment, angles, circle etc., in your earlier classes. Here you will learn how to draw parallel lines and triangles.

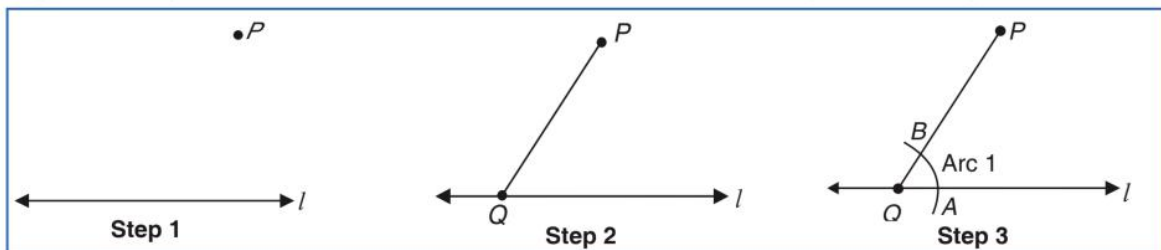## Construction of a line parallel to a given line through a point not on the line

Note that

Construction has to be done using ruler and compasses only.

Step 1 : Take a line l and a point P outside l.

Step 2 : Take any point Q on the line l and join Q to P.

Step 3 : With Q as centre and a convenient radius, draw an arc 1 cutting l at A and PQ at B.


Step 4 : Now, with P as centre and the same radius as in step 3, draw an arc 2 cutting PQ at C.

Step 5 : Place the steel point of the compasses at A and adjust the opening so that the pencil point is at B.

Step 6 : With the same opening as in step 5 and with C as centre, draw an arc cutting the arc 2 at D.

Step 7 : Draw a line through P and D.

Then line m is the required line parallel to line l and passing through the given point P.
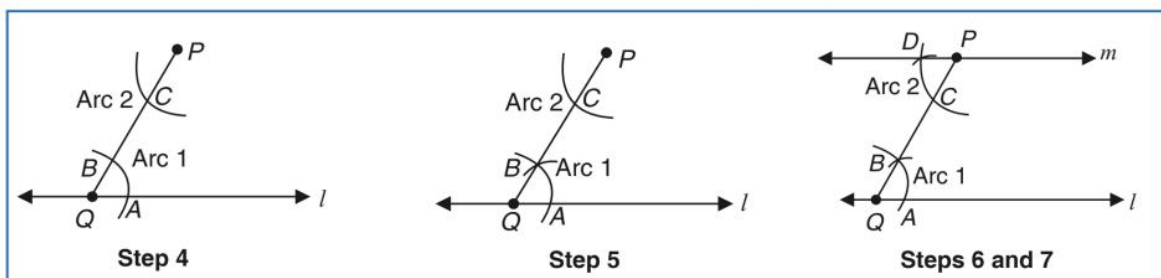

EXERCISE 12 (A)

1. Draw a line segment $AB = 6.8$ cm. Take any point P outside it. Using ruler and compasses draw a line through P parallel to AB.

2. Draw any $\triangle ABC$. Through A, draw the line parallel to BC.

3. Draw a line segment of length 6.3 cm. Draw another line parallel to it at a distance 3 cm from it.

   [Hint. Suppose AB is the line segment drawn by you. Take any point P on AB. Through P, draw a line segment PL, perpendicular to the line AB such that $PL = 3$ cm. Now, draw the line through L, parallel to AB.]

4. Draw any triangle ABC and let D be the mid-point of AB. Using ruler and compasses draw the line through D parallel to BC to meet AC in E. Measure DE, AE and EC. Do you find that $AE = EC$ and $DE = \dfrac{1}{2} BC$?
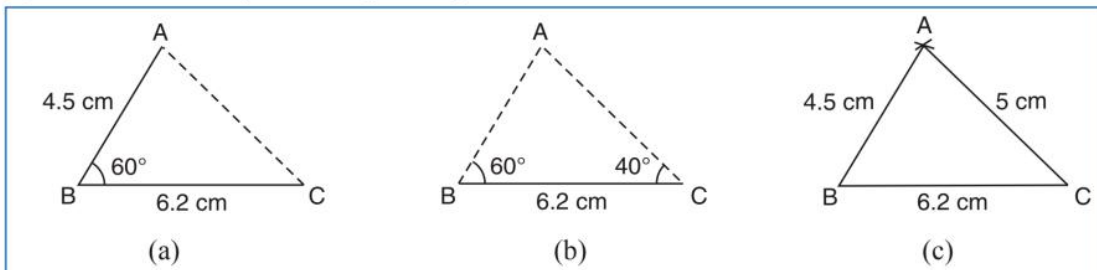

CONSTRUCTION OF TRIANGLES

Elements of a Triangle

Study $\triangle ABC$. It has 3 sides and 3 angles. We say that it has a total of 6 elements *viz.* three angles and three sides.

A triangle can be constructed if three of its six elements are given. However, a triangle is only fixed (*i.e.*, it has a definite size) if any of these three conditions are fulfilled :
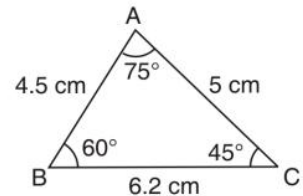
  (a) *Two sides and the included angle are given.*

  (b) *One side and two angles are given.*

  (c) *The three sides of the triangle are given.*

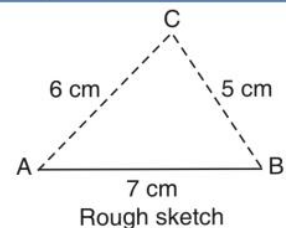   (a)   (b)   (c)

Note that

A triangle is not fixed if

(a) 3 angles are given, or   (b) two sides and a non-included angle are given.

---

1. Constructing triangles having been given the lengths of the three sides (SSS Construction)
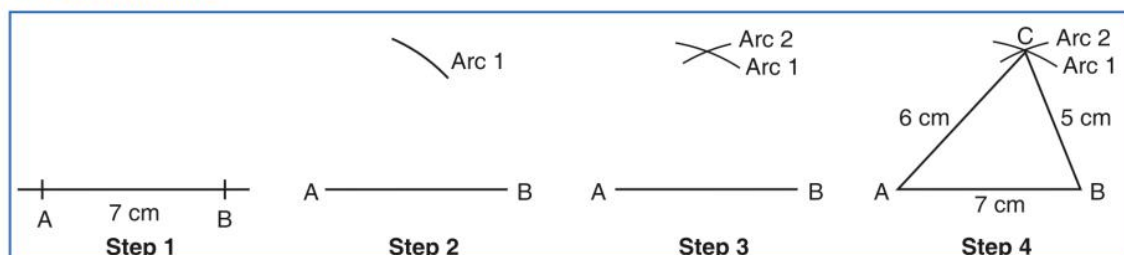
Ex. 1. Construct a triangle ABC with $AB = 7$ cm, $BC = 5$ cm and $AC = 6$ cm. (Three sides).

  Sol. First draw a rough sketch of the triangle and put in all the given measurements.

Rough sketch

Practical Geometry

Steps of Construction:

Step 1. Draw a line and mark two points *A* and *B* on it such that *AB* = 7 cm.

Step 2. Open your compasses to a length of 6 cm on the ruler and with *A* as centre draw an arc 1.

Step 3. Now, open your compasses to a length 5 cm on the ruler and with *B* as centre draw an arc 2 to cut the first one.

Step 4. Label as *C* the point where the two arcs intersect. Join *A* to *C* and *B* to *C*.

Then the triangle *ABC* so obtained is the required triangle.

EXERCISE 12 (B)

Construct the following triangles :

1. Δ *ABC* in which *AB* = 7 cm, *AC* = 6 cm, *BC* = 9 cm. Measure ∠*A*, ∠*B* and ∠*C*.

2. Δ *PQR* in which *PQ* = 5.5 cm, *QR* = 6.5 cm, *RP* = 5 cm.

3. Δ *XYZ* in which *XZ* = 8.4 cm, *XY* = 6.8 cm, *YZ* = 7.5 cm.

4. Δ *DEF* in which *DE* = 8 cm, *DF* = 7.2 cm, *EF* = 6.3 cm.

5. Δ *LMN* in which *LN* = 7 cm, *NM* = 5.5 cm, *LM* = 6.4 cm.

2. Constructing triangles having been given two sides and the angle between the two sides (Included angle) (SAS construction)
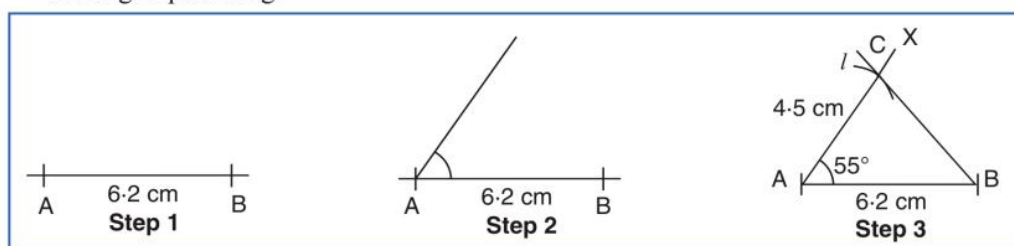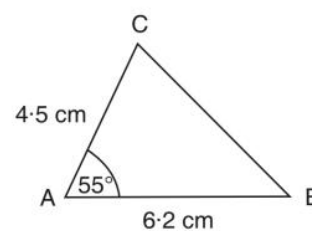
Ex. 2. Construct a triangle with *AB* = 6.2 cm, *AC* = 4.5 cm, ∠*BAC* = 55°.

Sol. First draw a rough sketch of Δ*ABC* and put in all the measurements that are given.

Steps of Construction :

Step 1. Draw one of the sides whose length you know. We draw
AB = 6.2 cm

Step 2. Using your protractor draw an angle of 55° at *A*. Make the arm of the angle quite long.

Step 3. Use your compasses to measure the length of *AC*, *i.e.*, 4.5 cm on your ruler and with the point of your compasses at *A*, draw an arc 1 to cut the arm of the angle. This is the point *C*. Join *C* and *B*.

The triangle *ABC* so obtained is the required triangle.

EXERCISE 12 (C)

Construct the following triangles and measure the third side :

1. Δ *ABC* in which *AB* = 6 cm, *AC* = 8 cm, ∠*BAC* = 50°.
2. Δ *PQR* in which *PQ* = 5.5 cm, *QR* = 6.5 cm, ∠*Q* = 40°.
3. Δ *XYZ* in which ∠*XYZ* = 70°, *XY* = 7.2 cm, *YZ* = 8.2 cm.
4. Δ *DEF* in which *DE* = 6.8 cm, ∠*E* = 48°, *EF* = 7.9 cm.
5. Δ *LMN* in which ∠*N* = 73°, *LN* = 5.7 cm, *MN* = 6.8 cm.

---

3. Constructing triangles having been given one side and two angles (ASA construction)

Ex. 3. **Construct a ΔABC given *AB* = 7 cm, ∠*A* = 35°, ∠*B* = 40°. Calculate the third angle.**

Sol. First make a rough sketch of Δ *ABC* and put all the given measurements in your sketch.

Steps of Construction :

Step 1. Draw the line segment *AB* making it 7 cm long. Label its ends.

Step 1   **Step 2**
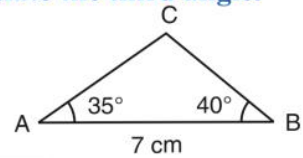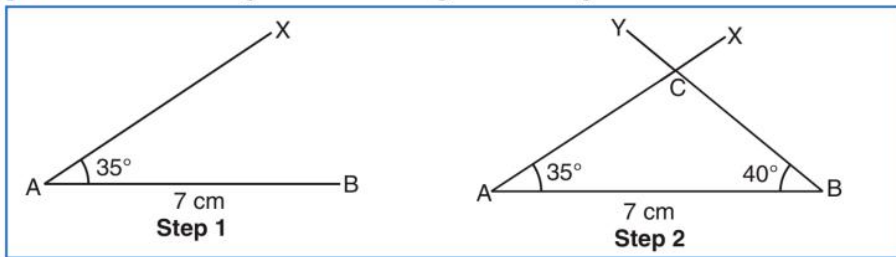
Step 2. Using your protractor, draw an angle *BAX* of 35° at *A*.

Step 3. Use your protractor to draw the second angle *ABY* equal to 40° at the point *B*.

Let *AX* and *BY* meet at *C*.

Then ΔABC is the required triangle.

Calculation: ∠*C* + ∠*A* + ∠*B* = 180°   (*angle sum of a* Δ)
or   ∠*C* + 35° + 40° = 180°
⇒   ∠*C* + 75° = 180°
⇒   ∠*C* = 180° – 75° = **105°.**

EXERCISE 12 (D)

Construct the following triangles; calculate the third angle in each triangle and measure this angle to check the accuracy of your construction.

1. ΔABC in which *AB* = 7.4 cm, ∠*BAC* = 47°, ∠*ABC* = 68°.
2. ΔPQR in which *PQ* = 6 cm, ∠*Q* = 50°, ∠*P* = 60°.
3. ΔXYZ in which *YZ* = 5.8 cm, ∠*Y* = 100°, ∠*Z* = 40°. Draw the perpendicular from *Y* to *XZ*.
4. ΔBCD in which ∠*B* = 105°, *BC* = 8.2 cm, ∠*C* = 45°.
5. Draw ΔFGH in which ∠*G* = 80°, ∠*H* = 55° and *GH* = 5.6 cm.

   Draw the perpendicular bisector of side *GH*.

4. Constructing a Right Triangle (RHS)

To construct a right triangle when its hypotenuse and one side are given.

Ex. 4. Construct a right △ABC, right angled at B, in which AC = 6 cm and AB = 4.5 cm.

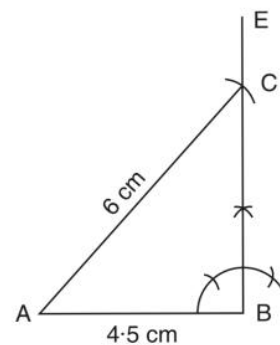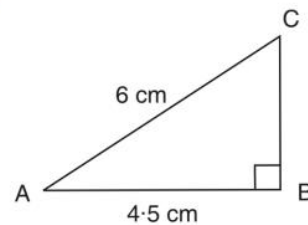**Sol.** First draw a rough sketch of △ABC showing all measurements.

Steps of Construction :

Step 1. Draw a line segment AB = 4.5 cm and at B draw BE ⊥ AB.

Step 2. With A as centre and radius = 6 cm draw an arc to cut BE at C.

Step 3. Join A to C.

Then right angled △ABC is the required triangle.

EXERCISE 12 (E)

Construct a right triangle :

1. △ABC right angled at B, in which AC = 10 cm, AB = 8 cm.

2. △PQR right angled at R, in which hypotenuse PQ = 10 cm, side PR = 7 cm.

3. △LMN in which MN = 5.9 cm, LM = 8.4 cm and ∠N = 90°.

4. △RST right angled at T in which ST = 6.2 cm and SR = 8.3 cm.