GRADE -9

LESSON – 11 [CONSTRUCTIONS]

Objective Type Questions

I. Multiple choice questions

1. With the help of a ruler and a compass it is not possible to construct an angle of :

   a) 37.5^0 b) 40^0 c) 22.5^0 d) 67.5^0

   Sol. As $40^0 = \frac{1}{2} \times 80^0$ and 80^0 cannot be constructed with the help of a ruler and a compass.

   $\therefore Correct\ option\ is\ (b)$

2. The construction of a triangle ABC in which AB = 4cm. $\angle A = 45^0$ is not possible when difference of BC and AC is equal to :

   Sol. a) $3.5cm$ b) $4.5cm$ c) $3\ cm$ d) $2.5cm$

   $\therefore Correct\ option\ is\ (b)$

3. Is it possible to construct the angle of 37.5^0 with the help of ruler and compass?

   Sol. Yes it is possible because by constructing 75^0 angle and bisecting it, we can obtain 37.5^0 angle.

4. Do you agree with the statement, ' ΔXYZ can be constructed, if $\angle Y = 90^0$, $\angle Z = 75^0$ and XY + YZ + ZX = $11.5^0 cm'$

   Sol: yes, because two base angles and perimeter is given and

   $\angle Y + \angle Z = 90^0 + 75^0 = 165^0 < 180^0$

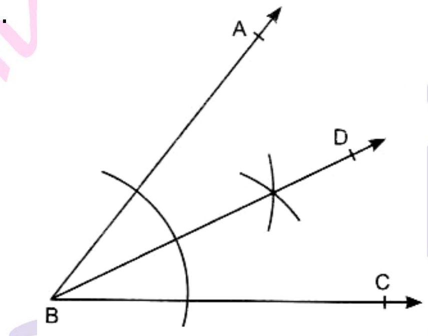
5. Can you construct a ΔABC, if AB = 6.5cm, AB = 60^0 and BC + AC = 11cm

   Sol : Yes, with the given dimensions, we can construct to ΔABC because BC + AC > AB

I. Short answer type question

1. Using protractor, draw an angle of 52^0 can you divide this angle into two equal parts. Show

Sol. Yes, we can divide ABC = 52^0 into two equal parts by bisecting it as shown in the figure.



2. Construct a triangle whose sides are in the ration 1 : 3 : 5 and whose perimeter is 18cm **[CBSE 2016]**

Sol. Given ratio of sides of a triangle = 1 : 3 : 5

Let the length of sides of a triangle be x, 3x and 5x respectively

Perimeter of triangle = 18cm

$\Rightarrow \quad x + 3x + 5x = 18$

$\Rightarrow \quad 9x = 18$

$\Rightarrow \quad x = 2cm$

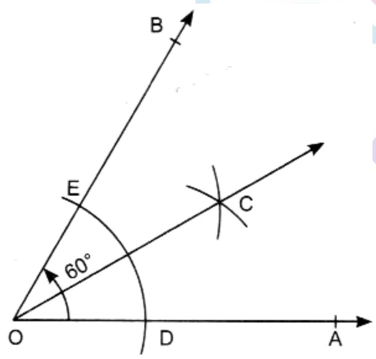
$\therefore$ Sides of triangle are 2cm, 6cm and 10cm

Here, we find that 2cm + 6cm <10cm

So, construction of given triangle would not be possible

3. Draw an angle of an equilateral triangle, using protractor. Bisect it using compass **[CBSE2016]**

Sol.



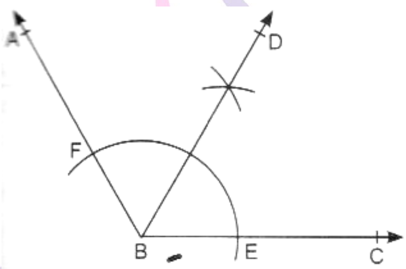
Each angle of an equilateral triangle is 60^0

$\therefore$ *According to qestions* $\angle AOB = 60^0$

$\Rightarrow$ OC is the bisector of $\angle AOB$.

4. Draw any obtuse angle. Bisect it using compass. **[CBSE 2016]**

Draw the bisector BD of $\angle ABC$ as shown in the figure.



5. Is it possible to construct a triangle of given sides as 44mm, 9.5cm and 46mm? Justify your answer.

Sol. Let AB = 44mm = 4.4cm

BC = 9.5cm

AC = 46mm = 4.6cm

Here AB + AC = 4.4cm + 4.6cm = 9cm

$\Rightarrow$ AB + AC <BC

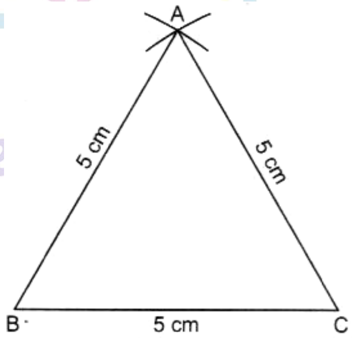
$\therefore$ No such triangle would be constructed because sum of two sides of a triangle is never less than the third side.

6. Construct an equilateral triangle, given its one side is 5cm **[CBSE 2012]**

Sol. We know that all sides of an equilateral triangle are equal

$\therefore$ In ABC, AB = BC = CA = 5cm

Steps of construction:



(i) Draw a line segment, BC = 5cm

(ii) Taking B and C as centres and radius equal to 5cm, draw arcs which intersect each other at A

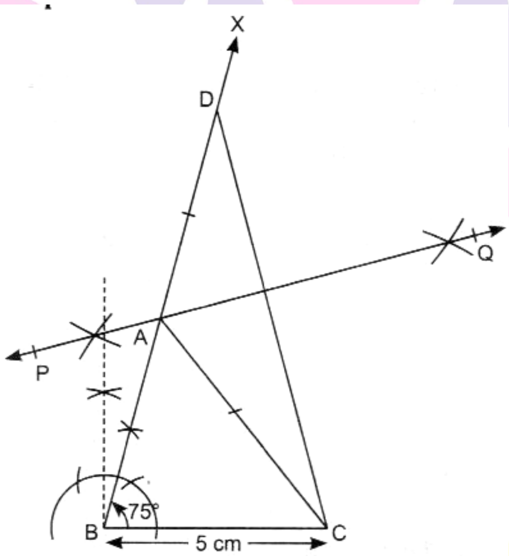
(iii) Join AB and AC.

Thus ΔABC is the required equilateral triangle.

II. Short answer type questions

7. Construct a triangle ABC in which BC = 5cm, ∠B = 75^0 and AB + AC = 9cm.
[CBSE2012]

Sol. Steps of construction:



(i) Draw a line segment, BC = 5cm, At point B, construct as ∠XBC = 75^0

(ii) Cut a line segment BD = AB + AC = 9cm from the ray BX

(iii) Join CD

(iv) Draw the perpendicular bisector PQ of CD which intersects BD at A

(v) Join AC.

(vi) Then, ΔABC is the required triangle. This is because point A lies on the perpendicular bisector of CD

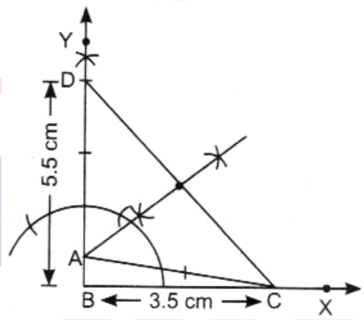
$\therefore$ AD = AC

$\Rightarrow$ BD = AB + AD = AB + AC

8. Construct a right triangle in which one side is 3.5cm and sum of the other side and hypotenuse is 5.5cm

Sol. We are given one side = 3.5cm and sum of other side and hypotenuse = 5.5cm

Steps of Construction:



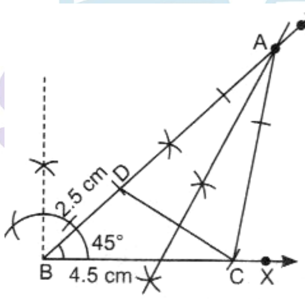
1. Draw a ray BX and cut off a line segment BC = 3.5cm from it.
2. Construct $\angle XBY = 90^0$
3. From BY, cut off a line segment BD = 5.5cm
4. Join CD
5. Draw the perpendicular bisector of CD intersecting BD at a point A
6. Join AC

So ΔABC is the required triangle

9. Construct a triangle ABC in which BC = 4.5cm, $\angle B = 45^0$ and AB – AC = 2.5cm

Sol. We are given BC = 4.5cm $\angle B = 45^0$ and AB – AC = 2.5cm

Steps of Construction:



1. Draw a ray BX and cut off a line segment BC = 4.5cm from it

2. Construct $\angle XBY = 45^0$

3. Cut off a line segment BD = 2.5cm from BY.

4. Join CD

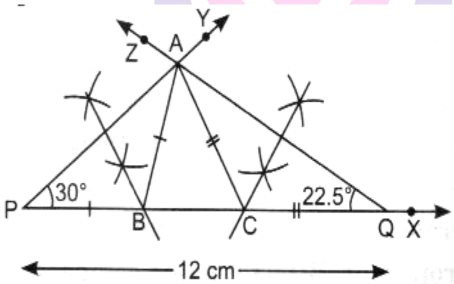
5. Draw the perpendicular bisector of CD cutting BY at a point A

6. Join AC

So ΔABC is the required triangle

10. Construct a triangle ABC whose perimeter is 12cm, $\angle B = 60^0$ and $\angle C = 45^0$

Steps of Construction:



1. Draw a ray PX and cut off a line segment PQ = 12cm from it

2. At P, Construct $\angle YPQ = 30^0\left(= \frac{1}{2} \times 60^0\right)$

3. At Q, construct $\angle ZQP = 22.5^0\left(= \frac{1}{2} \times 45^0\right)$

4. Let the ray PY and QZ intersect at A

5. Draw the perpendicular bisector of APintersecting PQ at a point B.

6. Draw the perpendicular bisector of AQ intersecting PQ at a point C.

7. Join AB and AC

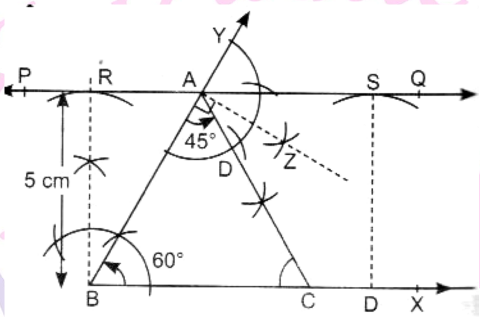
So ΔABC is the required triangle

11. **Construct a triangle ABC in which $\angle B = 60^0 \angle C = 75^0$ and perpendicular from the vertex A to the base BC is 5cm.**

Sol. ΔABC ,$\angle A + \angle B + \angle C = 180^0$ [Angle sum property of a triangle]

$\Rightarrow \angle A + 60^0 + 75^0 = 180^0 \Rightarrow \angle A + 180^0 - 135^0 = 45^0$

Step of construction



(i) Draw a line BX

(ii) At point B, construct B = 60^0 i.e., $\angle XBY = 60^0$

(iii) Draw tow arcs R and S with radius equal to 5cm from point B and from any other point D on BX as shown.

(iv) Draw a ray PQ touches the R and S in such a way that, RS || BX and distance between them is BR = DS = 5cm

(v) Let BY intersect PQ at A

(vi) At point A, construct $\angle ZAB = 90^0$

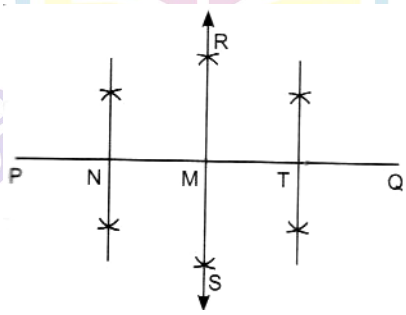
(vii) Bisect $\angle ZAB$ to get $\angle BAC = 45^0$. Bisector line intersects BX at point C

(viii) Join AC, then ΔABC is the required triangle.

12. **Draw a line segment PQ = 8.4cm. Divide it into four equal parts using a ruler and a compass.**

[CBSE 2014, 2015, HOTS]

Sol. Steps of construction



(i) Draw a line segment PQ = 8.4cm

(ii) Taking P and Q as centres and radius more than $\frac{1}{2}$PQ draw arcs above and below the line segment PQ intersecting at R and S respectively as shown.

(iii) Join RS. Let it intersect PQ at M. The ray RS divides the line segment PQ into two equal parts PM and QM

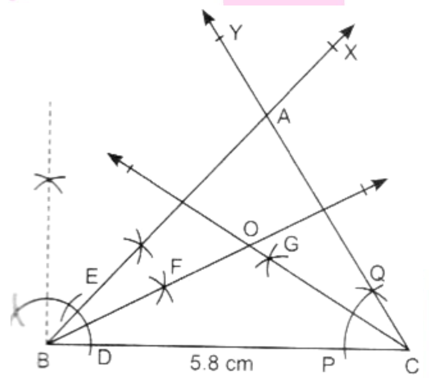
(iv) In a similar way, draw perpendicular bisectors of PM and QM which divides each PM and QM into two equal parts again as shown.

So, the four equal parts of line segment PQ are PN = NM = MT = TQ, On measuring them. They all are equal to 2.1cm

I. Long answer type questions

1. Construct a triangle ABC in which BC = 5.8cm ∠B = 45^0 and ∠C=60^0. Construct angle bisectors of ∠B and ∠C and intersect them at point O, Measure ∠BOC [CBSE2016]

Sol. Steps of construction:



(i) Draw a line segment BC = 5.8cm

(ii) At B and C, draw ∠XBC = 45^{0}and ∠YCB = 60^0

(iii) The rays XB and YC intersect at A, Therefore, ΔABC is the required triangle

(iv) Taking B as centre, and with some radius, draw arcs intersecting XB and BC at E and D respectively

(v) Taking D and E as centres with radius greater than $\frac{1}{2}$DE draw arcs intersecting each other at F.

(vi) Draw the ray BF. It is the angle bisector of $\angle B$

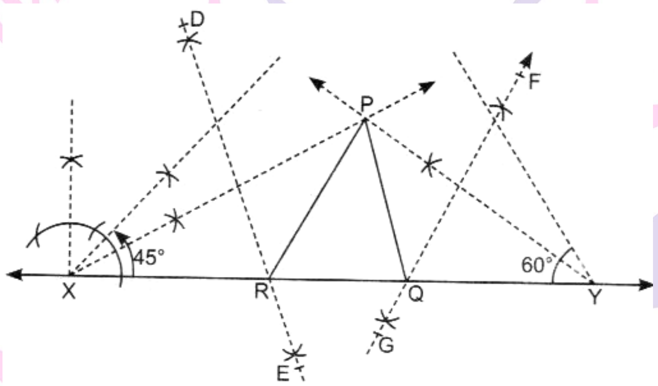
(vii) Similarly, construct angle bisector CG of $\angle C$

(viii) Let BF and CG intersect each other at O.

(ix) On measuring $\angle BOC$, we get BOC = 127^0.

2. Construct a triangle PQR in which $\angle R = 45^0$ $\angle Q = 60^0$ and PQ + QR + RP = 11cm

Sol. Steps of construction:



(i) Draw a line segment XY = PQ + QR + RP = 11cm

(ii) At X, construct an angle of 45^0 and Y, construct an angle of 60^0

(iii) Bisect these angles. Let the bisectors of $\angle X$ and $\angle Y$ intersect each other at a point P

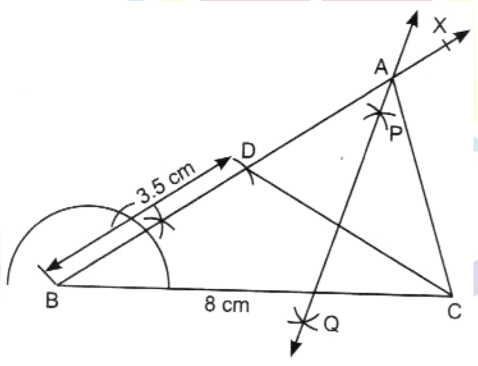
(iv) Draw perpendicular bisector DE, of PX to intersect XY at R Now, draw perpendicular bisector FG of PY to intersect XY at Q.

(v) Join PQ and PR as shown in the figure. Then, ΔPQR is the required triangle.

3. Construct a triangle ABC in which BC=8cm, $\angle B = 30^0$ and AB – AC = 3.5cm

Sol. Here AB >AC, i.e., AB – AC is given

Steps of construction:



(i) Draw the base BC = 8cm and at point B, make an angle $\angle XBC = 30^0$

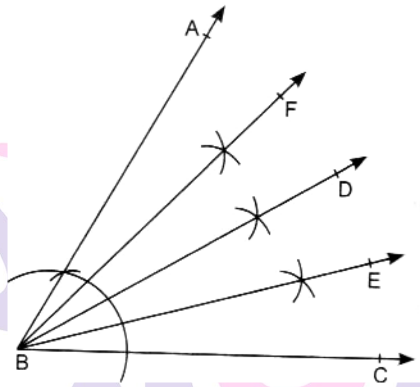
(ii) Cut a line segment BD = AB – AC = 3.5cm from the ray BX

(iii) Join DC and draw the perpendicular bisector PQ of DC

(iv) Let PQ intersect BX at a point A. Join AC as shown in the figure.

4. Draw any acute angle. Divide it into four equal parts using a ruler and a compass. Measure them using protractor. [CBSE 2014]

Sol. Steps of construction:



(i) Draw an angle $\angle ABC = 60^0$(say)

(ii) Bisect $\angle ABC$. Join BD. Then

$\angle ABD = \angle CBD = \frac{1}{2}\ \angle ABC = \frac{1}{2} X\ 60^0 = 30^0$

(iii) Again bisect $\angle ABD$ join BF as shown then.

$\angle ABF = \angle FBD = \frac{1}{2}\ \angle ABD = \frac{1}{2} X\ 30^0 = 15^0$

(iv) Again bisect $\angle CBD$. Join BE. Then

$\angle DBE = \angle EBC = \frac{1}{2}\ \angle CBD = \frac{1}{2} X\ 30^0 = 15^0$

Thus$\angle ABC$ has been divided into four equal parts

$\therefore\ \angle ABF = \angle FBD = \angle DBE = \angle EBC$

$= \frac{1}{4}\angle ABC = \frac{1}{4} x\ 60^0 = 15^0$

On measuring them, we also got each angle equals to 15^0