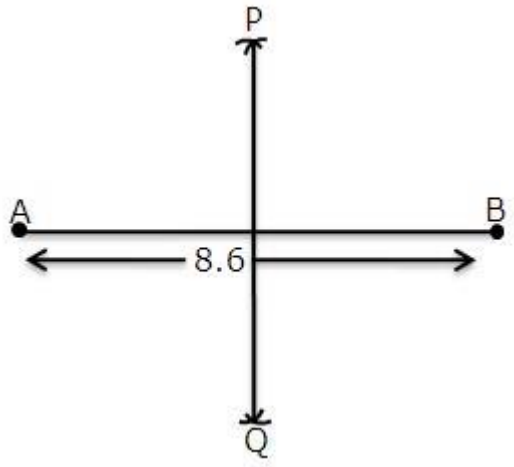
RD SHARMA Solutions for Class 9 Maths Chapter 16 - Constructions

Chapter 16 - Constructions Exercise Ex. 16.1

Question 1

Draw a line segment of length 8.6 cm. Bisect it and measure the length of each part.

Solution 1



Steps of construction :

(1) Draw a line segment AB of 8.6 cm.

(2) With centre A and radius more than $\frac{1}{2}AB$, draw arcs, one on each side of AB.

(3) With centre B and same radius, draw arcs cutting the previous arcs at P and Q respectively.

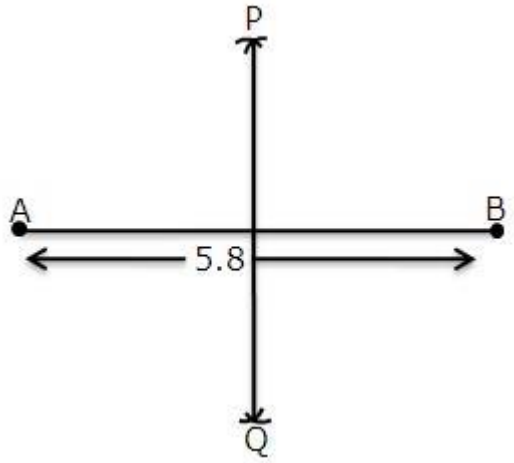
(4) Join PQ.

$\therefore$ $AC = BC = 4.3$ cm

Question 2

Draw a line segment AB of length 5.8 cm. Draw the perpendicular bisector of this segment.

Solution 2



Steps of construction:-

(1) Draw a line segment *AB* of 5.8 cm.

(2) With centre *A* and radius more than $\frac{1}{2}$ *AB*, draw arcs, one on each side of *AB*.

(3) With centre *B* and same radius, draw arcs cutting the previous arcs at *P* and *Q* respectively.

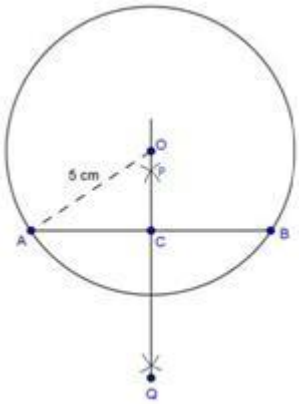
(4) Join *PQ*.

Hence, *PQ* is the perpendicular bisector of *AB*.

Question 3

Draw a circle with centre at point *O* and radius 5 cm. Draw its chord *AB*, draw the perpendicular bisector of line segment *AB*. Does it pass through the centre of the circle?

Solution 3



Steps of construction:-

(1) With centre *O* and radius 5 cm, draw a circle.

(2) Draw a chord *AB*.

(3) With centre *A* and radius more than $\frac{1}{2}$ *AB*, draw arcs, one on each side of *AB*.

(4) With centre *B* and same radius, draw arcs cutting previous arcs at *P* and *Q* respectively.

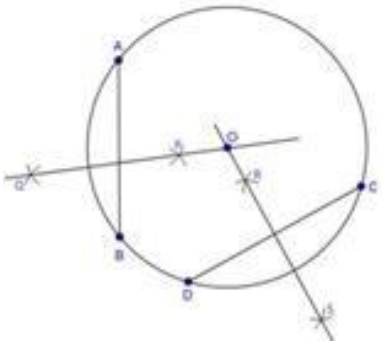
(5) Join *PQ*.

∴ yes perpendicular bisector *PQ* of *AB* passes through the centre of the circle.

Question 4

Draw a circle with centre at point *O*. Draw its two chords *AB* and *CD* such that *AB* is not parallel to *CD*. Draw the perpendicular bisectors of *AB* and *CD*. At what point do they intersect?

Solution 4



Steps of construction:–

(1) With centre *O* and any radius, draw a circle.

(2) Draw two chords *AB* and *CD*.

(3) With centre *A* and radius more than $\frac{1}{2}$ *AB*, draw arcs, one on each side of *AB*.

(4) With centre *B* and same radius, draw arcs cutting previous arcs at *P* and *Q* respectively.

(5) Join *PQ*.

(6) With centre *D* and radius more than $\frac{1}{2}$ *DC*, draw arcs, one on each side of *DC*.

(7) With centre *C* and same radius, draw arcs cutting previous arcs at *R* and *S* respectively.

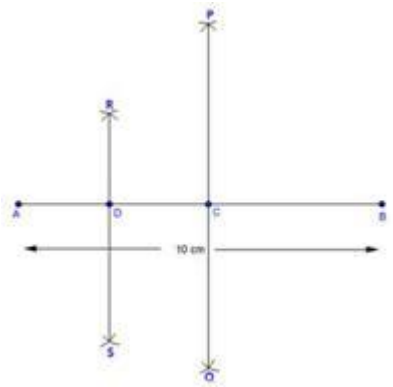
(8) Join *RS*.

Both perpendicular bisectors *PQ* and *RS* intersect each other at the centre *O* of the circle.

Question 5

Draw a line segment of length 10 cm and bisect it. Further bisect one of the equal parts and measure its length.

Solution 5



Steps of construction:-

(1) Draw a line segment AB of 10 cm.

(2) With centre A and radius more than $\frac{1}{2}$ AB, draw arcs, one on each side of AB.

(3) With centre B and same radius, draw arcs cutting previous arcs at P and Q respectively.

(4) Join PQ which intersect AB at C.

(5) With centre A and radius more than $\frac{1}{2}$ AC, draw arcs, one on each side of AC.

(6) With centre C and same radius, draw arcs cutting previous arcs at R and S respectively.

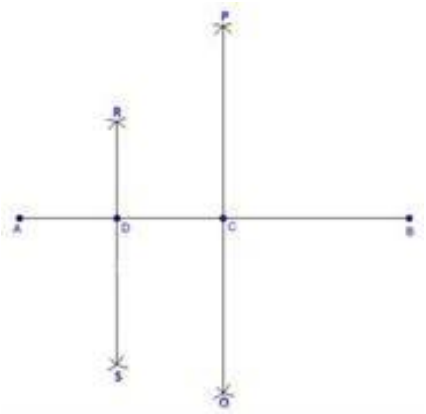
(7) Join RS which intersect AC at D.

$\therefore \quad AD = 2.5$ cm

Question 6

Draw a line segment AB and bisect it. Bisect one of the equal parts of obtain a line segment of length $\frac{1}{2}$ (AB)

Solution 6



Steps of construction:-

(1) Draw a line segment AB.

(2) With centre A and radius more than $\frac{1}{2}AB$, draw arcs, one on each side of AB.

(3) With centre B and same radius, draw arcs cutting previous arcs at P and Q respectively.

(4) Join PQ which intersect AB at C.

(5) With centre A and radius more than $\frac{1}{2}AC$, draw arcs, one on each side of AC.

(6) With centre C and same radius, draw arcs cutting previous arcs at R and S respectively.

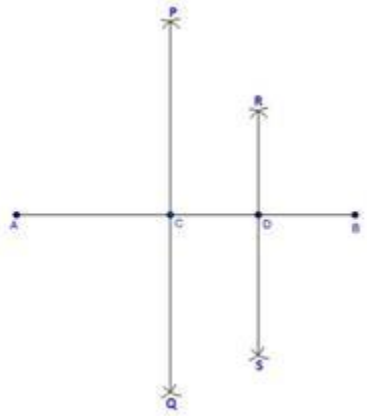
(7) Join RS which intersect AC at D.

$\therefore \quad AD = \frac{1}{4}AB$

Question 7

Draw a line segment AB and by ruler and compasses, obtain a line segment of length $\frac{3}{4}(AB)$.

Solution 7



Steps of construction:-

(1) Draw a line segment AB.

(2) With centre A and radius more than $\frac{1}{2}AB$, draw arcs, one on each side of AB.

(3) With centre B and same radius, draw arcs cutting previous arcs at P and Q respectively.

(4) Join PQ which intersect AB at C.

(5) With centre C and radius more than $\frac{1}{2}CB$, draw arcs, one on each side of CB.

(6) With centre B and same radius, draw arcs cutting previous arcs at R and S respectively.

(7) Join RS which intersect CB at D.

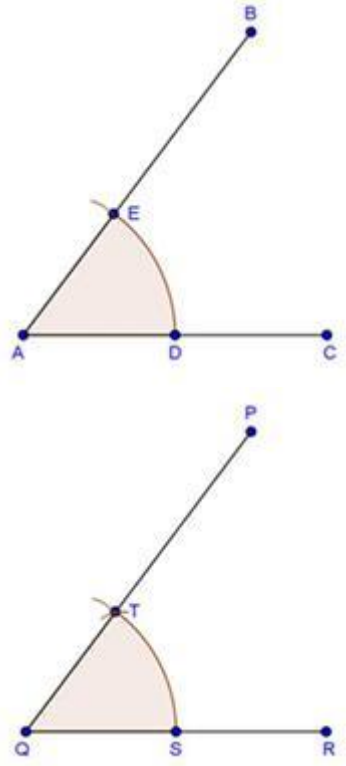
$\therefore \quad AD = \frac{3}{4}AB$

Chapter 16 - Constructions Exercise Ex. 16.2

Question 1

Draw an angle and label it as $\angle BAC$. Construct another angle, equal to $\angle BAC$.

Solution 1



Steps of construction:-

(1) Draw an angle BAC and a line segment QR.

(2) With centre A and any radius, draw an arc which intersects $\angle BAC$ at E and D.

(3) With centre Q and same radius draw an arc which intersect QR at S.

(4) With centre S and radius equal to DE, draw an arc which intersect previous arc at T.

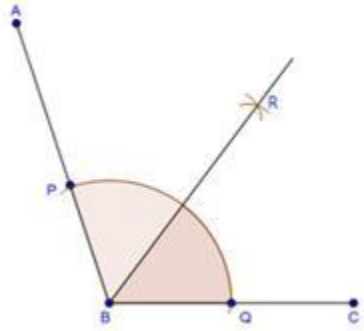
(7) Draw a line segment joining Q and T.

$\therefore \quad \angle PQR = \angle BAC$

Question 2

Draw an obtuse angle. Bisect it. Measure each of the angles so obtained.

Solution 2



Steps of construction:-

(1) Draw angle ABC of 120°.

(2) With centre B and any radius, draw an arc which intersect AB at P and BC at Q.

(3) With centres P and Q and radius more than $\frac{1}{2}PQ$, draw two arcs which intersect each other at R.

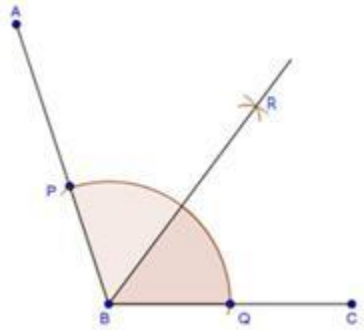
(4) Join BR.

$\therefore \quad \angle ABR = \angle RBC = 60^\circ$

Question 3

Using your protractor, draw an angle of measure 108°. With this angle as given, draw an angle of 54°.

Solution 3



Steps of construction:-

(1) Draw an angle ABC of 108°.

(2) With centre B and any radius, draw an arc which intersect AB at P and BC at Q.

(3) With centres P and Q and radius more than $\frac{1}{2}PQ$, draw two arcs which intersect each other at R.

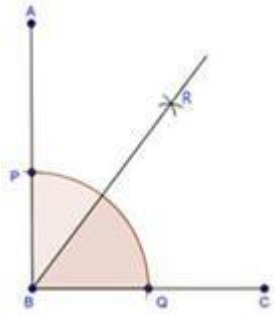
(4) Join BR.

$\therefore \quad \angle RBC = 54^\circ$

Question 4

Using protractor, draw a right angle. Bisect it to get an angle of measure 45°.

Solution 4



Steps of construction:-

(1) Draw an angle ABC of 90°.

(2) With centre B and any radius, draw an arc which intersect AB at P and BC at Q.

(3) With centres P and Q and radius more than $\frac{1}{2}PQ$, draw two arcs which intersect each other at R.

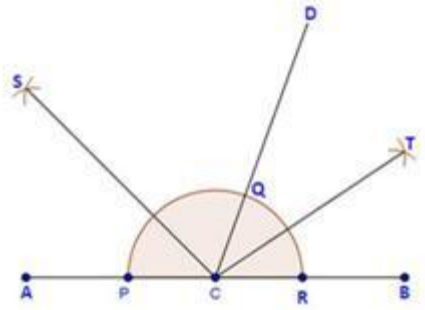
(4) Join RB.

$\therefore \quad \angle RBC = 45^\circ$

Question 5

Draw a linear pair of angles. Bisect each of the two angles. Verify that the two bisecting rays are perpendicular to each other.

Solution 5



Steps of construction:-

(1) Draw two angles DCA and DCB forming a linear pair.

(2) With centre C and any radius draw an arc which intersect AC at P, CD at Q and CB at R.

(3) With centres P and Q and any radius, draw two arcs which intersect each other at S.

(4) Join SC.

(5) With centres Q and R and any radius, draw two arcs which intersect each other at T.

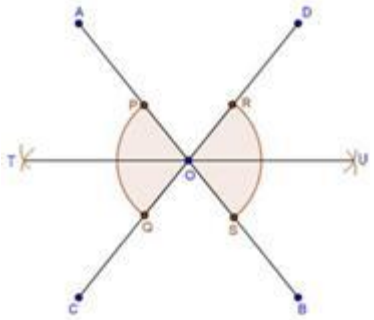
(6) Join TC.

$\therefore \quad \angle SCT = 90^\circ$ **[By using protractor]**

Question 6

Draw a pair of vertically opposite angles. Bisect each of the two angles. Verify that the bisecting rays are in the same line.

Solution 6



Steps of construction:–

(1) Draw a pair of vertically opposite angles AOC and DOB.

(2) With centre O and any radius draw two arcs which intersect OA at P, OC at Q, OB at S and OD at R.

(3) With centres P and Q and radius more than $\frac{1}{2}PQ$, draw two arcs which intersect each other at T.

(4) Join TO.

(5) With centres R and S and radius more than $\frac{1}{2}RS$, draw two arcs which intersect each other at U.

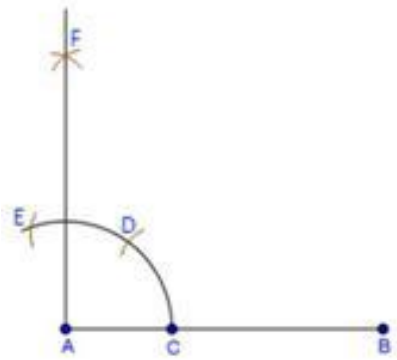
(6) Join OU.

$\therefore$ TOU is a straight line.

Question 7

Using ruler and compasses only, draw a right angle.

Solution 7



Steps of construction:-

(1) Draw a line segment AB.

(2) With centre A and any radius draw an arc which intersects AB at C.

(3) With centre C and same radius draw an arc which interseds previous arc at D.

(4) With centre D and same radius draw an arc which interseds arc in (2) at E.

(5) With centres E and C and any radius, draw two arcs which intersect each other at F.

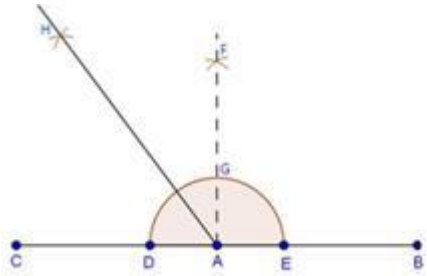
(4) Join FA.

$\therefore \quad \angle FAB = 90^\circ$

Question 8

Using ruler and compasses only, draw an angle of measure 135°.

Solution 8



Steps of construction:-

(1) Draw a line segment AB and produce BA to point C.

(2) With centre A and any radius draw an arc which intersects AC at D and AB at E.

(3) With centres D and E and radius more than $\frac{1}{2}DE$, draw two arcs which intersect each other at F.

(4) Join FA which intersects the arc in (2) at G.

(5) With centres G and D and radius more than $\frac{1}{2}GD$, draw two arcs which intersect each other at H.

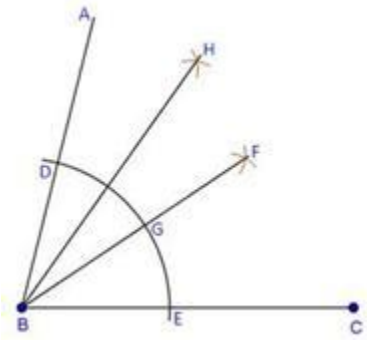
(6) Join HA.

$\therefore \quad \angle HAB = 135^\circ$

Question 9

Using a protractor, draw an angle of measure 72°. With this angle as given, draw angles of measure 36° and 54°.

Solution 9



Steps of construction:–

(1) Draw an angle ABC of 72° with the help of protractor.

(2) With centre B and any radius, draw an arc which intersects AB at D and BC at E.

(3) With centres D and E and radius more than $\frac{1}{2}DE$, draw two arcs which intersect each other at F.

(4) Join FB which intersects the arc in (2) at G.

(5) With centres D and G and radius more than $\frac{1}{2}DG$, draw two arcs which intersect each other at H.

(6) Join HB.

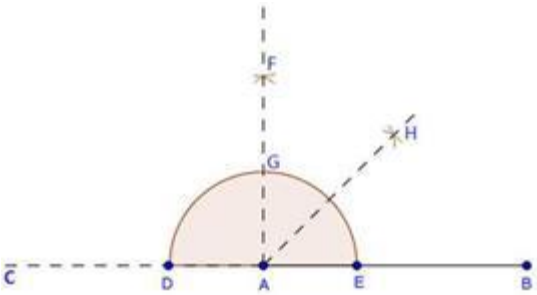
$\therefore \quad \angle FBC = 36^\circ$

and $\quad \angle HBC = 54^\circ$

Question 10(i)

Construct the following angles at the initial point of a given ray and justify the construction: 45°

Solution 10(i)



Steps of construction:-

(1) Draw a line segment AB and produce BA to point C.

(2) With centre A and any radius draw an arc which intersects AC at D and AB at E.

(3) With centres D and E and radius more than $\frac{1}{2}DE$, draw arcs cutting each other at F.

(4) Join FA which intersects arc in (2) at G.

(5) With centres G and E and radius more than $\frac{1}{2}GE$, draw arcs cutting each other at H.

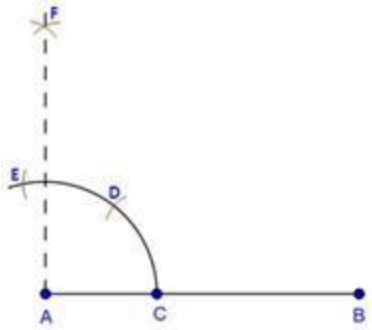
(6) Join HA.

$\therefore \quad \angle HAB = 45^\circ$

Question 10(ii)

Construct the following angles at the initial point of a given ray and justify the construction: 90°

Solution 10(ii)



Steps of construction:-

(1) Draw a line segment *AB*.

(2) With centre *A* and any radius draw an arc which intersects *AB* at *C*.

(3) With centre *C* and same radius draw an arc which intersects previous arc at *D*.

(4) With centre *D* and same radius draw an arc which intersects arc in (2) at *E*.

(5) With centres *E* and *D* and radius more than $\frac{1}{2}$ *ED*, draw arcs cutting each other at *F*.

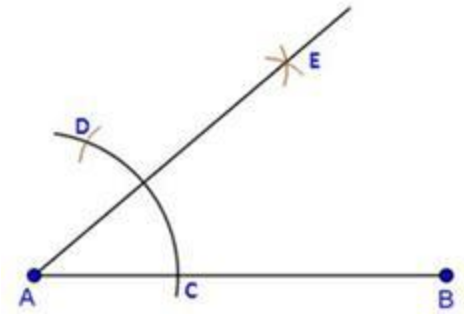
(6) Join *FA*.

$\therefore \quad \angle FAB = 90^\circ$

Question 11(i)

Construct an angle of 30°

Solution 11(i)



Steps of construction:-

(1) Draw a line segment *AB*.

(2) With centre *A* and any radius, draw an arc which intersects *AB* at *C*.

(3) With centre *C* and same radius, draw an arc which intersects previous arc at *D*.

(4) With centres *D* and *C* and radius more than $\frac{1}{2}$ *DC*, draw arcs intersecting each other at *E*.

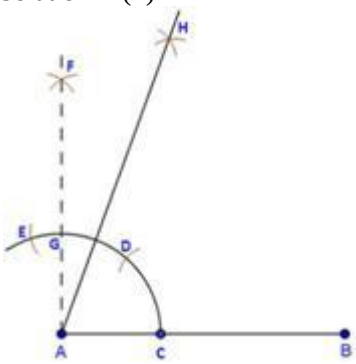
(5) Join *EA*.

$\therefore \quad \angle EAB = 30^\circ$

Question 11(ii)

Construct an angle of 75°

Solution 11(ii)



Steps of construction:-

(1) Draw a line segment *AB*.

(2) With centre *A* and any radius, draw an arc which intersects *AB* at *C*.

(3) With centre *C* and same radius, draw an arc which intersects previous arc at *D*.

(4) With centre *D* and same radius, draw an arc which intersects arc in (2) at *E*.

(5) With centres *E* and *D* and radius more than $\frac{1}{2}$ *ED*, draw arcs intersecting each other at *F*.

(6) Join *FA* which intersects arc in (2) at *G*.

(7) With centres *G* and *D* and radius more than $\frac{1}{2}$ *GD*, draw arcs intersecting each other at *H*.

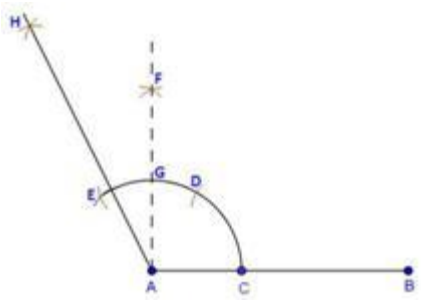
(8) Join *HA*.

$\therefore \quad \angle HAB = 75^\circ$

Question 11(iii)

Construct an angle of 105°

Solution 11(iii)



Steps of construction:-

(1) Draw a line segment AB.

(2) With centre A and any radius, draw an arc which intersects AB at C.

(3) With centre C and same radius, draw an arc which intersects previous arc at D.

(4) With centre D and same radius, draw an arc which intersects arc in (2) at E.

(5) With centres E and D and radius more than $\frac{1}{2}ED$, draw arcs intersecting each other at F.

(6) Join FA which intersects arc in (2) at G.

(7) With centres E and G and radius more than $\frac{1}{2}EG$, draw arcs intersecting each other at H.

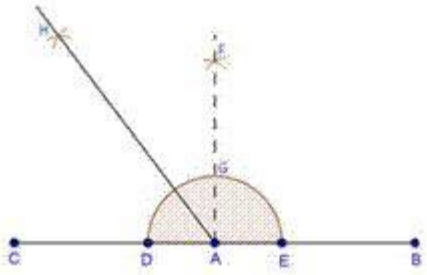
(8) Join HA.

$\therefore \quad \angle HAB = 105^\circ$

Question 11(iv)

Construct an angle of 135°

Solution 11(iv)



Steps of construction:-

(1) Draw a lines segment AB and produce BA to point C.

(2) With centre A and any radius draw an arc which intersects AC to D and AB at E.

(3) With centres D and E and radius more than $\frac{1}{2}$ DE, draw two arcs which intersect each other at F.

(4) Join FA which intersects the arc in (2) at G.

(5) With centres G and D and radius more than $\frac{1}{2}$ GD, draw two arcs which intersect each other at H.

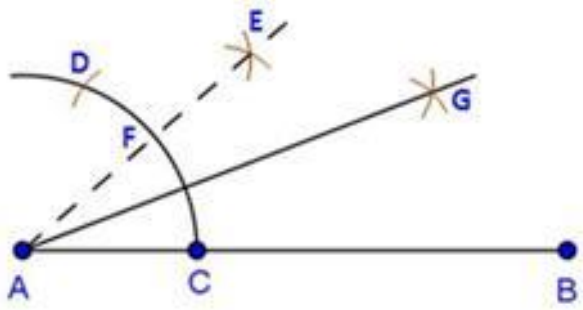
(6) Join HA.

$\therefore \angle HAB = 135^{\circ}$

Question 11(v)

Construct an angle of 15º.

Solution 11(v)



Steps of construction:

(1) Draw a line segment AB.

(2) With centre A and any radius, draw an arc which intersects AB at C.

(3) With centre C and same radius, draw an arc which intersects previous arc at D.

(4) With centre D and C and radius more than $\frac{1}{2}$ DC, draw acrs intersecting each other at E.

(5) Join EA which intersects arc in (2) at F.

(6) With centres F and C and radius more than $\frac{1}{2}$ FC, draw arcs intersecting each other at G.

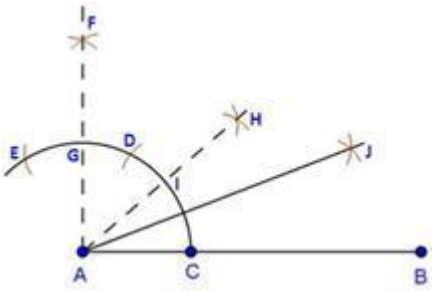
(7) Join GA.

$\therefore \angle GAB = 15^{\circ}$

Question 11(vi)

Construct the angles of the following measurements: $22\frac{1}{2}^{\circ}$

Solution 11(vi)



Steps of construction:-

(1) Draw a line segment AB.

(2) With centre A and any radius, draw an arc which intersects AB at C.

(3) With centre C and same radius, draw an arc which intersects previous arc at D.

(4) With centre D and same radius, draw an arc which intersects arc in (2) at E.

(5) With centres E and D and radius more than $\frac{1}{2}ED$, draw arcs intersecting each other at F.

(6) Join FA which intersects arc in (2) at G.

(7) With centres G and C and radius more than $\frac{1}{2}GC$, draw arcs intersecting each other at H.

(8) Join HA which intersects arc in (2) at I.

(9) With centres I and C and radius more than $\frac{1}{2}IC$, draw arcs intersecting each other at J.

(10) Join JA.

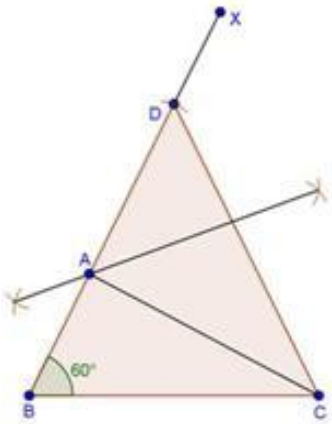
$\therefore \quad \angle JAB = 22\frac{1}{2}^{\circ}$

Chapter 16 - Constructions Exercise Ex. 16.3

Question 1

Construct a $\triangle ABC$ in which $BC = 3.6$ cm, $AB + AC = 4.8$ cm and $\angle B = 60^{\circ}$.

Solution 1



Steps of construction:-

(1) Draw a line segment BC of 3.6 cm.

(2) At the point B, draw $\angle XBC$ of 60°.

(3) With centre B and radius 4.8 cm, draw an arc which intersects XB at D.

(4) Join DC.

(5) Draw the perpendicular bisector of DC which intersects DB at A.

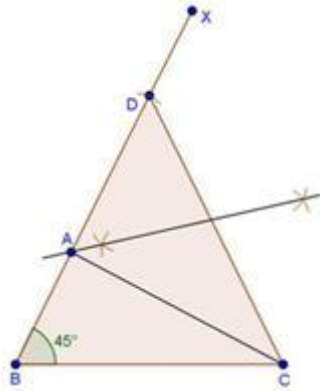
(6) Join AC.

Hence, ΔABC is the required triangle.

Question 2

Construct a $\triangle ABC$ in which $AB + AC = 5.6$ cm, $BC = 4.5$ cm and $\angle B = 45°$.

Solution 2



Steps of construction:-

(1) Draw a line segment BC of 4.5 cm.

(2) At B, draw an angle XBC of 45°.

(3) With centre B and radius 5.6 cm, draw an arc which intersects BX at D.

(4) Join DC.

(5) Draw the perpendicular bisector of DC which intersects BD at A.

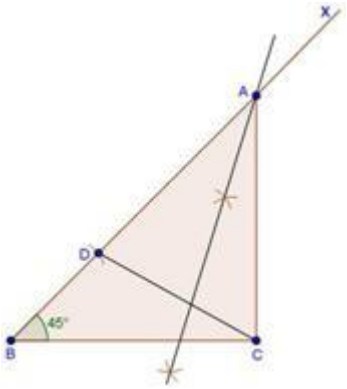
(6) Join AC.

$\therefore$ $\triangle ABC$ is the required triangle.

Question 3

Construct a $\triangle ABC$ in which $BC = 3.4$ cm, $AB - AC = 1.5$ cm and $\angle B = 45°$.

Solution 3



Steps of construction:–

(1) Draw a line segment BC of 3.4 cm.

(2) At B, draw an angle XBC of 45°.

(3) With centre B and radius 1.5 cm, draw an arc which intersects BX at D.

(4) Join DC.

(5) Draw the perpendicular bisector of DC which intersects BD produced at A.

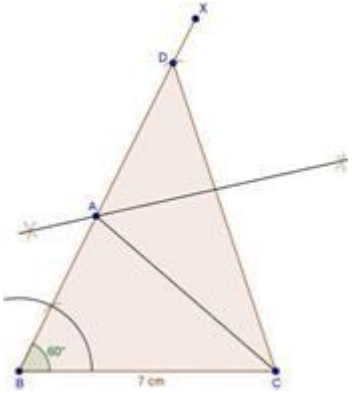
(6) Join AC.

$\therefore$ $\triangle ABC$ is the required triangle.

Question 4

Using ruler and compasses only, construct a $\triangle ABC$, given base $BC = 7$ cm, $\angle ABC = 60^\circ$ and $AB + AC = 12$ cm.

Solution 4



Steps of construction:–

(1) Draw a line segment BC of 7 cm.

(2) At B, draw an angle XBC of 60°.

(3) With centre B and radius 12 cm, draw an arc which intersects BX at D.

(4) Join DC.

(5) Draw the perpendicular bisector of DC which intersects BD at A.

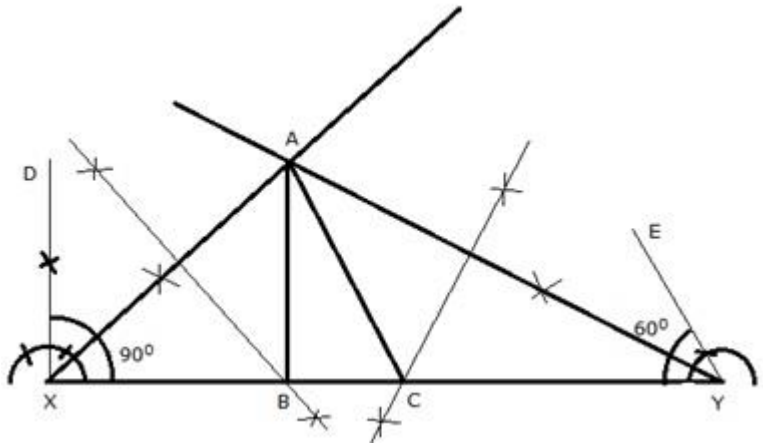
(6) Join AC.

$\therefore$ $\triangle ABC$ is the required triangle.

Question 5

Construct a right angled triangle whose perimeter is equal to 10 cm and one actute angle equal to 60°.

Solution 5



Steps of construction:-

(1) Draw a line segment XY of 10 cm.

(2) Draw $\angle DXY = \angle B = 90°$ and $\angle EYX = \angle C = 60°$.

(3) Draw the angle bisectors of $\angle DXY$ and $\angle EYX$ which intersect each other at A.

(4) Draw the perpendicular bisectors of AX and AY which intersect XY at B and C respectively.

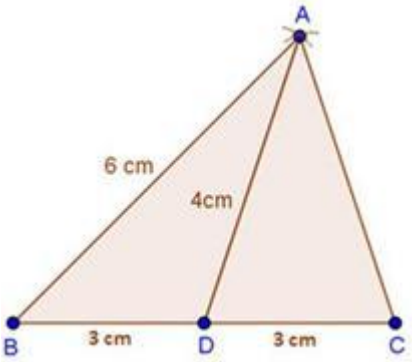
(5) Join AB and AC.

$\therefore$ $\triangle ABC$ is the required triangle.

Question 6

Construct a triangle ABC such that $BC = 6$ cm, $AB = 6$ cm and median $AD = 4$ cm.

Solution 6



Steps of construction:-

(1) Draw a line segment BC of 6 cm.

(2) Take mid-point D of side BC.

(3) With centres B and D and radii 6 cm and 4 cm, draw two arcs which intersects each other at A.

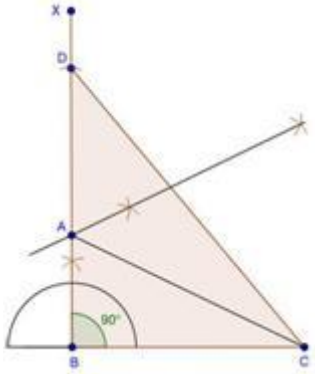
(4) Join AB, AD and AC.

$\therefore$ $\triangle ABC$ is the required triangle.

Question 7

Construct a right triangle ABC whose base BC is 6 cm and the sum of hypotenuse AC and other side AB is 10 cm.

Solution 7



Steps of construction:-

(1) Draw a line segment BC of 6 cm.

(2) At B, draw an angle XBC of 90°.

(3) With centre B and radius 10 cm draw an arc which intersects XB at D.

(4) Join DC.

(5) Draw the perpendicular bisector of DC which intersects DB at A.

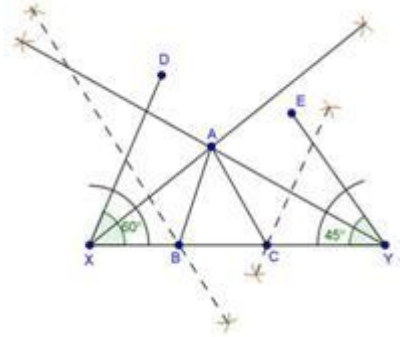
(6) Join AC.

∴ $\triangle ABC$ is the required triangle.

Question 8

Construct a triangle whose perimeter is 6.4 cm, and angles at the base are 60° and 45°.

Solution 8



Steps of construction:-

(1) Draw a line segment XY of 6.4 cm.

(2) Draw $\angle DXY = \angle B = 60°$ and $\angle EYX = \angle C = 45°$.

(3) Draw the angle bisectors of $\angle DXY$ and $\angle EYX$ which intersect each other at A.

(4) Draw the perpendicular bisectors of AX and AY which intersect XY at B and C respectively.

(5) Join AB and AC.

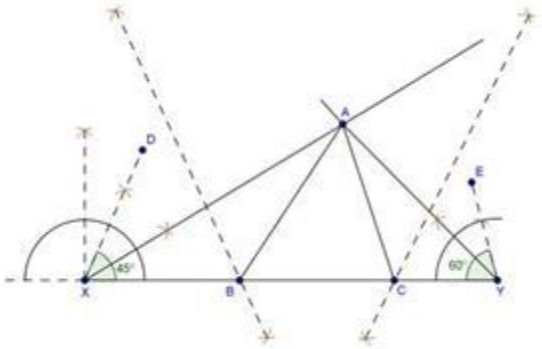
∴ $\triangle ABC$ is the required triangle.

Question 9

Using ruler and compasses only, construct a $\triangle ABC$, from the following data:

$AB + BC + CA = 12$ cm, $\angle B = 45^\circ$ and $\angle C = 60^\circ$.

Solution 9



Steps of construction:-

(1) Draw a line segment XY of 12 cm.

(2) Draw $\angle DXY = \angle B = 45^\circ$ and $\angle EYX = \angle C = 60^\circ$.

(3) Draw the angle bisectors of angles DXY and EYX which intersect each other at A.

(4) Draw the perpendicular bisectors of AX and AY which intersect XY at B and C respectively.

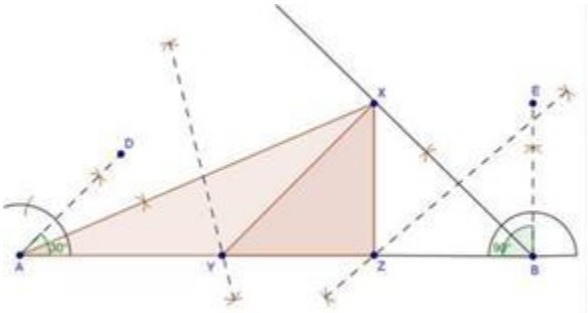
(5) Join AB and AC.

$\therefore$ $\triangle ABC$ is the required triangle.

Question 10

Construct a triangle XYZ in which $\angle Y = 30^\circ$, $\angle Z = 90^\circ$ and $XY + YZ + ZX = 11$.

Solution 10



Steps of construction:-

(1) Draw a line segment AB of 11 cm.

(2) Draw $\angle DAB = \angle Y = 30^\circ$ and $\angle EBA = \angle Z = 90^\circ$.

(3) Draw the angle bisectors of $\angle DAB$ and $\angle EBA$ which intersect each other at X.

(4) Draw the perpendicular bisectors of XA and XB which intersect AB at Y and Z respectively.

(5) Join XY and XZ.

$\therefore$ $\triangle XYZ$ is the required triangle.