NCERT Exercises (Questions-Solutions)

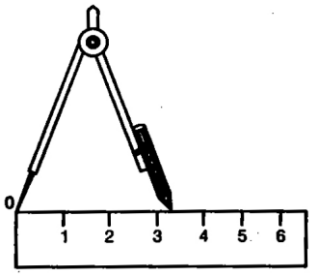
Exercise 14.1

Page No. 276

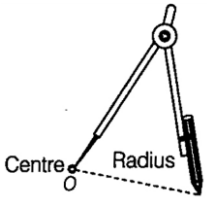
1. Draw a circle of radius 3.2cm.

Sol. To draw a circle of radius 3.2 cm, we use the following steps:

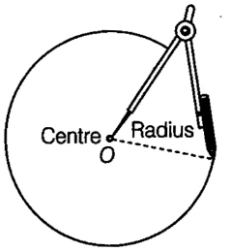
Step I Open the compasses to take a distance of 3.2 cm for the required radius of circle.



Step II Mark a point with a sharp pencil for the centre of the circle and name it as O.

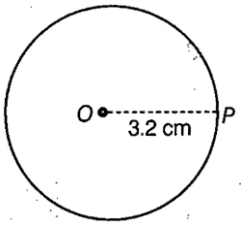


Step III Place the pointer of the compasses on O.



Step IV Turn the compasses slowly to draw the circle.

Then, the figure obtained is of the required circle of radius 3.2 cm.



2. With the same centre O, draw two circles of radii 4 cm and 2.5 cm.

Sol. Here, to draw two circles of radii 4 cm and 2.5 cm with the same centre O, we use the following steps:

Step I Open the compasses to take distance of 4 cm for the required radius of circle.

Step II Mark a point with a sharp pencil for the centre of the circle and name it as O.

Step III Place the pointer of the compasses on O.

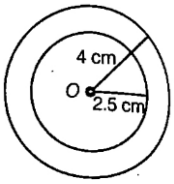
Step IV Turn the compasses slowly, to draw the circle of radius4cm.

Step V Now, again open the compasses to take a distance of2.5 cm for the required radius of circle.

Step VI Place the pointer of the compasses on O (since, both circles have same centre).

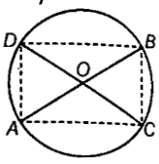
Step VII Turn the compasses slowly, to draw the circle of radius 2.5 cm.

Thus, we get two circles with same centre O and radius 4 cm and 2.5 cm, respectively.



3. Draw a circle with any two of its diameters. If you join the ends of these diameters, what is the figure obtained ifthe diameters are perpendicular to each other? How do you check your answer?

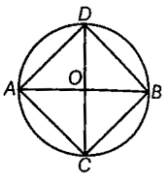
Sol. Firstly, draw a circle with O as centre and of any radius.



Then, draw any two diameters, say AOB and COD.

Now, join DA, AC, CB, and BD. It is clear from the given figure that DACB is a rectangle.

When the diameter AOB and DOC are perpendicular to each other, then figure obtained by joining AC, CB, BD and DA is a square ADBC.



To check our answer, we can compare lengths of sides by using divider.

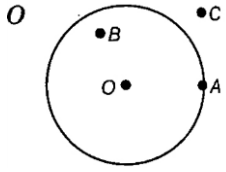
4. Draw any circle and mark points A,B and C such that

(i) A is on the circle.

(ii) B is in the interior of the circle.

(iii) C is in the exterior of the circle.

Sol. On drawing, we get the following circle with O as centre and of any radius.



(i) Take a point A such that A lies on the circle.

(ii) Take a point B such that B lies in the interior of the circle.

(iii) And take a point C such that C lies in the exterior of the circle.

5. **Let A and B be the centres of two circles of equal radii, draw them so that each one of them passes through the centre of the other. Let them intersect at C and D.**

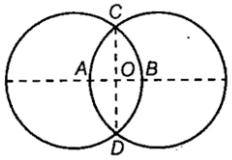
Examine whether $\overline{AB}$ and $\overline{CD}$ are at right angles.

Sol. To draw two circles such that each one of them passes through the centre of the other, we use the following steps:

Step I Firstly, mark two points A and B on the paper.

Step II Take the distance between A and B as radius and draw a circle with centre A

Step III Now, take B as centre and draw a circle with radius AB.



Thus, we get two circles which passes through the centres of each other. Let these circles intersect each other at C and D. Join C and D, which intersect AB at O. Then, we observe that, the $\angle AOC$ and $\angle COB$ are equal to 90°.Hence, $\overline{AB} \perp \overline{CD}$.

So, we can say that $\overline{AB}$ and $\overline{CD}$ are at right angles.

Exercise 14.2

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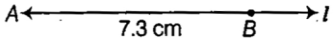
1. **Draw a line segment of length 7.3 cm using a ruler.**

Sol. In order to construct a line segment of length 7.3 cm using a ruler, we use the following steps:

Step I Mark a point A on the paper and place the ruler, so that zero mark of the ruler is at A.

Step II Mark with a pencil a point B against the mark on the ruler which indicates 7.3 cm.



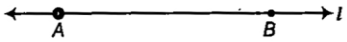
Step III Join points A and B by moving the tip of thepencil against the straight edge of the ruler.

The line segment AB, so obtained is the required linesegment of length 7.3 cm.

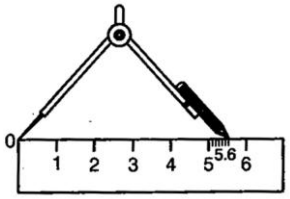
2. **Construct a line segment of length 5.6 cm using ruler and compasses.**

Sol. To construct a line segment of length 5.6 cm using ruler and compasses, we use the following steps:

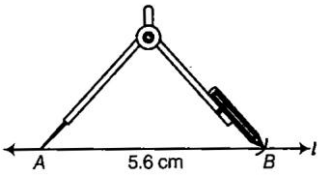
Step I Draw a line l and mark a point A on this line.



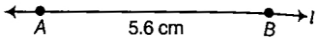
Step II Place the pointer of the compasses at a zero mark of the ruler. Open it to place the pencil point up to the 5.6 cm mark.



Step III Taking caution that the opening of the compasses has not changed, place the pointer on A and swing an arc to cut l at B.



Step IV $\overline{AB}$ is a line segment of required length.



3. Construct $\overline{AB}$ of length 7.8 cm. From this, cut off $\overline{AC}$ of length 4.7 cm. Measure $\overline{BC}$.

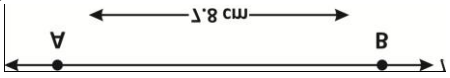
Sol. Given, $\overline{AB}=7.8cm$ and $\overline{AC}=4.7cm$. Now, to construct a line segment of length 7.8 cm, we use the following steps:

Step I Draw a line l. Mark a point A on this line.

Step II Place the pointer of compasses at the zero mark of the ruler. Open it to place the pencil point up to the 7.8 cm mark.

Step III Without changing the opening to the compasses. Place the pointer on A and swing an arc to cut l at B.

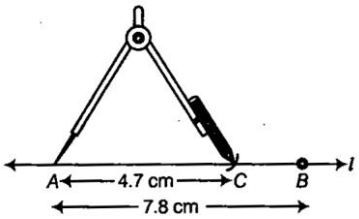
Step IV $\overline{AB}$ is a line segment of length 7.8 cm.



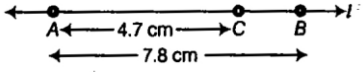
Now, to cut off $\overline{AC}$ of length 4.7 cm from $\overline{AB}$, we use the following steps:

Step V Now, place the pointer of compasses at the zero mark of the ruler. Open it to the place the pencil point upto4.7 cm mark.

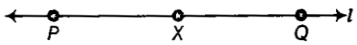
Step VI Without changing the opening of the compasses, place the pointer on A and swing an arc to cut l at C.



Step VII Now, $\overline{AC}$ is a line segment of length 4.7 cm. On measuring, we get $\overline{BC}=3.1cm$



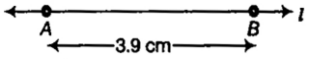
4. Given $\overline{AB}$ of length 3.9 cm, construct $\overline{PQ}$ such that the length of $\overline{PQ}$ is twice that of $\overline{AB}$. Verify by measurement.



(Hint Construct such that length of $\overline{XQ}=$ length of AB, then cut of $\overline{AB}$, such that $\overline{XQ}$ also has the length as $\overline{AB}$).

Sol. Given, $\overline{AB}=3.9cm$. Now, to construct required line segment byusing compasses, we use the following steps:

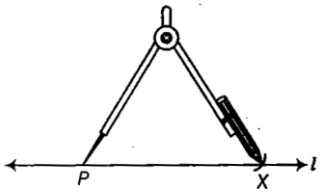
Step I Firstly, draw $\overline{AB}=3.9cm$.



Step II Now, to draw an another line l, mark a point P on it.

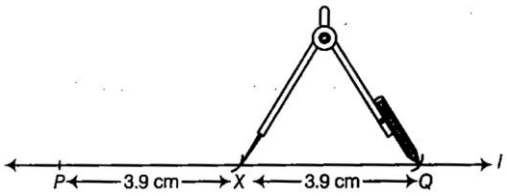
Step III Place the pointer of compasses at the zero mark of the ruler. Open it to the place of the pencil point upto 3.9 cmmark.

Step IV Without changing the opening of the compasses, place the pointer on P and swing an arc to cut l at X.



Step V Measure $\overline{PX}$, we get $\overline{PX}=3.9cm=\overline{AB}$.

Step VI Again, without changing the opening of the compasses, place the pointer on X and swing an arc to cut l at Q.



Step VII Now, measure $\overline{XQ}$, we get $\overline{XQ}=3.9cm=\overline{AB}$

Step VIII

$\overline{PQ}=\overline{PX}+\overline{XQ}=(3.9+3.9)cm=\overline{AB}+\overline{AB}=2\overline{AB}$ Hence, PQ is twice that of AB.

Verification : On measuring the length of $\overline{PQ}$ and $\overline{AB}$.

We get, $\overline{PQ}=7.8cm$ and $\overline{AB}=3.9cm$ and $\overline{PQ}=2(\overline{AB})=7.8cm$

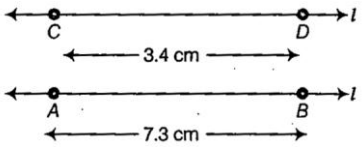
Thus, twice of $\overline{AB}$ is equal to $\overline{PQ}$.

5. Given, $\overline{AB}$ of length 7.3 cm and $\overline{CD}$ of length 3.4 cm construct a line segment $\overline{XY}$ such that the length of $\overline{XY}$ is equal to the difference between the lengths of $\overline{AB}$ and $\overline{CD}$.
Verify by measurement.
TIPS
Firstly, draw $\overline{AB}$ and $\overline{CD}$, then cut length of $\overline{CD}$ from $\overline{AB}$ and remaining length of $\overline{AB}$ gives the difference between their lengths. Now, draw a line l and cut line segment $\overline{XY}$ from it, whose length is equal to the difference of length $\overline{AB}$ and $\overline{CD}$.

Sol. Given, $\overline{AB}=7.3cm$ and $\overline{CD}=3.4cm$

Now, to construct required line segment $\overline{XY}$, we use the following steps:

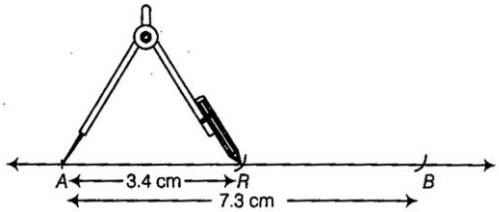
Step I Firstly, draw $\overline{AB}=7.3cm$ and $\overline{CD}=3.4cm$



Step II Now, place the pointer of compasses on C of pencil on D.

The opening of the instrument gives the length of $\overline{CD}$ i.e.3.4 cm.

Step III Without changing the opening of the compasses place the pointer on A and swing an arc to cut $\overline{AB}$ at R.



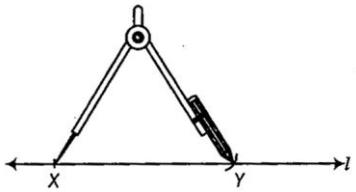
Step IV Thus, $\overline{AR}=3.4cm$ and $\overline{RB}$ is the difference between the length of $\overline{AB}$ and $\overline{CD}$.

Step V Now, draw a line l and mark a point X on it.

Step VI Place the pointer of compasses on R and of pencil on B. The opening of the compasses gives the length of $\overline{RB}$.

Step VII Without changing the opening of the compasses, place the pointer on X and swing an arc to cut l at Y.

Thus, $\overline{XY}$ is a line segment whose length is equal to the difference between the lengths of $\overline{AB}$ and $\overline{CD}$.



Verification By actual measurement, we have $\overline{XY}=3.9cm$

Now, $\overline{AB}-\overline{CD}=7.3cm-3.4cm=3.9cm$

$\Rightarrow \overline{XY}=\overline{AB}-\overline{CD}$

i.e. length of $\overline{XY}$ = The difference of lengths $\overline{AB}$ and $\overline{CD}$.

Hence, verified.

Exercise 14.3

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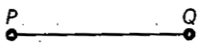
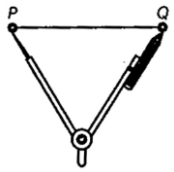
1. Draw any line segment $\overline{PQ}$. Without measuring $\overline{PQ}$, construct a copy of $\overline{PQ}$.

Sol. To make a copy of $\overline{PQ}$, we use the following steps:

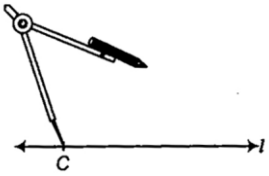
Step I Firstly, draw $\overline{PQ}$ of any length because length is not known.



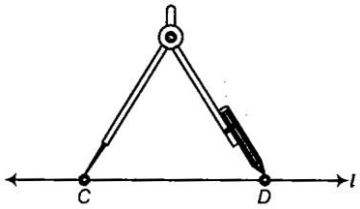
Step II Fix the compasses pointer on P and the pencil end Q. The opening of the instrument now gives the length of $\overline{PQ}$.



Step III Draw any line l add choose a point C on it. Without changing the compasses setting, place the pointer on C.



Step IV Swing an arc that cuts l at a point, say D. Then, $\overline{CD}$ is copy of $\overline{PQ}$.



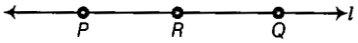
2. Given, some line segment $\overline{AB}$ whose length you do not know, construct $\overline{PQ}$ such that the length of $\overline{PQ}$ is twice that of $\overline{AB}$.

Sol. To make $\overline{PQ}$, we use the following steps:

Step I First of all, draw a line segment AB, whose length is notknown.

Step II Fix the pointer of compasses on A and the pencils end onB. The opening of the instrument now gives the length of $\overline{AB}$.

Step III Draw any line l. Choose a point P on l, without changing the compasses setting, place the pointer on P, swing an arc that cuts l at point R.



Step IV Now, place the pointer on R and without changing the compasses setting, swing another are that cuts l at a point Q.

Step V Thus, $\overline{PQ}$ is the required line segment whose length is twice that of $\overline{AB}$. Hence, $\overline{PQ} = 2\overline{AB}$

Exercise 14.4

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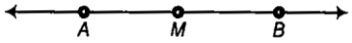
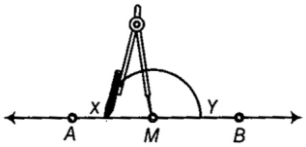
1. Draw any line segment $\overline{AB}$. Mark any point M on it. Through M, draw a perpendicular to $\overline{AB}$. (use ruler and compasses).

Sol. To draw a perpendicular to $\overline{AB}$, we use the following steps:

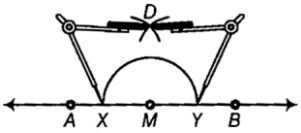
Step I Firstly, draw a line segment $\overline{AB}$ and take any point M on it.



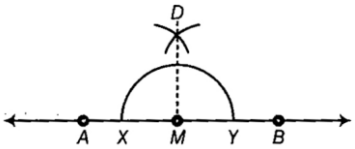
Step II With M as centre and a convenient radius, construct an arc intersecting the line $\overline{AB}$ at two points X and Y.



Step III With X and Y as centres and a radius greater than $\overline{XM}$ construct two arcs which cut each other at D.



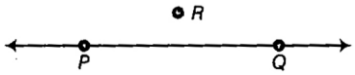
Step IV Now, join MD. Then, $\overline{MD}$ is perpendicular to $\overline{AB}$ and we can write it as $\overline{MD} \perp \overline{AB}$.



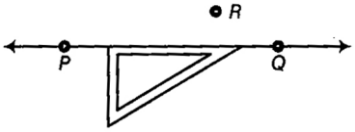
2. Draw any line segment $\overline{PQ}$. Take any point R not on it. Through R, draw a perpendicular to $\overline{PQ}$. (use ruler and set-square).

Sol. To draw a perpendicular to $\overline{PQ}$ using ruler and set-square, we use the following steps:

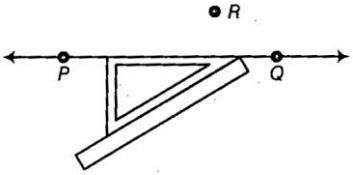
Step I Draw a line segment $\overline{PQ}$ and take a point R, outside of $\overline{PQ}$ **.**



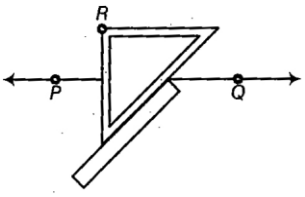
Step II Place a set-square on $\overline{PQ}$ such that one arm of its right**angle aligns along** $\overline{PQ}$ **.**



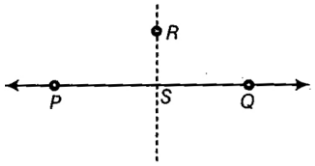
Step III Place a ruler along the edge opposite to the right angle of the set-square.



Step IV Hold the ruler fixed. Slide the set-square along the rulertill the point R touches the other arm of the set square.



Step V Join RS along the edge through R meeting $\overline{PQ}$ at S.



Hence, $\overline{RS} \perp \overline{PQ}$

3. **Draw a line l and a point X on it. Through X, draw a line segment $\overline{XY}$ perpendicular to l. Now, draw a perpendicular to $\overline{XY}$ at Y. (use ruler and compasses)**

Sol. To draw $\overline{XY}$ perpendicular on l and then a perpendicular to $\overline{XY}$ at Y, we use the following steps:

Step I Firstly, draw a line I and take point X on it.

Step II With X as centre and a convenient radius, draw an arc intersecting the line l at two points A and B.

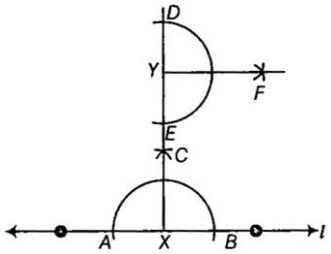
Step III With A and B as centres and radius greater than $\overline{XA}$, draw two arcs, which cut each other at C.

Step IV Join $\overline{XC}$ and produce it to Y. Then, $\overline{XY}$ is perpendicular to l.

Step V With y as centre and a convenient radius, draw an arc intersecting $\overline{XY}$ at two points E and D.

Step VI With E and D as centres and a radius greater than $\overline{YD}$, draw two arcs, which cut each other at F.

Step VII Join $\overline{YF}$, then YF is perpendicular to $\overline{XY}$ at Y. i.e. $YF \perp XY$ and $YX \perp l$.



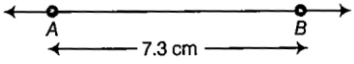
Exercise 14.5

Page No. 286

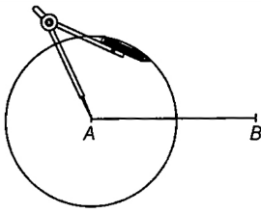
1. **Draw $\overline{AB}$ of length 7.3 cm and find its axis of symmetry.**

Sol. To find out the axis of symmetry of AB of length 7.3 cm, we use the following steps:

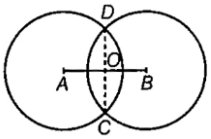
Step I Draw a line segment $\overline{AB}$ of length 7.3 cm.



Step II With A as centre, using compasses, draw a circle, whose radius is more than half the length of $\overline{AB}$.



Step III With the same radius and with B as centre, draw another circle using compasses. It cut the previous circle at C andD.



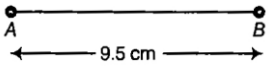
Step IV Join $\overline{CD}$. It cuts $\overline{AB}$ at O.

Then, CD is the perpendicular bisector of $\overline{AB}$.
Also, it is the axis of symmetry.

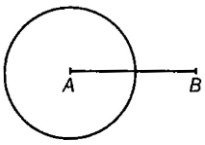
2. Draw a line segment of length 9.5 cm and construct its perpendicular bisector.

Sol. To construct the perpendicular bisector, we use the following steps:

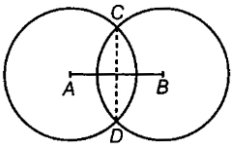
Step I Draw a line segment $\overline{AB}$ of length 9.5 cm.



Step II With A as centre and radius more than half of $\overline{AB}$, draw a circle.



Step III With B as centre and same radius draw another circle which intersects the first circle at C and D, respectively.



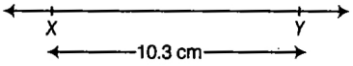
Step IV Join CD, which intersects $\overline{AB}$ at O.

Then, $\overline{CD}$ is the required perpendicular bisector of $\overline{AB}$.

3. Draw the perpendicular bisector of $\overline{XY}$ whose leng this 10.3 cm.
(a) Take any point P on the bisector drawn. Examine whether PX=PY.
(b) If M is the mid-point of $\overline{XY}$, what can you say about the lengths of MX and XY?

Sol. Firstly, we will draw the perpendicular bisector of $\overline{XY}$, so we use the following steps:

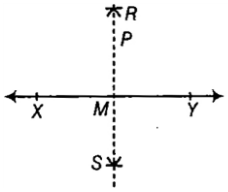
Step I Draw a line segment of $\overline{XY}$ whose length is 10.3 cm.



Step II With X as centre, using compasses, draw an arc of a circle whose radius is more than half of XY. (Here, we can draw a circle also but here more than half length of given line segment is long and circle will be very big, so we use arc in place of circle).

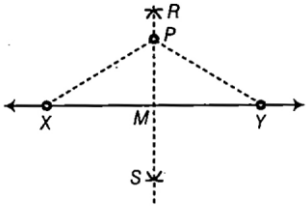
Step III With the same radius and with Y as centre, draw another arc of circle using compasses. It cut the previous arcs at R and S.

Step IV Join $\overline{RS}$. It cuts $\overline{XY}$ at M.



Then, $\overline{RS}$ is the perpendicular bisector of $\overline{XY}$.

(a) Let P be any point on the bisector, then join PX and PY.



$PX = PY$ [using divider]

(b) If M is the mid-point of $\overline{XY}$, then we can say that the length ofXY is the twice of MX or MY (or MX or MY is half of XY)i.e. $MX = \frac{1}{2}XY$ or $MY = \frac{1}{2}XY$ or $XY = 2MX$ or $XY = 2MY$

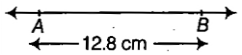
4. Draw a line segment of length 12.8 cm. Using compasses, divide it into four equal parts. Verify by actual measurement.

TIPS

To divide the given line segment $\overline{AB}$ into four equal parts, firstly we draw the perpendicular bisector of $\overline{AB}$ which divide it into two equal parts. Then, draw perpendicular bisector of each part. Out of these twoparts divide the given line segment into four equal parts.

Sol. To divide a line segment into four equal parts, we use the following steps:

Step I Draw a line segment $\overline{AB}$ of length 12.8 cm.



Step II With A as centre using compasses, draw an arc of a circle(we also draw circle here) of radius more than half length of $\overline{AB}$.

Step III With the same radius and with B as centre, draw another arc using compasses. It cut the previous arc at P and Q.

Step IV Join $\overline{PQ}$. It is the perpendicular bisector of $\overline{AB}$.

Step V Now, with A as centre, using compasses draw an arc of a circle of radius more than half of the length AO.

Step VI With the same radius and with O as centre, draw another arc of a circle which intersect the previous arc sat R and S.

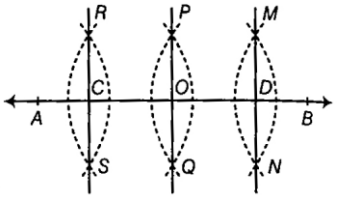
Step VII Join RS. It cuts $\overline{AO}$ (or AB) at C. Therefore, RS is the perpendicular bisector of $\overline{AO}$.

Step VIII Now, with B as centre, using compasses, draw an arc of a circle whose radius is more than half of the length of OB.

Step IX With the same radius and with O as centre, draw another arc of a circle which intersect the previous arc at M and N.

Step X Join $\overline{MN}$. It cuts $\overline{OB}$ (or AB) at D. Therefore, MN is the perpendicular bisector of $\overline{OB}$.

Step XI Now, the line segment is divided into 4 equal parts i.e. $\overline{AC}=\overline{CO}=\overline{OD}=\overline{DB}$



Verification By actual measurement, we get

$\overline{AC}=\overline{CO}=\overline{OD}=\overline{DB}=3.2cm$

and $\overline{AB}=4\times3.2cm=12.8cm$

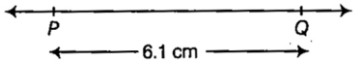
5. With $\overline{PQ}$ of length 6.1 cm as diameter, draw a circle.

TIPS

Firstly, divide the given diameter into two equal parts i.e. draw its perpendicular bisector, then take any one part as radius and common point of both part as centre, draw a circle which gives the required circle of diameter 6.1 cm.

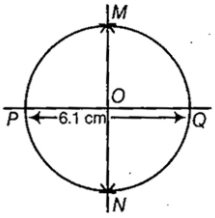
Sol. To draw a circle, of diameter 6.1 cm, we use the following steps:

Step I Draw a line segment $\overline{PQ}$ of length 6.1 cm.



Step II With P as centre, using compasses, draw an arc of a circle (here, we can draw a circle also) with radius more than half of the length of $\overline{PQ}$.

Step III With the same radius and with Q as centre, draw another circle using compasses. Let it cut the previous circle at M and N.



Step IV Now, join $\overline{MN}$. It cuts $\overline{PQ}$ at O.

Therefore, $\overline{MN}$ is the perpendicular bisector of $\overline{PQ}$ and O is the mid-point of $\overline{PQ}$. Now, with O as centre and OP or OQ as radius, draw a circle. Thus, it is a circle whose diameter is the line segment $\overline{PQ}$.

Hence, the circle PMQN is the required circle.

6. Draw a circle with centre C and radius 3.4 cm. Draw any chord AB. Construct the perpendicular bisector of $\overline{AB}$. and examine if it passes through C.

Sol. To construct the perpendicular bisector of chord $\overline{AB}$, we use the following steps:

Step I Draw a circle with C as centre and radius 3.4 cm.

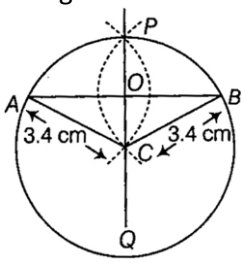
Step II Now, draw a chord $\overline{AB}$ of the circle (a chord of a circle is a line segment joining any two points on the circle)

Step III With A as .centre, using compasses draw an arc (here, we can draw circle also) with radius more than half of the length of $\overline{AB}$.

Step IV With the same radius and with B as centre, draw an another arc using compasses. Let it cut the previous arc at P And C.

Step V Join $\overline{PC}$ and produced unto Q. It Cuts $\overline{AB}$ at O. Therefore, $\overline{PC}$ is the perpendicular bisector of $\overline{AB}$.

Also, the perpendicular bisector $\overline{PC}$ passes through the centre C of 1 the circle.



Hence, the perpendicular bisector of chord AB passes through the centre C.

7. Repeat Question 6, if $\overline{AB}$, happens to be a diameter.

Sol. To construct the perpendicular bisector of diameter $\overline{AB}$, we use the following steps

Step I Draw a circle with C as centre and radius 3.4 cm.

Step II Draw diameter AB of the circle (a diameter is a chord passing through the centre of the circle).

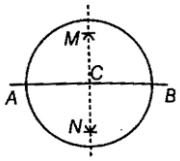
Step III With A as centre, using compasses, draw an arc with radius more than half of the length of $\overline{AB}$.

Step IV With the same radius and with B as centre, draw another arc using compasses. Let it cuts the previous arc at M and N.

Step V Join $\overline{MN}$. It cuts $\overline{AB}$ at C.

Therefore, $\overline{MN}$ is the perpendicular bisector of $\overline{AB}$. Also, $\overline{MN}$ passes through the centre C of the circle.

Hence, perpendicular bisector of diameter passes through the centre of the circle.



8. Draw a circle of radius 4 cm. Draw any two of its chords. Construct the perpendicular bisectors of these chords.
Where do they meet?

Sol. Here, we will use the following steps of construction:

Step I Mark a point O on the paper and draw a circle of radius of 4 cm with O as centre.

Step II Draw any two chords $\overline{AB}$ and $\overline{CD}$ of this circle.

Step III Now, with A as centre, using compasses, draw an arc of radius more than half of the length of AB.

Step IV With the same radius and with B as centre, draw another arc using compasses. Let it cut the previous arc at P and Q.

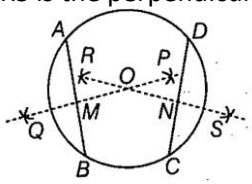
Step V Join $\overline{PQ}$. It cuts $\overline{AB}$ at M.

Therefore, PQ is the perpendicular bisector of $\overline{AB}$.

Step VI Now, with C as centre and radius more than half of the length of CD draw an arc.

Step VII WithD as centre and same radius draw another arc which intersects previous arc at R and S.

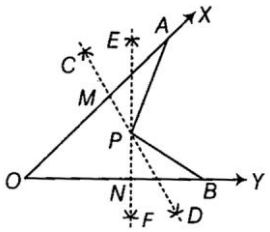
Step VIII Join RS. It cuts CD at N. Therefore, RS is the perpendicular bisector of CD.



From the above figure, it is clear that these perpendicular bisectors also passes through O, the centre of the circle.
Hence, the perpendicular bisectors of these chords meet each other at centre of the circle.

9. Draw any angle with vertex O. Take a point A on one of its arms and B on another such that OA = OB. Draw the perpendicular bisectors of $\overline{OA}$ and $\overline{OB}$. Let them meet at P.Is PA = PB?

Sol. Here, we will use the following steps of construction:
Step I Draw any angle XOY with vertex O.
Step II Take a point A on OX and a point B on OY, such that OA=OB.



Step III Now, with O as centre, using compasses, draw an arc radiusmore than half of the length of $\overline{OA}$.
Step IV With the same radius and with A as centre, draw anotherarcs using compasses. Which cut the previous arc at Cand D respectively.
Step V Join $\overline{CD}$. It cuts $\overline{OA}$ at M. Therefore, $\overline{CD}$ is the perpendicular bisector of $\overline{OA}$.
Step VI Now, with O as centre and radius equal to more than halfof the length of OB, draw arcs.
Step VII With same radius and with B as centre, draw anotherarcs which cut the previous arcs at E and F.
Step VIII Join $\overline{EF}$. It cuts $\overline{OB}$ at N. Therefore, EF is the perpendicular of $\overline{OA}$.
Also, both perpendicular bisectors meet at A.
On measuring, we get PA = PB.

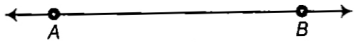
Exercise 14.6

Page No. 291

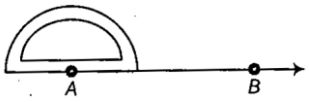
1. Draw $\angle POQ$ of measure 75^o and find its line of symmetry.

TIPS
The line of symmetry of angle 75^o is its perpendicular bisector.

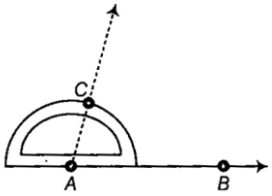
Sol. So, to find the line of symmetry of angle 75^o, we use the following steps:
Step I Draw $\overline{AB}$ of any length.



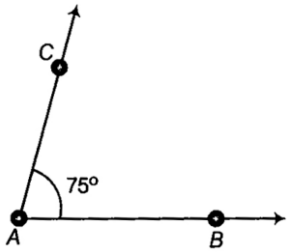
StepII Place the centre of the protractor at A and the zero edge along $\overline{AB}$.



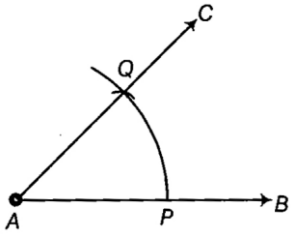
Step III Start with zero near B, mark point C at 75^o.



Step IV Join $AC.\angle BAC$ is the required angle of measure 75^o.

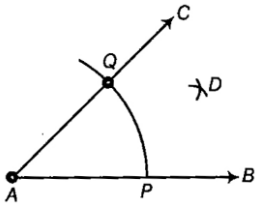


Step V With A as centre and using compasses, draw an arc that cuts both rays of $\angle A$ at P and Q.

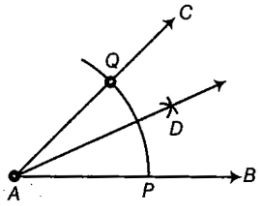


Step VI With P as centre, draw (in the interior of $\angle A$ an arc whose radius is more than half of the length of PQ).

Step VII With the same radius and with Q as centre, draw another arc in the interior of $\angle A$. Let the two arcs intersect at D.



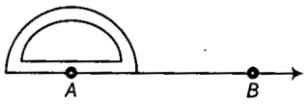
Step VIII Join AD, then $\overline{AD}$ is the required bisector of $\angle A$. i.e. AD is the line of symmetry of an angle of measure 75^o.



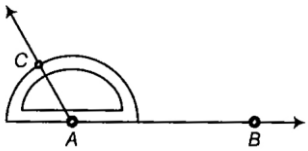
2. Draw an angle of measure 147^o and construct its bisector.

Sol. Here, we firstly draw an angle of 147^o and then construct its bisector.
So, we use the following steps:

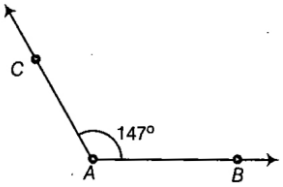
Step I Draw $\overline{AB}$ of any length place the centre of the protractor at A and the zero edge along AB.



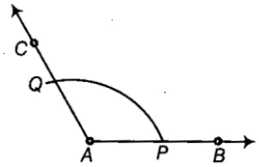
Step II Start with zero near B. Mark a point C at 147^o.



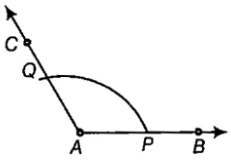
Step III Join AC. Then, $\angle BAC$ is an angle of measure 147^o.



Step IV Now, with A as centre and using compasses, draw an arc that cuts both rays of $\angle A$ at P and Q.

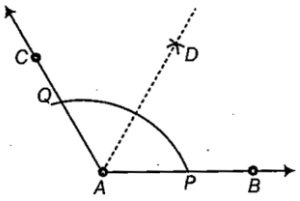


Step V With P as centre, draw (in the interior of $\angle A$) an arc whose radius is more than half of the length of PQ.



Step VI With the same radius and with Q as centre, draw another arc in the interior of $\angle A$ Let the two arcs intersect at D.

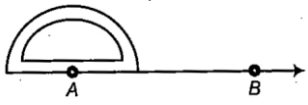
Join $\overline{AD}$. Then, $\overline{AD}$ is the required bisector of $\angle A$.



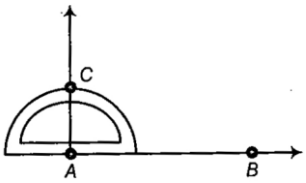
3. Draw a right angle and construct its bisector.

Sol. Here, firstly draw an angle of measure 90^o and then construct its bisector. For this, we use the following steps:

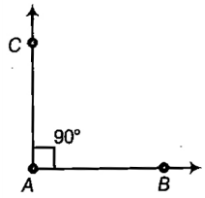
Step I Draw $\overline{AB}$ of any length. Place the centre of the protractor at A and the zero edge along $\overline{AB}$.



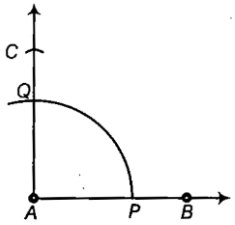
Step II Start with zero near B. Mark point C at 90^o.



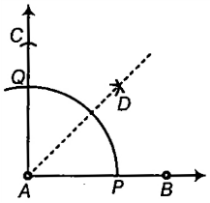
Step III Join AC. Then, $\angle BAC$ is an angle of measure 90^o.



Step IV With P as centre and using compasses, draw an arc whose radius is more than half of the length of PQ.



Step V With the same radius and with Q as centre, draw another arc in the interior of $\angle A$, which intersects the previous arc at D. Join $\overline{AD}$. Then, $\overline{AD}$ is the required bisector of $\angle A$,



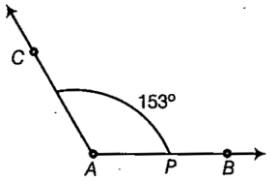
4. Draw an angle of measure of 153^o and divide it into four equal parts.

Sol. Here, to divide an angle of measure 153^o into four equal parts, we use the following steps.

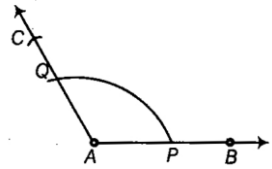
Step I Draw $\overline{AB}$ of any length. Place the centre of the protractor at A and the zero edge along $\overline{AB}$.

Step II Start with zero near B. Mark point Cat 153^o.

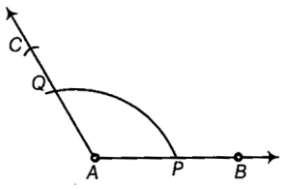
Step III Join AC, then $\angle BAC$ is an angle of measure 153^o.



Step IV With A as centre and using compasses, draw an arc that cuts both rays of $\angle A$ at P and Q.

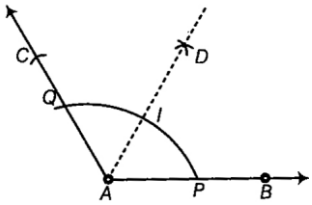


Step V With P as centre, draw (in the interior of $\angle A$) an arc whose radius is more than half the length of PQ.



Step VI With the same radius and with Q as centre, draw another arc in the interior of $\angle A$. Let the two arcs intersect at O.

Join $\overline{AD}$. Let $\overline{AD}$ cut the arc PQ at J. Then, $\overline{AD}$ divides the $\angle BAC$ in two equal parts.

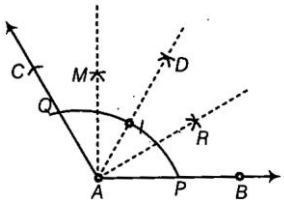


Step VII Now, with P and I as centre and with radius more than half of length PI, draw two arcs respectively, which cut each other at R.

Step VIII Join $\overline{AR}$. Then, $\overline{AR}$ divides $\angle BAD$ into two equal parts.

Step IX Now, with Q and I as centre and with radius more than half of length QI, draw two arcs respectively, which cut each other at M.

Step X Join $\overline{AM}$. Then, divide $\angle CAD$ into two equal parts.



Thus, $\overline{AM}, \overline{AD}$ and $\overline{AR}$ divide $\angle BAC$ into four equal parts.

5. Construct with ruler and compasses, angle of the following measures.

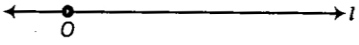
(a) 60^o **(b)** 30^o

(c) 90^o **(d)** 120^o

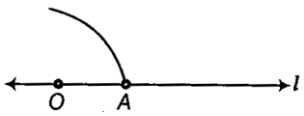
(e) 45^o **(f)** 135^o

Sol. (a) For constructing an angle of 60^o, we use the following steps of construction:

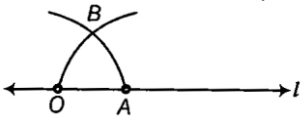
Step I Draw a line l and mark a point O on it.



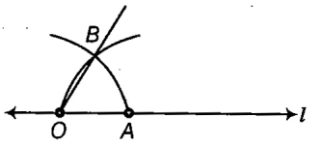
Step II Place the pointer of the compasses at O and draw an arc of convenient radius which cuts the line I at a point say A.



Step III With the pointer at A (as centre), now draw an arc that passes through O.

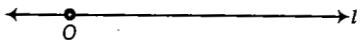


Step IV Let the two arcs intersect at B. Join OB. Then, we get $\angle BOA$, whose measure is 60^o.

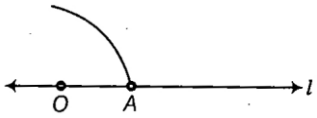


(b) For constructing an angle of 30^o, we firstly construct an angle of 60^o and then bisect it. Here, we use the following steps of construction:

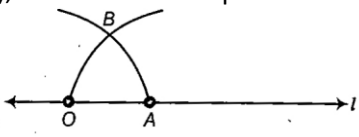
Step I Draw a line I and mark a point O on it.



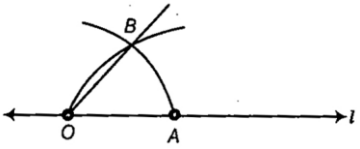
Step II Place the pointer of the compasses at O and draw an arc of convenient radius which cuts the line l at a point, say A.



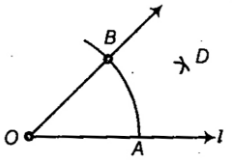
Step III With the pointer at A (as centre), draw an arc that passes through O.



Step IV Let the two arcs intersect at B. Join OB. Then, we get $\angle BOA$, whose measure is 60.

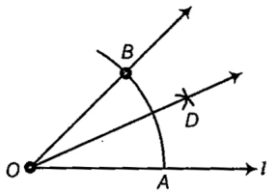


Step V With A as centre, draw (in the interior of $\angle AOB$ an arc, whose radius is more than half the length of AB).



Step VI With the same radius and with B as centre, draw another arc in the interior of $\angle O$. Let the two arcs intersect at D.

Join OD. Then, $\overline{OD}$ is the bisector of $\angle BOA$.

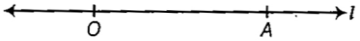


Thus, we get $\angle BOD$ and $\angle AOD$, which are equal in measure.

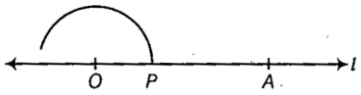
On measuring, $\angle BOD = \angle AOD = 30^o$.

(c) To draw an angle of measure 90^o, we use following steps of construction:

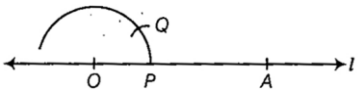
Step I Draw a line I and mark point O and A on it.



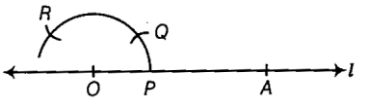
Step II Place the pointer of the compasses at O and draw an arc of convenient radius which cuts the line I at a point P.



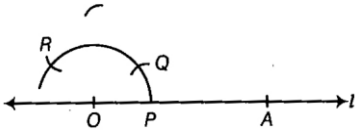
Step III Without disturbing the radius on the compasses, draw an arc with P as centre which cuts the first arc at Q.



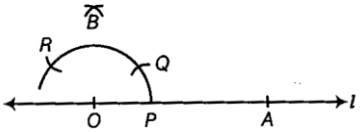
Step IV Again, without disturbing the radius on the compasses and with Q as centre, draw an arc which cuts the arc(drawn in Step II) at R.



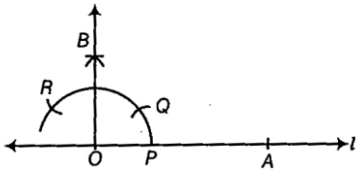
Step V Now, with Q as centre and with radius more than half of length RQ draw an arc.



Step VI Without disturbing the radius on the compasses, draw another arc with R as centre, which cuts the arc draw in Step V at B.



Step VII Join OB. Then, we get $\angle BOA$ which is of measure 90^o.

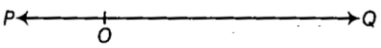


(d) To draw an angle of measure 120^o, use the following steps of construction :

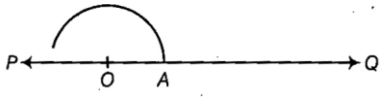
An angle of 120^o is nothing but twice of an angle of 60^o.

Therefore, it can be constructed by using the following steps of construction.

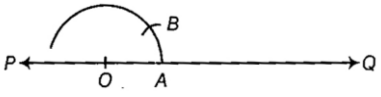
Step I Draw any line PQ and take a point O on it.



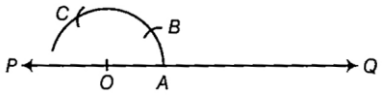
Step II Place the pointer of the compasses at O and draw an arc of convenient radius which cuts the line at A.



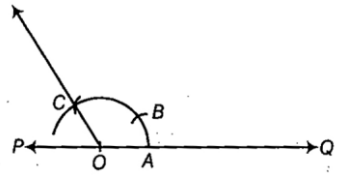
Step III Without disturbing the radius on the compasses, draw an arc with A as centre, which cuts the first arc at B.



Step IV Again, without disturbing the radius on the compasses and with B as centre, draw an arc which cuts the first arc(drawn in Step II) at C.

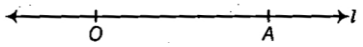


Step V Join OC, Thus, $\angle COA$ is the required angle, whose measure is 120^o.

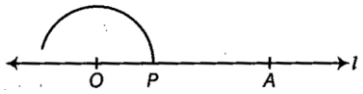


(e) To draw an angle of measure 45^o, we use the following steps of construction:

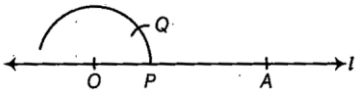
Step I Draw a line I and mark points O and A on it.



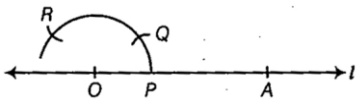
Step II Place the pointer of the compasses of O and draw an arc of convenient radius, which cuts the line I at a point P.



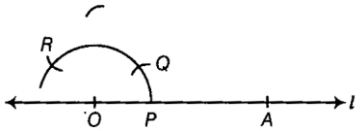
Step III Without disturbing the radius on the compasses, draw an arc with P as centre, which cuts the first arc at Q.



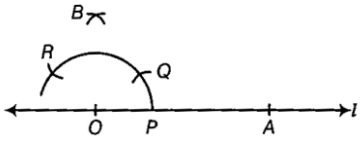
Step IV Again without disturbing the radius on the compasses and with Q as centre, draw an arc, which cuts the first arc(drawn in Step II) at E.



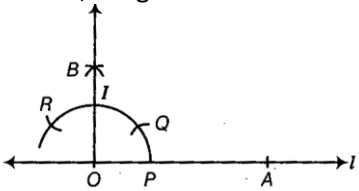
Step V Now, with Q as centre and with radius more than half of length RQ draw an arc.



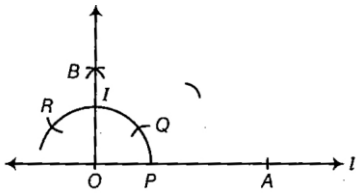
Step VI Without disturbing the radius on the compasses, draw another arc with R as centre, which cut the arc drawn in Step V at B.



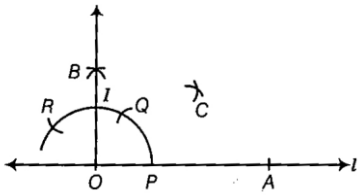
Step VII Join OB, let it cut the arc QR at *I*. Then, we get $\angle BOA$ which is of measure 90^o.



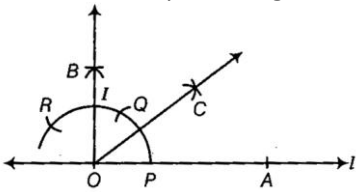
Step VIII Now, with P as centre and with radius more than half of length PI, draw an arc.



Step IX Without disturbing the radius on the compasses, draw another arc with I as centre which cuts the arc drawn in Step VIII at C.



Step X Join OC. Then, we get $\angle COA$ which is the required angle of measure 45^o.



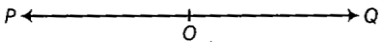
(f) To construct an angle of measure 135^o, we use the followingsteps of construction:

TIPS

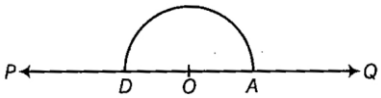
We know that, $135^o = 120^o + 15^o = 120 + \frac{30^o}{2} = 120^o + \frac{(150^o - 120^o)}{2}$.

So, firstly construct an angle of 120^o and then angle of 150^o. Then, bisect the angle between 120^o and 150^o to get required angle of measure 135^o.

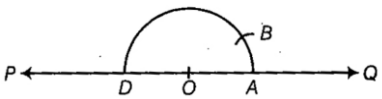
Step I Draw any line PQ and take a point O on it.



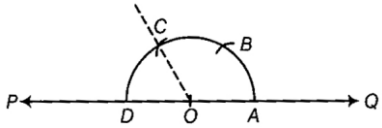
Step II Place the pointer of the compasses at O and draw an arc of convenient radius which cuts the line at A and D.



Step III Without disturbing the radius of the compasses, draw an arc with A as centre, which cuts the first arc at B.



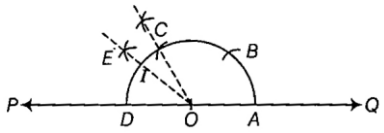
Step IV Again, with the same radius draw an arc with B as centre which cuts the first arc (as drawn in Step II) at C. Join OC by dotted line. Then, we get $\angle COQ = 120^o$.



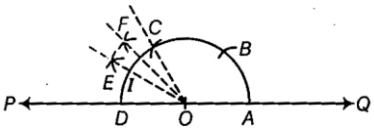
Step V Now, with C and D as centre and radius more than half of length CD, draw arcs which cut each other at E.

Join OE by dotted line, we get $\angle EOQ = 150^o$.

Also, OE cuts the arc CD at 7.



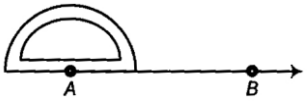
Step VI With C and l as centre and radius more than half of length CI, draw arcs which cut each other at F. Join OF. Then, we get $\angle FOQ = 135^o$



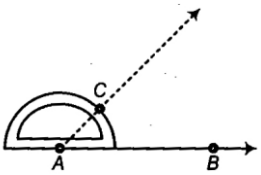
6. Draw an angle of measure 45^o and bisect it.

Sol. Here we use the following steps of construction:

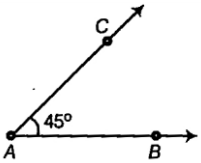
Step I Draw $\overline{AB}$ of any length. Place the centre of the protractor at A and the zero edge along $\overline{AB}$.



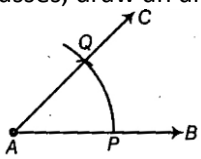
Step II Start with zero near B, mark point Cat 45^o.



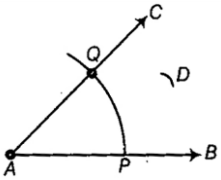
Step III Join AC. Then, $\angle BAC$ is an angle of measure 45^o.



Step IV Now, with A as centre and using compasses, draw an arc that cuts both rays of $\angle A$ at P and Q.

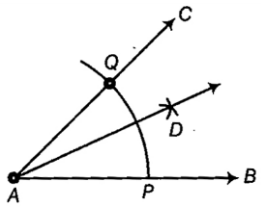


StepV With P as centre, draw (in the interior of $\angle A$) an arc whose radius is more than half the length of PQ.



Step VI With the same radius and with Q as centre, draw another arc in the interior of $\angle A$. Let the two arcs intersect at D.

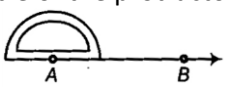
Join $\overline{AD}$ Then, $\overline{AD}$ is the required bisector of $\angle A$.i.e. angle bisector of angle 45^o.



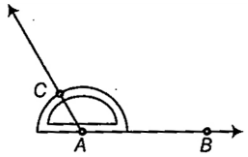
7. **Draw an angle of measure 135^o and bisect it.**

Sol. Here, to bisect an angle of 135^o, we use the following steps of construction:

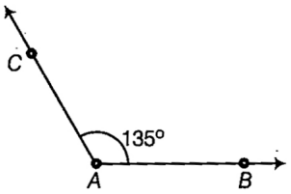
Step I Draw $\overline{AB}$ of any length. Place the centre of the protractor at A and the zero edge along $\overline{AB}$.



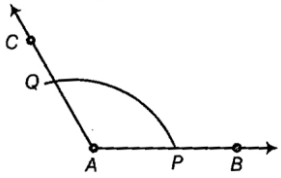
Step II Start with zero near A. Mark point C at 135^o.



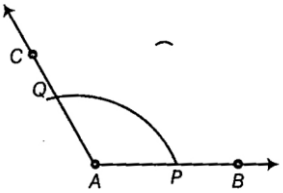
Step III Join AC. Then, $\angle BAC$ is an angle of measure 135^o.



Step IV With A as centre and using compasses, draw an arc that cuts both sides of $\angle A$ at points P and Q.

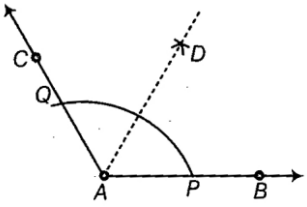


Step V With P as centre, draw (in the interior of $\angle A$) an arc, whose radius is more than half of length **PQ.**



Step VI With the same radius and with Q as centre, draw another arc in the interior of $\angle A$. Let the two arcs intersect at D.

Join $\overline{AD}$. Then, $\overline{AD}$ is the required bisector of i.e. $\angle BAC = 135^o$.



8. **Draw an angle of 70^o . Make a copy of it using only as traight edge and compasses.**

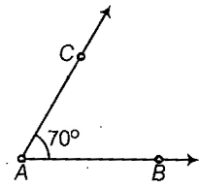
Sol. To draw an angle of measure 70^o , we use the following steps of construction:

Step I Draw $\overline{AB}$ of any length. Place the centre of the protractor at A and the zero edge along $\overline{AB}$.

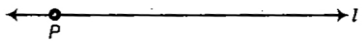
Step II Start with zero near B. Mark point Cat 70^o .

Step III Join AC. Then, $\angle BAC$ is an angle of measure 70^o .

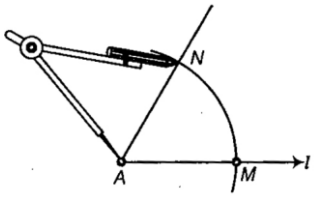
Now, to draw a copy of 70^o , by using straight edge and compasses, we use the following steps of Construction :



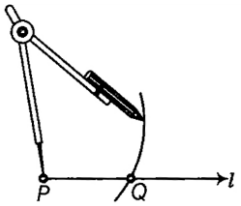
Step IV Draw a line I and choose a point P on it.



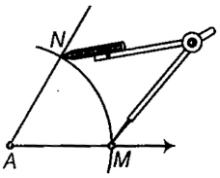
Step V Place the pointer at A and draw an arc to cut the rays of $\angle A$ at M and N.



Step VI Use the same compasses setting to draw an arc with P as centre, cutting I at Q.

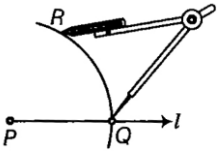


Step VII Set your compasses to the length of MN.



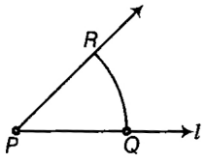
Step VIII Without disturbing the compasses.

Place the compasses pointer at Q and draw an arc at R to cut the arc drawn in Step VI.



Step IX Join PR, then give us $\angle RPQ$. It has the same measure as $\angle BAC$.

Hence $\angle RPQ$ is required copy of an angle of measure 70^o .



9. Draw an angle of 40^o. Copy its supplementary angle.

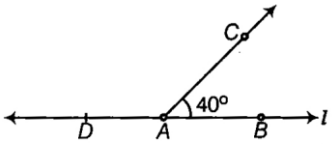
Sol. To draw an angle of measure 40^o, we use the following steps:

Step I Draw a line I and mark three points D, A and B on it.

Place the centre of the protractor at A and the zero edge along $\overline{AB}$.

Step II Start with zero near B, mark point Cat 40^o.

Step III Join AC. Then, $\angle BAC$ is an angle of measure 40^o.

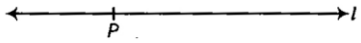


We know that, the sum of two supplementary angles is 180^o and I is a straight line.

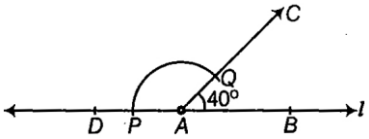
So, $\angle BAC + \angle DAC = 180^o$ i.e. $\angle DAC$ is the supplementary angle of $\angle BAC$.

Now, to draw the supplementary of an angle 40^o, we use the following steps of construction :

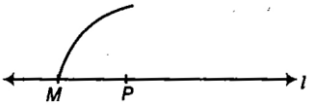
Step IV To copy $\angle DAC$, draw a line I and choose a point P on it.



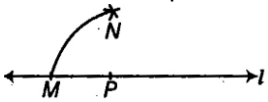
Step V Place the compasses at A and draw an arc to cut the rays of DAC at P and Q, respectively.



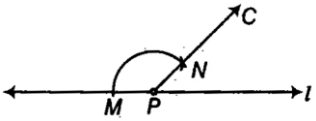
Step VI Use the same compasses setting to draw an arc with P as centre, which cuts the line I at M.



Step VII Set your compasses to the length PQ. Then, without disturbing the setting of compasses. Place the compasses pointer at M and draw the arc which cuts the previous arc(drawn in Step VI at N).



Step VII Join MN. Then, we get $\angle MPN$ which is the copy of $\angle DAC$ i.e. supplementary angle of 40^o.

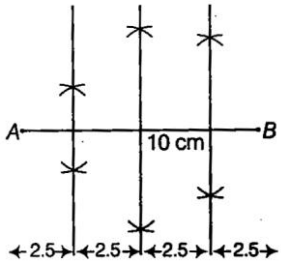


1. Draw a line segment of length 10 cm. Divide it into four equal parts. Measure each of these parts.

Sol. To draw a line segment, we use following steps of construction:

Step I Firstly, we draw a line segment (AB) of length 10 cm.

Step II By the help of compasses and ruler bisect the line segment and join both the points with line segment.

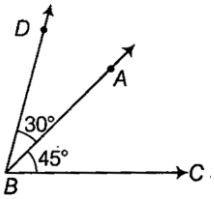


Step III By the help of bisector of theline segment either side of line is also bisected by the ruler andcompasses.

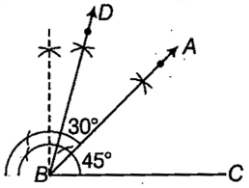
Step IV Both bisector points of either side is joined.

Step V By the help of ruler, we measure the each part of bisectedline segment and each part is measured of length2.5 cm.

2. Draw an $\angle ABC$ of measure 45^o, using ruler and compasses. Now, draw an $\angle DBA$ of measure 30^o, using ruler and compasses as shown in figure. What is the measure of $\angle DBC$?



Sol. To draw an angle, we use following steps of construction:



Step I Draw a line segment BC of any length.

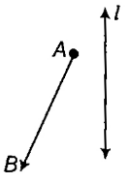
Step II Place the compasses pointer at B and draw a right angle (90^o).

Step III Right angle (90^o) is also bisected in 45^o $(\angle ABC)$ by the help of ruler and compasses.

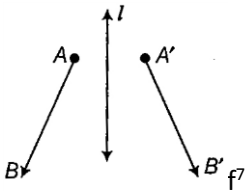
Step IV Place the compasses pointer at B and draw an angle of $(\angle DBA)30^o$ between the right angle and bisected angle.

Step V By the help of protractor, we get $\angle DBC = 75^o$.

3. Draw the images of points A and B in line l of figure and name them as A' and B', respectively. Measure AB and A' B'. Are they equal?



Sol.

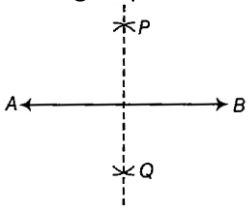


f7

Yes, they are equal because by the rule of reflection of symmetry, theimage of points. AandB in the line (l) is the points A' and B' and bothare equal in length. Lines are measured by the help of ruler.

4. Draw a line segment of length 6 cm. Construct itsperpendicular bisector. Measure the two parts of the linesegment.

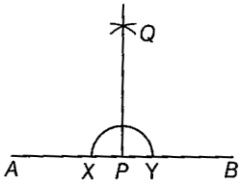
Sol. To draw a perpendicular bisector, we use following steps ofconstruction:



Step I Firstly, we draw a line segment AB of length 6 cm.
Step II With A and B as centre, draw arcs which intersect atpoints P and Q.
Step III Join PQ, thus PQ is perpendicular to line segment AB.
Step IV Measure the two parts of line segments with the help of ruler, it comes out to be 3 cm each.

5. Bisect a straight angle, using ruler and compasses. Measure each part.

Sol. To bisect a straight angle, we use following steps of construction:
Step I Firstly, draw a line of any length say AB.
Step II WithP as centre, draw an arc which bisects the line at XandY.
Step III WithX and Y as centres, draw two arcs which cut eachother at Q.
Step IV Join PQ, thus PQ is a bisector of straight angle.
Step V By the help of protractor, the measure of the angle is 90^o



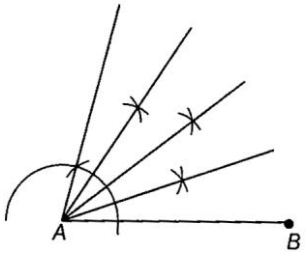
6. Draw an angle of 60^o, using ruler and compasses anddivide it into four equal parts. Measure each part.

Sol. To draw an angle of 60^o, using ruler and compasses, we use thefollowing steps of construction:

Step I Firstly, draw a line segment of any length.

Step II Place the compasses pointer at point A and draw an angle of 60^o by the help of ruler and compasses.

Step III Place the pointer at point A and bisect the angle.



Step IV Either side of bisected angle is also bisected by the helpof ruler and compasses.

Step V Measure the bisected angles with the help of protractor, each comes out to be of 15^o

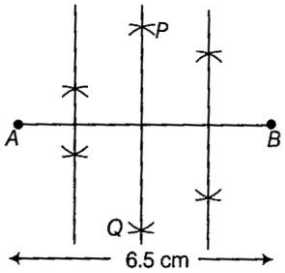
7. Draw a line segment of length 6.5 cm and divide it intofour equal parts, using ruler and compasses.

Sol. Here, are the steps of construction:

Step I Firstly, draw a line segmentAB of length 6.5 cm.

Step II Place the compasses pointer atpoints A and B and cut the arcs at points P and Q Join PQ and it is the bisector of line segment AB.

Step III The either sides of bisector length is also bisected by the help of ruler and compasses.



Step IV Join the arc points.

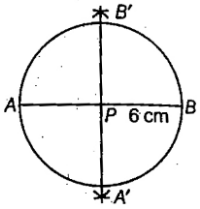
Step V Hence, the line segment AB is divided into four equalparts by using ruler and compasses.

8. Draw a circle of radius 6 cm, using ruler and compass.Draw one of its diameters. Draw the perpendicular bisectorof this diameter. Does this perpendicular bisector containanother diameter of the circle?

Sol. To draw a circle, we use the following steps of construction:

Step I Firstly, draw a circle of radius 6 cm with the help of ruler and compasses,

StepII Draw a diameter of 12 cm length in circle.



Step III Place the compasses pointer at points

A and B and draw an arc at A' and B'. Join A' B' which intersects at P point of diameter.Thus, A' B is perpendicular at line segment AB.

Hence, the same circle is also draw by same length of diameter A' B’.

9. Draw an angle of 65^o and draw an angle equal to thisangle, using ruler and compasses.

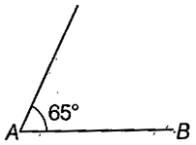
Sol. Here, are the steps of construction:

Step I Firstly, draw an angle of 65^o, by using protractor.

Step II Draw a line segment AB of any length.

Step III Place the pointer at point A and cut an arc with reference point.

Step IV Join the cut arc at point A.



Hence, the given angle is of 65^o.

10. Draw an angle of 80^o, using a protractor and divide itinto four equal parts, using ruler and compasses. Checkyour construction by measurement.

Sol. Here, to divide an angle of measure 80^o into four equal parts, we use the following steps of construction:

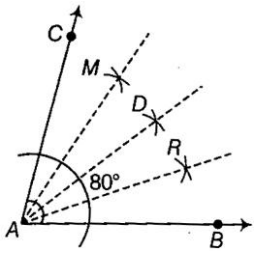
Step I Draw $\overline{AB}$ of any length. Place the centre of the protractor at A and the zero edge along $\overline{AB}$.

Step II Start with zero near B. Mark Cat 80^o.

Step III Join AC, then $\angle BAC$ is an angle of measure 80^o.

Step IV With A as centre and using compasses, draw an arc that cuts both rays of ZA at P and Q.

Step V With P as centre, draw (in the interior of $\angle A$) an arc whose radius is more than half the length of PQ.



Step VI With the same radius with Q as Acentre, draw another arc in the interior of $\angle A$ Let the two arcs intersect at D. Let thetwo arcs intersect at D. Join $\angle A$ which cuts the arc PQ and I. Then, AD divides the $\angle BAC$ in two equal parts.

Step VII Now taking P and I as centre, having radius more thanhalf of length PJ, draw two arcs respectively, which cuteach other at A

Step VIII Join $\overline{AR}$, which divides $\angle BAC$ into two equal parts.

Step IX Now taking Q and I as centre, having radius more thanhalf of length QI, draw two arcs respectively, which cuteach other at M.

Step X Join $\overline{AM}$ Then, divide $\angle CAD$ into two equal parts.

Thus $\overline{AM}, \overline{AD}$ and $\overline{AR}$ divide $\angle BAC$ into four equal parts.

11. Draw a line segment of length 7cm. Draw itsperpendicular bisector, using ruler and compasses.

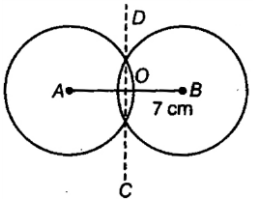
Sol. To draw a perpendicular bisector of line segment of length 7 cm. Weuse the following steps of construction:

Step I Firstly, draw a line segment AB of length 7cm.

Step II With A as centre, using compasses, draw a circle. Theradius of circle should be more than half the length of $\overline{AB}$.

Step III With the same radius and with B as centre draw anothercircle using compasses. Let it cut the previous circle at Cand D.

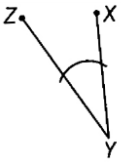
Step IV Join CD. It cuts $\overline{AB}$ at O.



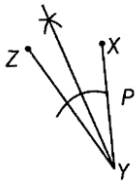
Use your divider to verify that O is the mid-point of $\overline{AB}$. Also, verify that $\angle COA$ and $\angle COB$ are right angles.

Therefore, $\overline{CD}$ is the perpendicular bisector of $\overline{AB}$.

12. Bisect $\angle XYZ$ in figure given below.



Sol.



In the given figure, firstly cut the arc by compasses from point P and bisect as the shown in figure.

Direction In questions 13 to 15 four options are given choose the correct answer.

13. The instrument in the geometry box having the shape of a triangle is called a

(a) protractor **(b) compasses**

(c) divider **(d) set-square**

Sol. Set-square has the shape of triangle.

Hence, option (d) is correct.

14. The instrument to draw a circle is

(a) ruler **(b) protractor**

(c) divider **(d) compasses**

Sol. Compasses is used to draw a circle by the help of ruler.

Hence, option (d) is correct.

15. The instrument to measure an angle is a

(a) ruler **(b) protractor**

(c) divider **(d) compasses**

Sol. Protractor is used for measuring an angle.

Hence, option (b) is correct.