EXERCISE – 4.1

1. Construct an angle of 90º at the initial point of a given ray and justify the construction.
2. Construct an angle of 45º at the initial point of a given ray and justify the construction.
3. Construct the angles of the following measurements.
   (i) 30º (ii) 22½°
   (iii) 15º
4. Construct the following angles and verify by measuring them by using a protractor:
   (i) 75º (ii) 105º
   (iii) 135º
5. Construct an equilateral triangle when its sides are given and justify the construction.

TEST YOURSELF – CST 1

1. Construct the following angles (using ruler and compasses only.)
   (i) 22.5º (ii) 67.5º
   (iii) 150º (iv) 37.5º
2. Construct ∠EFG = 60º and bisect it. Bisect one of the parts to get an angle of 15º.
3. Construct an equilateral triangle whose one side is 5.3 cm.
4. Construct an angle of 120º and bisect it.
5. Using ruler and compass, construct the following angles:
   45º, 75º, 105º, 150º, 22½º, 15º.
6. Construct the following angles and verify it by measuring by using a protractor:
   135º, 60º, 30º, 120º, 165º.
7. Draw a line AB = 6.8 cm, construct ∠CAB = 60º and ∠ABC = 45º. From C, draw an altitude to AB.
8. Draw a line segment of 8 cm and draw its perpendicular bisector.

EXERCISE – 4.2

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

2. Construct a triangle ABC in which BC = 8 cm, ∠B = 45º and AB – AC = 3.5 cm.
3. Construct a triangle PQR in which QR = 6 cm, ∠Q = 60º and PR – PQ = 2 cm.
4. Construct a triangle XYZ in which ∠Y = 30º, ∠Z = 90º and XY + YZ + ZX = 11 cm.
5. Construct a right triangle whose base is 12 cm and sum of its hypotenuse and other side is 18 cm.

TEST YOURSELF – CST 2

1. Construct a triangle ABC where BC = 5 cm, AC – BC = 2 cm and ∠B = 30º.
2. Construct a triangle ABC whose perimeter is 12 cm and ∠C = 45º.
3. Construct a right triangle whose one side is 3.5 cm and sum of the other side and hypotenuse is 5.5 cm.
4. Construct an equilateral triangle whose side is 6 cm.
5. Construct triangle ABC with base BC = 5 cm, ∠ABC = 60º and AB + AC = 7.8 cm.
6. Construct a triangle XYZ with ∠Y = 45º, YZ = 6 cm and XY – XZ = 4 cm.
7. Construct a triangle PQR in which ∠Q = 60º, QR = 7 cm and PQ – PR = 5 cm.
8. Construct a triangle ABC such that ∠B = 30º, ∠C = 60º and AB + BC + AC = 15 cm.
9. Construct an equilateral triangle, if one of its altitude is 3.2 cm.
10. Construct a triangle ABC with perimeter 10 cm and each base angle is of 45º.

ANSWERS

NCERT Exercises and Assignments

Exercise – 4.1

1. Steps of Construction

1. Draw a ray OA.
2. With its initial point O as centre and any radius, draw an arc CDE, cutting OA at C.
3. With centre C and same radius (as in step 2), draw an arc cutting the arc CDE at D.
4. With D as centre and the same radius, draw an arc cutting the arc CDE at E.
5. With D and E as centres, and any convenient radius $\left(\text{more than } \frac{1}{2}\text{DE}\right)$, draw two arcs intersecting at P.
6. Join OP. Then $\angle AOP = 90^\circ$.

Justification

By construction, OC = CD = OD

$\therefore$ ΔOCD is an equilateral triangle. So, $\angle COD = 60^\circ$.

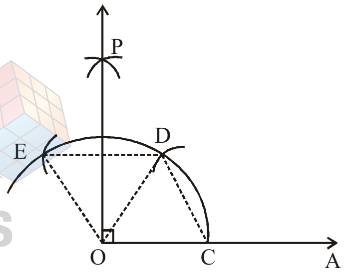
Again, OD = DE = EO

$\therefore$ ΔODE is also an equilateral triangle.

So, $\angle DOE = 60^\circ$.

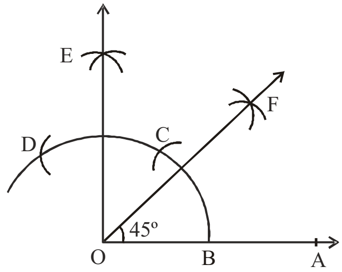
Since OP bisects $\angle DOE$, so $\angle POD = 30^\circ$.

Now, $\angle AOP = \angle COD + \angle DOP = 60^\circ + 30^\circ = 90^\circ$



2. Steps of Construction

1. Draw a ray OA.
2. With O as centre and any suitable radius draw an arc cutting OA at B.
3. With B as centre and same radius cut the previous drawn arc at C and then with C as centre and same radius cut the arc at D.
4. With C and D as centres and radius more than half of CD draw two arcs intersecting at E.
5. Join OE. Then $\angle AOE = 90^\circ$.
6. Draw the bisector OF of $\angle AOE$. Then $\angle AOF = 45^\circ$.

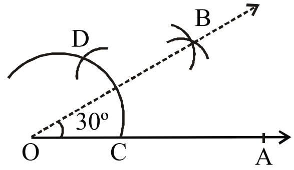


Justification

By construction, $\angle AOE = 90^\circ$ and OF is the bisector of $\angle AOE$,

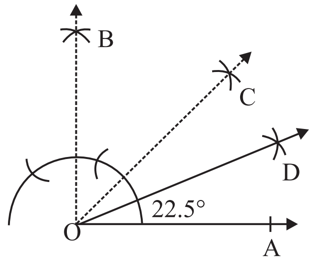
$\therefore \quad \angle AOF = \frac{1}{2}\angle AOE = \frac{1}{2} \times 90^\circ = 45^\circ.$

3. (i) **Steps of Construction**



1. Draw a ray OA.
2. With its initial point O as centre and any radius, draw an arc, cutting OA at C.
3. With centre C and same radius (as in Step 2). Draw an arc cutting the arc of Step 2 in D.
4. With C and D as centres, and any convenient radius (more than half of CD), draw two arcs intersecting at B.
5. Join OB. Then $\angle AOB = 30^\circ$.

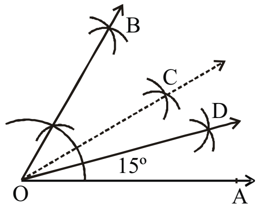
(ii) **Steps of Construction**



1. Draw an $\angle AOB = 90^\circ$.
2. Draw the bisector OC of $\angle AOB$, then $\angle AOC = 45^\circ$.
3. Bisect $\angle AOC$, such that $\angle AOD = \angle COD = 22.5^\circ$

   Thus, $\angle AOD = 22.5^\circ$.

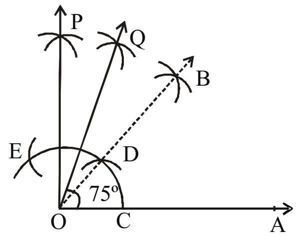
(iii) **Steps of Construction**



1. Construct an $\angle AOB = 60^\circ$.
2. Bisect $\angle AOB$ so that $\angle AOC = \angle BOC = 30^\circ$
3. Bisect $\angle AOC$ so that $\angle AOD = \angle COD = 15^\circ$

   Thus, $\angle AOD = 15^\circ$

4. (i) **Steps of Construction**



1. Draw a ray OA.
2. Construct $\angle AOB = 60^\circ$.
3. Construct $\angle AOP = 90^\circ$.
4. Bisect $\angle BOP$ so that

$$\angle BOQ = \frac{1}{2}\angle BOP = \frac{1}{2}(\angle AOP - \angle AOB)$$

$$= \frac{1}{2}(90^\circ - 60^\circ) = \frac{1}{2} \times 30^\circ = 15^\circ$$

So, we obtain,

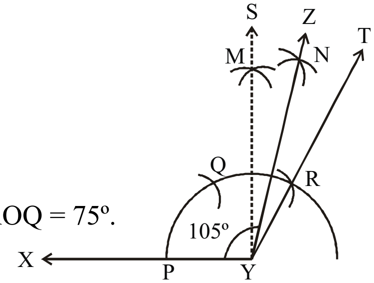
$$\angle AOQ = \angle AOP + \angle BOQ$$

$$= 60^\circ + 15^\circ = 75^\circ$$

Verification

On measuring $\angle AOQ$, with the protractor, we find $\angle AOQ = 75^\circ$.

(ii) **Steps of Construction**

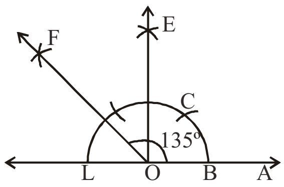


1. Draw a line segment XY.

2. Construct ∠XYT = 120º and ∠XYS = 90º, so that
   ∠SYT = ∠XYT – ∠XYS
   = 120º – 90º
   = 30º
3. Bisect angle SYT by drawing its bisector YZ.
   Then ∠XYZ is the required angle of 105º.

(iii) Steps of Construction

1. Draw ∠AOE = 90º
   Then, ∠LOE = 90º
2. Draw the bisector OF of ∠LOE.
   Then, ∠AOF = 135º.

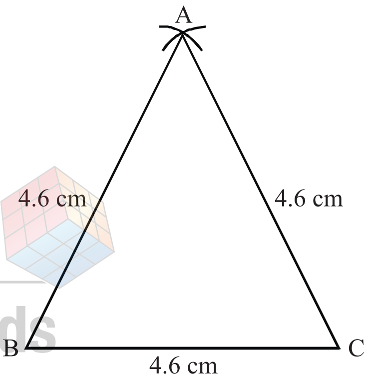


5. Let us draw an equilateral triangle of side 4.6 cm (say).

Steps of Construction

1. Draw BC = 4.6 cm.
2. With B and C as centres and radii equal to BC = 4.6 cm, draw two arcs on the same side of BC, intersecting each other at A.
3. Join AB and AC.

Then, ABC is the required equilateral triangle.



Justification

Since by construction :

AB = BC = CA = 4.6 cm.

∴ ΔABC is an equilateral triangle.

Exercise – 4.2

1. Given: Base BC = 7 cm, ∠B = 75º and sum of two sides, AB + BC = 13 cm.

Required: To construct ΔABC.

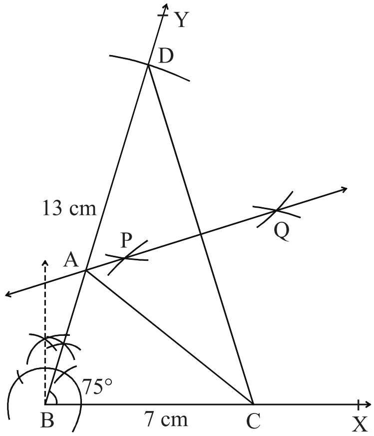
Steps of Construction

1. Draw a ray BX and cut off a line segment BC = 7 cm from it.
2. At B, construct ∠YBX = 75º.
3. With B as centre and radius as 13 cm (AB + BC = 13 cm) draw an arc to meet BY at D.
4. Join CD.
5. Draw a perpendicular bisector PQ of

CD intersecting BD at A.

6. Join AC.

Then ABC is the required triangle.



Justification: Since A lies on the perpendicular bisector of CD,

$\therefore$ AC = AD and then

AB = BD – AD

$\Rightarrow$ AB = BD – AC

$\Rightarrow$ AB + AC = BD = 13 cm.

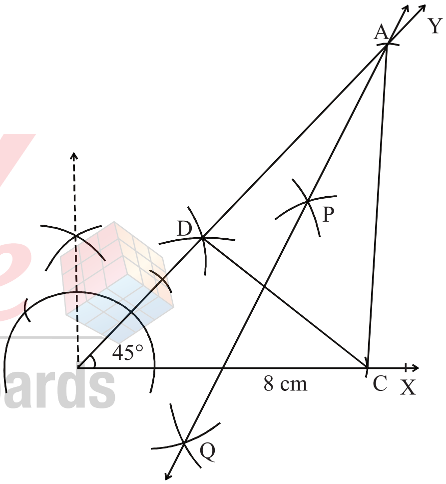
2. **Given:** Base BC = 8 cm, one base angle, $\angle$B = 45º and difference of two sides, AB – AC = 3.5 cm.

Required: To construct ΔABC.

Steps of Construction

1. Draw a ray BX and cut off a line segment BC = 8 cm from it.
2. Cut $\angle$YBC = 45º.
3. Cut off a line segment BD = 3.5 cm (AB – AC = 3.5 cm) from BY.
4. Join CD.
5. Draw a perpendicular bisector PQ of CD intersecting BY at a point A.
6. Join AC.

   Then, ABC is the required triangle.



Justification: Since the point A lies on perpendicular bisector of CD.

$\therefore$ AD = AC

Now, BD = AB – AD

$\Rightarrow$ BD = AB – AC

$\Rightarrow$ AB – AC = BD = 3.5 cm

3. **Given:** Base QR = 6 cm, one base angle $\angle$Q = 60º and difference of two sides PR – PQ = 2 cm.

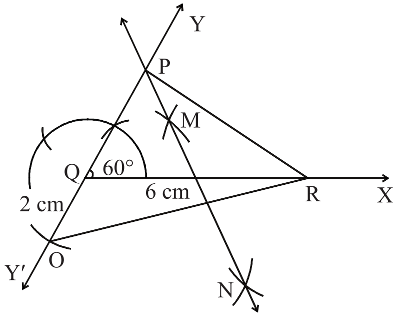
Required: To construct ΔPQR.

Steps of Construction

1. Draw a ray QX and cut off a line segment QR = 6 cm from it.
2. Construct a ray QY making an angle of 60º with QR and produce YQ to form a line YQY′.
3. Cut off a line segment QO = 2 cm (PR – PQ = 2 cm) from QY′.

4. Join OR.
5. Draw perpendicular bisector MN of OR.
6. Join PR.

Then, PQR is the required triangle.



Justification: Since the point P lies on perpendicular bisector of OR.

$\therefore \quad PO = PR$

$\Rightarrow \quad PQ + QO = PR$

$\Rightarrow \quad QO = PR - PQ$

$\Rightarrow \quad PR - PQ = 2$ cm

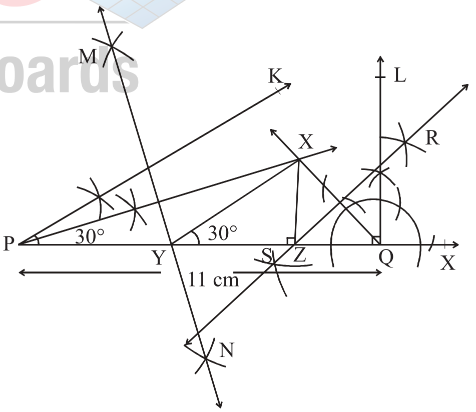
4. Given: Base angles $\angle Y = 30^o$ and $\angle Z = 90^o$, Sum of three sides, XY + YZ + ZX = 11 cm.

Required: To construct ΔXYZ

Steps of Construction

1. Draw a line segment PQ = 11 cm. ($\because$ XY + YZ + ZX = 11 cm)
2. Draw KPQ = 30º, ($\angle Y = 30^o$) and $\angle$ LQP = 90º ($\angle Z = 90^o$).
3. Bisect $\angle$KPS and $\angle$LQP. Let the bisectors intersect at point X.
4. Draw perpendicular bisectors MN of PX and RS of XQ respectively.
5. Let MN intersect PQ at Y and RS intersect PQ at Z respectively.
6. Join XY and XZ.

Then, XYZ is the required triangle.



Justification: We observe that Y lies on the perpendicular bisector MN of PX and so

PY = XY and similarly, QZ = XZ This gives

XY+ YZ + ZX = PY + YZ + QZ = PQ = 11 cm

again $\angle YXP = \angle XPY$ (as in ΔXPY, XY = PY)

$\therefore \quad \angle XYZ = \angle YXP + \angle XPY$

$= 2\angle XPY$

$= \angle KPQ$

$\Rightarrow \quad \angle XYZ = 30^o$

Similarly, $\angle XZY = \angle LQP$

$\angle XZY = 90^o$

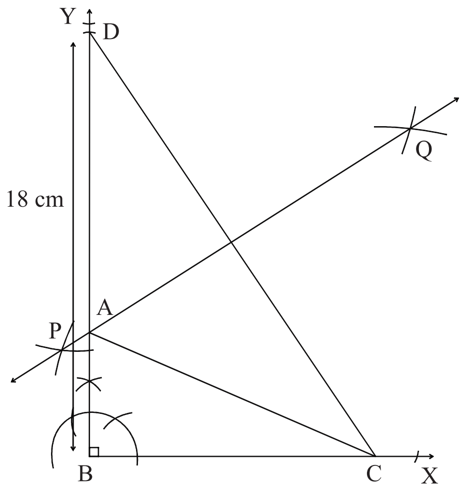
5. Given: Let the triangle to be constructed is ΔABC with base BC = 12 cm, the sum of its other side and hypotenuse, i.e. AB + AC = 18 cm and $\angle ABC = 90^o$.

Required: To construct ΔABC.

Steps of Construction

1. Draw a ray BX and cut off a line segment BC = 12 cm from it.

2. Construct $\angle XBY = 90^\circ$
3. From BY cut off a line segment BD = 18 cm.
4. Join CD.
5. Draw the perpendicular bisector of CD intersecting BD at A.
6. Join AC.



Then, ABC is the required right triangle.

Justification: Since the point A lies on the perpendicular bisector of CD,

$\therefore$ AC = AD and then

AB = BD – AD

$\Rightarrow$ AB = BD – AC

$\Rightarrow$ AB + AC = BD = 18 cm

i.e., sum of other side and hypotenuse is 18 cm.