

CHAPTER 14

GEOMETRIC CONSTRUCTIONS

1. Construct line segments whose lengths are:

(i) 4.8 cm

(ii) 12 cm 5 mm

(iii) 7.6 cm

Solution:

(i) 4.8 cm

Construct a line L on a paper and mark A on it.

Now place the metal point of the compass at zero mark of the ruler.

Make adjustments in the compass such that the pencil point is at 4.8 cm mark on the ruler.

Take compass on L such that its metal point is on A.

Now mark a small mark as B on L which is corresponding to the pencil point of the compass.

Here, AB is the required line segment of length 4.8 cm.



(ii) 12 cm 5 mm

Construct a line L on a paper and mark A on it.

Now place the metal point of the compass at zero mark of the ruler.

Make adjustments in the compass such that the pencil point is at 5 small points from the mark of 12 cm to 13 cm on the ruler.

Take compass on L such that its metal point is on A.

Now mark a small mark as B on L which is corresponding to the pencil point of the compass.

Here, AB is the required line segment of length 12 cm 5 mm.



(iii) 7.6 cm

Construct a line L on a paper and mark A on it.

Now place the metal point of the compass at zero mark of the ruler.

Make adjustments in the compass such that the pencil point is at 6 small points from the mark of 7 cm to 8 cm of the ruler.

Take compass on L such that its metal point is on A.

Now mark a small mark as B on L which is corresponding to the pencil point of the compass.

Here, AB is the required line segment of length 7.6 cm.



2. Construct two segments of length 4.3 cm and 3.2 cm. Construct a segment whose length is equal to the sum of the lengths of these segments.

Solution:

With the help of compass and ruler, construct AB and CD of lengths 4.3 cm and 3.2 cm.

Construct a line L and mark P on it.

Now place the metal point of the compass at zero mark of the ruler.

Make adjustments in the compass such that the pencil point reaches the point B.

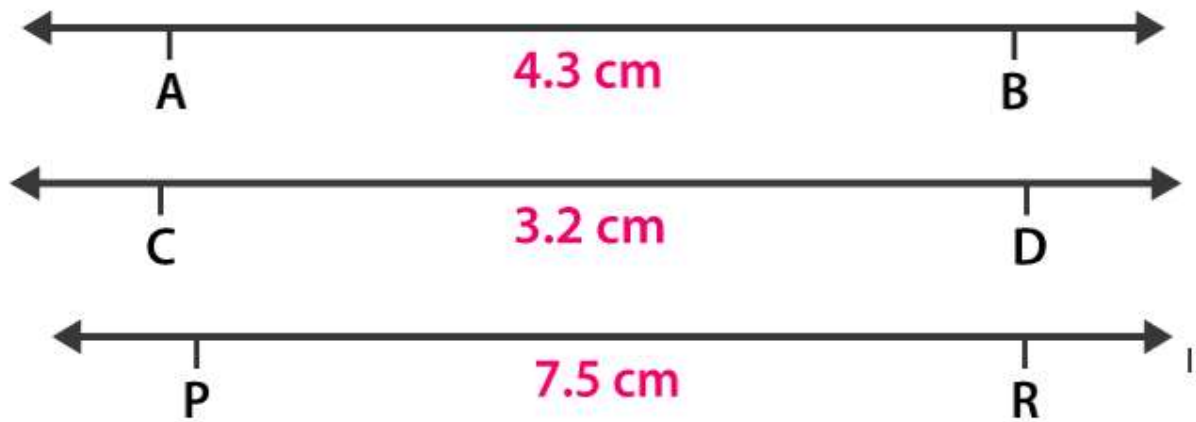
Take compass on L such that its metal point is on P.

Now mark a small mark as Q on the line L corresponding to the pencil point of the compass.

Reset the compass so that its metal and pencil points are on C and D.

Take compass on L such that its metal point is on Q and the pencil point makes a small mark as R which is opposite to P on L.

Here, PR is the required segment whose length is equal to the sum of the lengths of these segments.



3. How many lines can be drawn which are perpendicular to a given line and pass through a given point lying

(i) outside it?

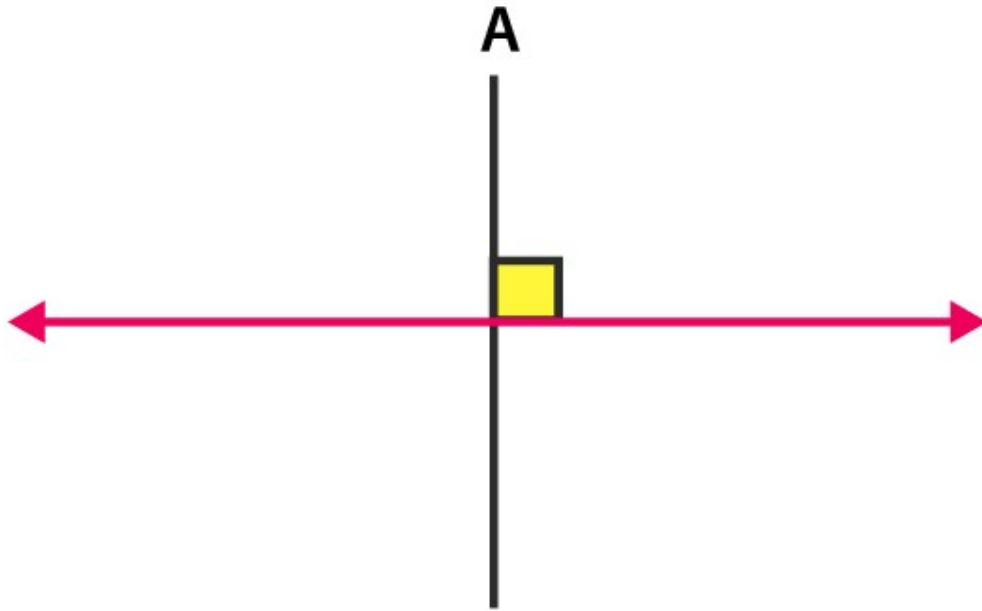
(ii) on it?

Solution:

(i) We know that a line perpendicular from a given point to a given line is the shortest distance between them.

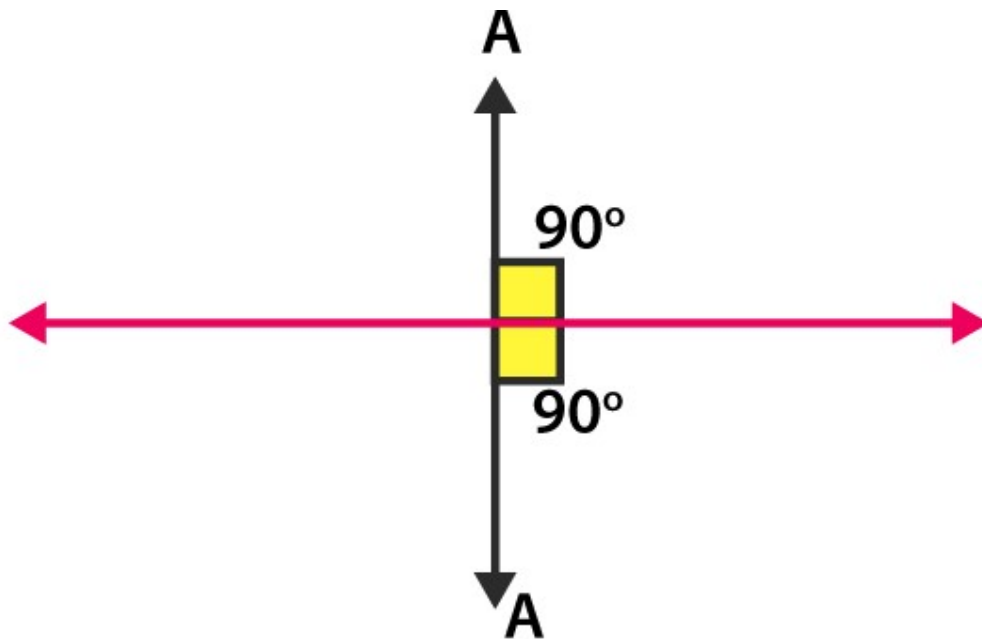
Here only one shortest distance is possible.

Therefore, only one perpendicular line is possible from a given point lying outside it.



(ii) We can draw only one perpendicular line from any point on the line.

Therefore, only one perpendicular line can be drawn from a given point lying on it.



4. Draw a line PQ. Take a point R on it. Draw a line perpendicular to PQ and passing through R.

(Using (i) ruler and a set-square (ii) ruler and compasses)

Solution:

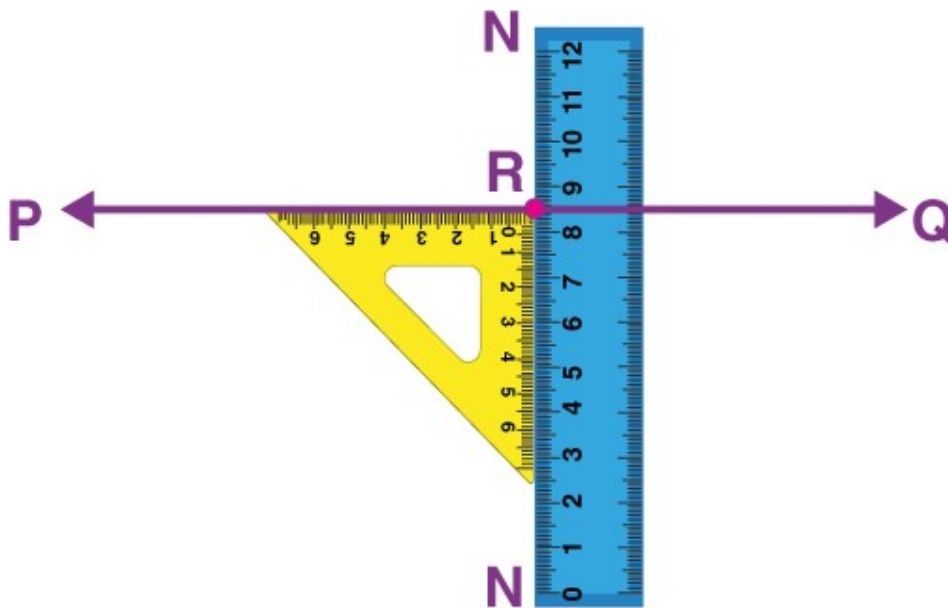
(i) Construct a line PQ and mark a point R on it.

Now place the set square with its one arm of the right angle along the line PQ.

Place the ruler along its edge without disturbing the position of set square.

Remove the set square without disturbing the position of the ruler and construct a line MN through R.

Here, MN is the required line which is perpendicular to PQ through the point R.



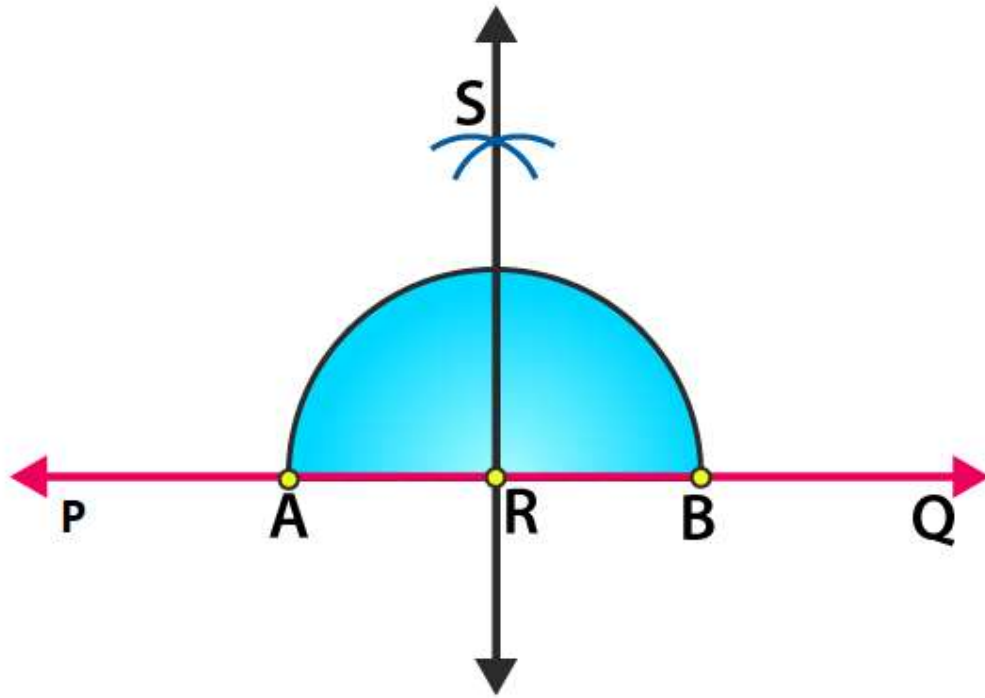
(ii) Construct a line PQ and mark R on it.

Considering R as the centre and measuring convenient radius, draw an arc which touches the line PQ at A and B.

Considering A and B as centres and radius which is greater than AR, draw two arcs which cut each other at the point S.

Now join the points RS and extend in both directions.

Here, RS is the required line which is perpendicular to PQ through the point R.



5. Draw a line l . Take a point A , not lying on l . Draw a line m such that $m \perp l$ and passing through A .

(Using (i) ruler and a set-square (ii) ruler and compasses)

Solution:

(i) Construct a line L and mark a point A outside it.

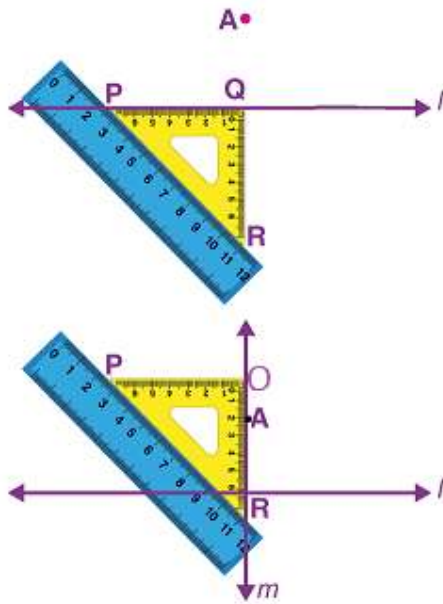
Now place the set square PQR with its one arm PQ of the right angle along the line L .

Place the ruler along the edge PR without disturbing the position of set square.

Slide the set square along the ruler until its arm QR reaches A without disturbing the position of the ruler.

Draw a line m .

Here, line m is the required line which is perpendicular to the line L .

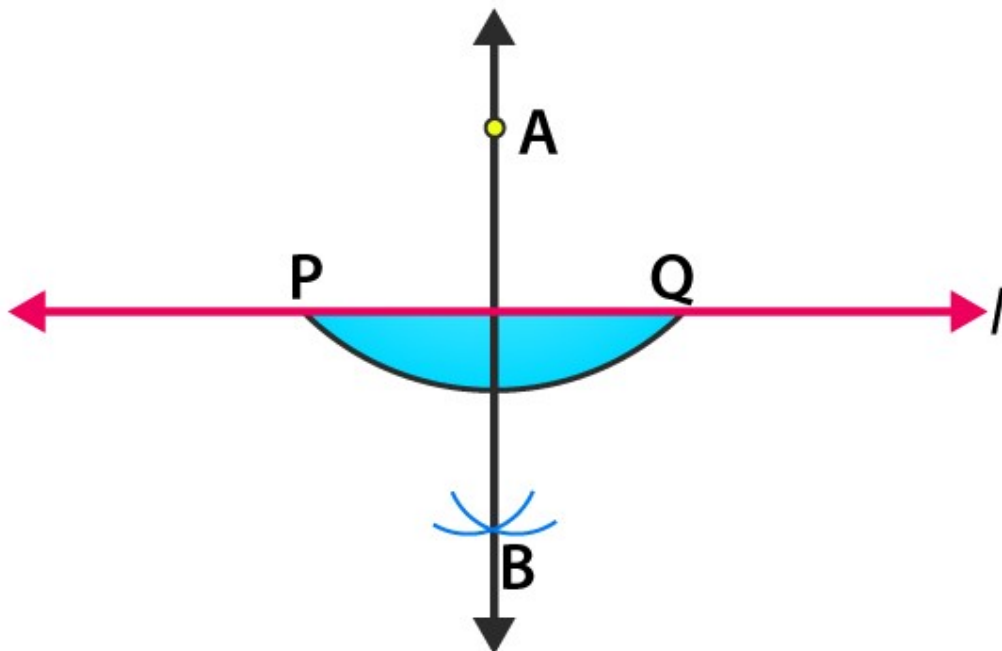


(ii) Considering A as centre, construct an arc PQ which intersects the line L at P and Q.

By taking P and Q as centres, draw two arcs which intersect each other at the point B.

Now join the points A and B and extend in both the directions.

Here, AB is the required line.



6. Draw a line AB and take two points C and E on opposite sides of AB. Through C, draw $CD \perp AB$ and through E draw $EF \perp AB$.

(Using (i) ruler and a set-square (ii) ruler and compasses)

Solution:

(i) Construct a line AB and mark two points C and E on the opposite sides of AB.

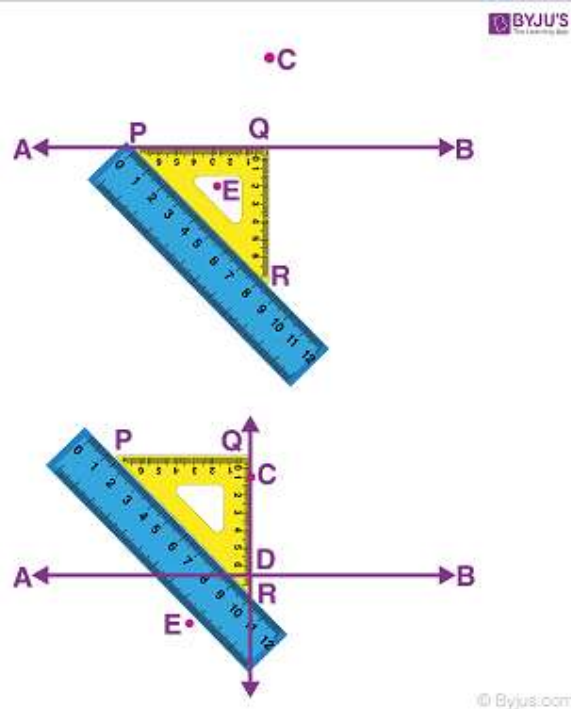
Place the set square PQR on the side E with its one arm PQ of the right angle along the line AB. Place the ruler along the edge PR.

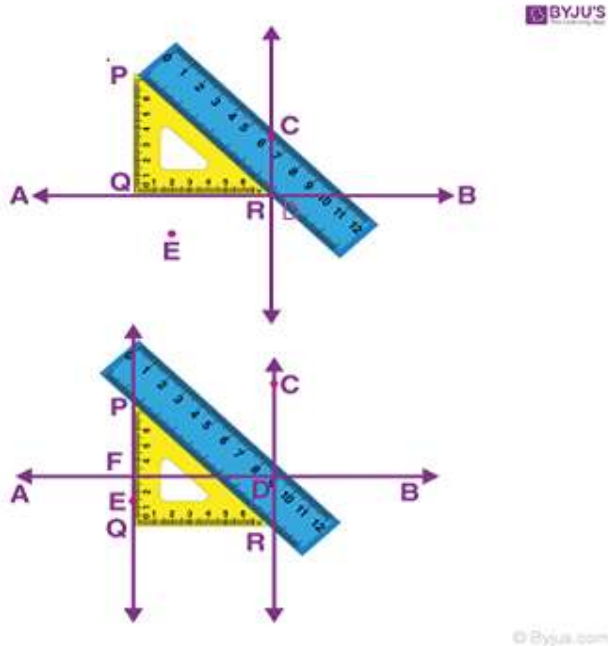
Slide the set square along the ruler until the arm QR reaches C.

Construct a line CD where D is a point on the line AB.

Here CD is the required line where $CD \perp AB$

Now follow the same steps using a set square on the side E, we construct a line $EF \perp AB$.





(ii) Construct a line AB and mark two points C and E on the opposite sides.

Considering C as centre, construct an arc PQ which intersects AB at P and Q.

Considering P and Q as centres, draw two arcs which intersect each other at the point H.

Now join the points H and C where HC crosses the line AB at the point D.

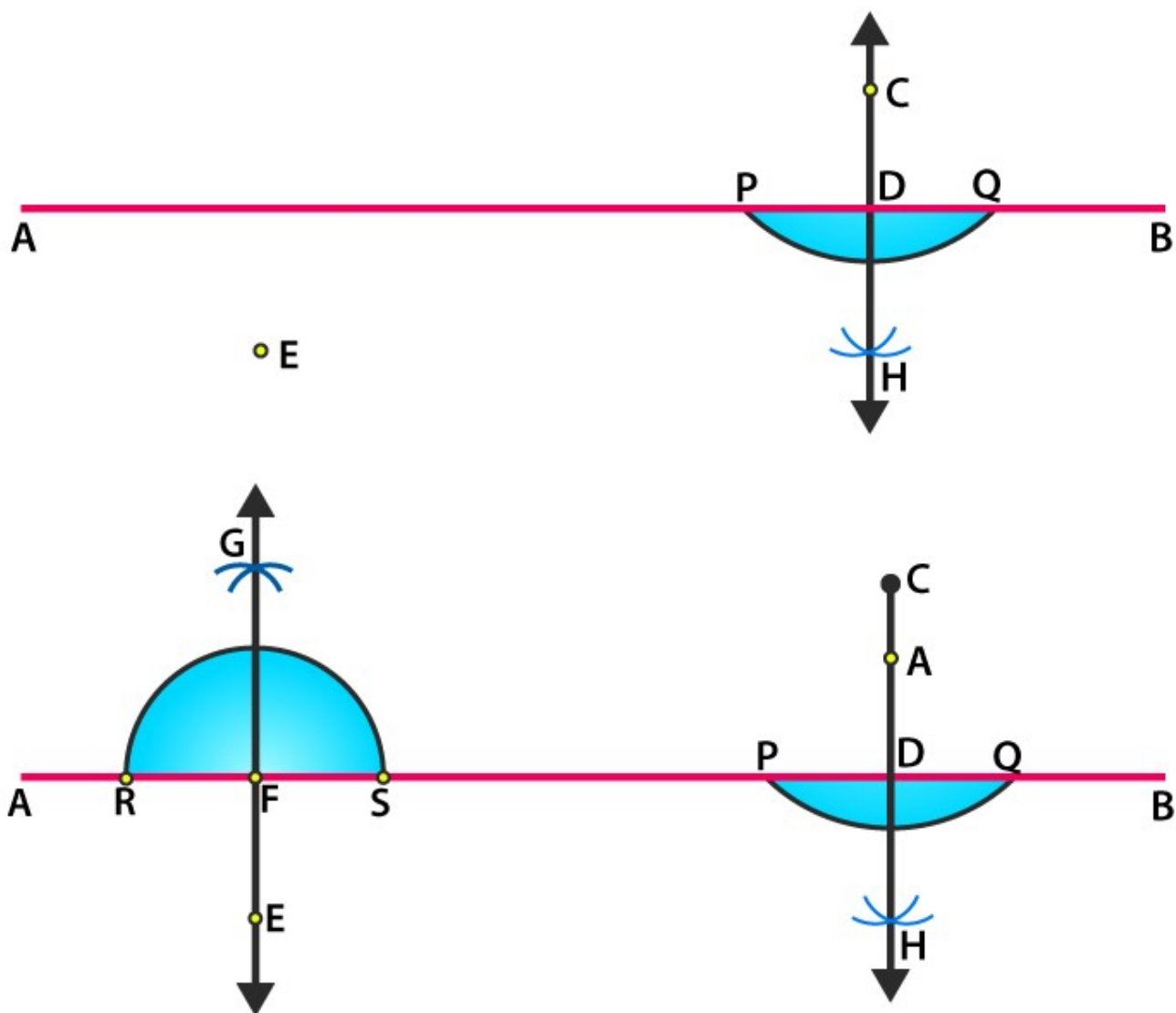
We know that $CD \perp AB$

In the same way, consider E as centre and construct an arc RS.

Considering R and S as centres, construct two arcs which intersect each other at the point G.

Now join the point G and E such that GE crosses the line AB at the point F

We know that $EF \perp AB$.



7. Draw a line segment AB of length 10 cm. Mark a point P on AB such that $AP = 4$ cm. Draw a line through P perpendicular to AB.

Solution:

Construct a line L and mark a point A on it.

With the help of a ruler and a compass mark a point B which is at 10 cm from the point A on the line L.

Here, AB is the required line segment of length 10 cm.

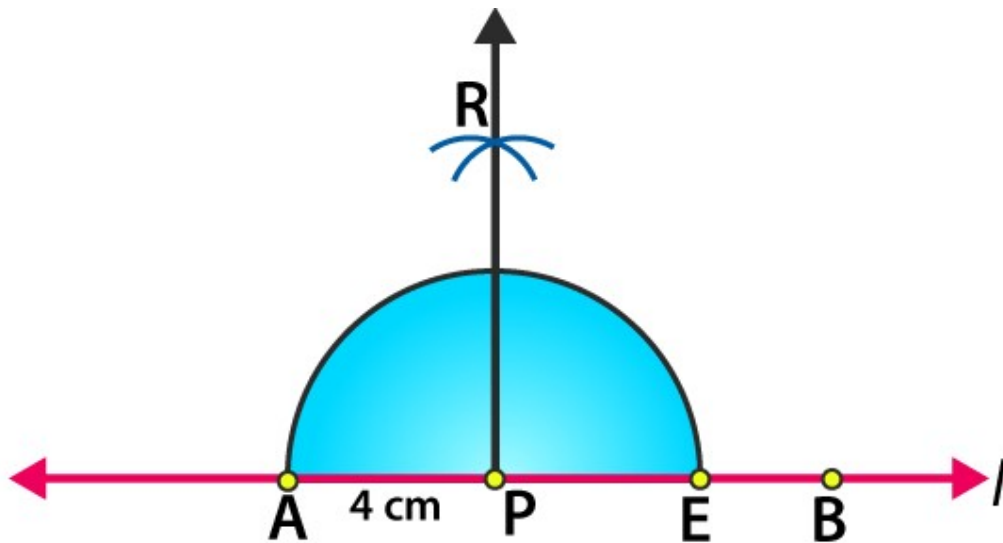
Now, mark a point P which is 4 cm from the point A in the direction of B.

Taking P as centre and radius 4 cm draw an arc which intersects the line L at A and E.

Taking A and E as centres and radius 6 cm draw two arcs which intersect each other at the point R.

Now join P and R and extend it.

Here, PR is the required line which is perpendicular to the line AB.



8. Draw a line segment PQ of length 12 cm. Mark a point O outside this segment. Draw a line through O perpendicular to PQ.

Solution:

Construct a line L and mark a point P on it.

With the help of a ruler and a compass mark a point Q on the line L having a length $PQ = 12$ cm

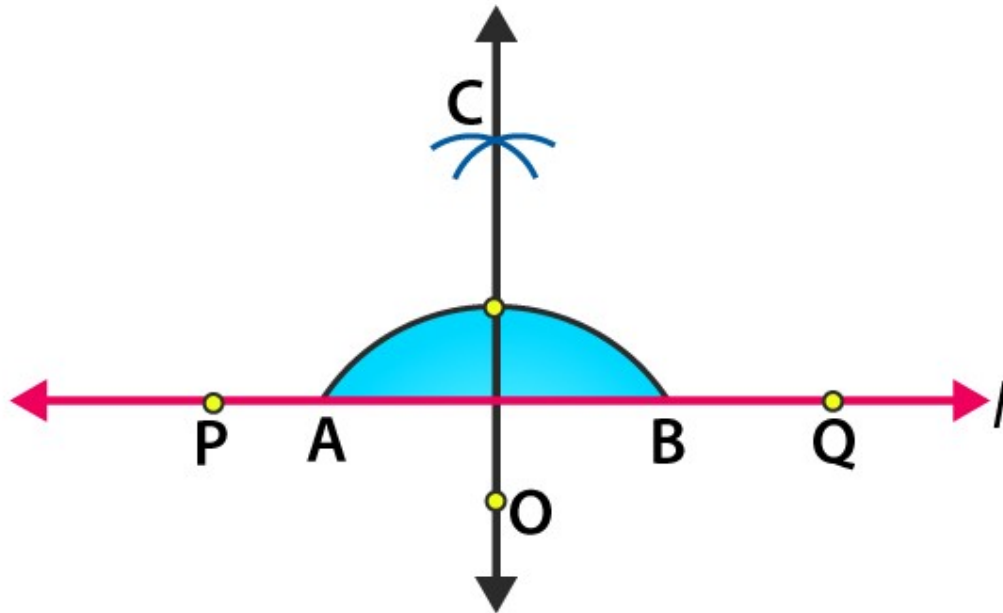
Now mark a point O outside the line PQ.

Taking O as centre, construct an arc having appropriate radius such that the arc cuts the line at A and B.

Considering A and B as centres, draw two arcs such that they intersect each other at the point C.

Join the points OC.

Here, OC is the required line which is perpendicular to the line PQ.



9. Using a protractor, draw $\angle BAC$ of measure 70° . On side AC, take a point P, such that $AP = 2$ cm. From P draw a line perpendicular to AB.

Solution:

Construct a line segment AC on the line L

(i) Place a protractor on the line segment AC such that it coincides with the line of diameter of protractor and the middle of the line coincides with A.

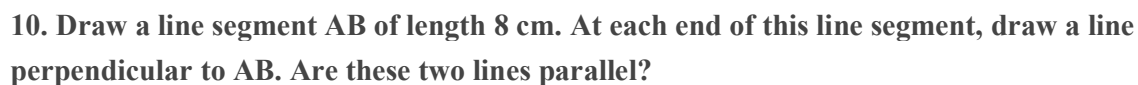
(ii) Now by counting from the right side, mark B as the point of 70° of the protractor and construct AB.

(iii) Measure 2 cm from the point A on the line segment AC and mark P.

(iv) Considering P as centre, construct an arc which intersects the line l at E and F.

(v) Considering the same radius and the points E and F as centres, draw two arcs which intersect G on the other side.

(vi) Join the points P and G.



(i) By taking a convenient radius with A as centre construct an arc which intersects the line at W and X.

(ii) Taking W and X as centres and radius which is greater than AW, draw two arcs which intersects each other at the point M.

(iii) Now join the points AM and extend in both directions to P and Q.

(iv) With B as centre and convenient radius construct an arc which intersects the line at Y and Z.

(v) Considering Y and Z as centres and radius which is greater than YB, draw two arcs which intersects each other at the point N.

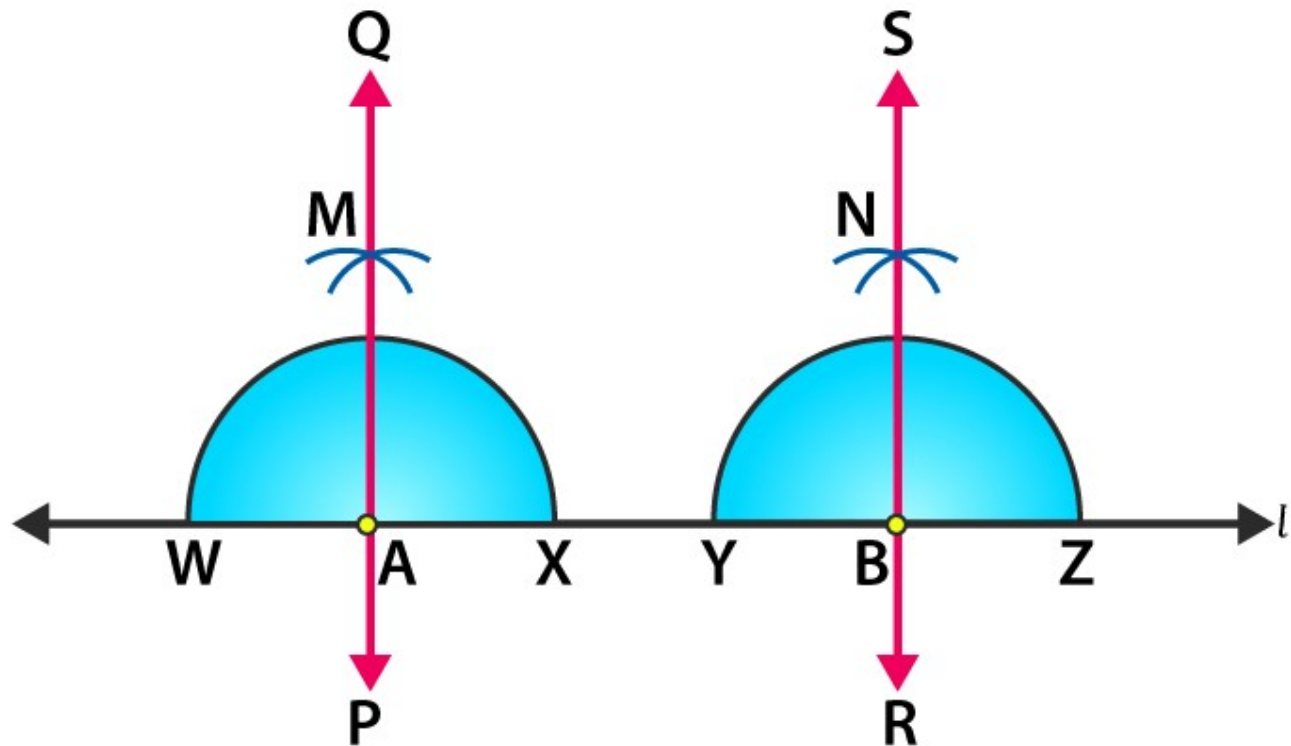
(vi) Now join the points BN and extend in both directions at the point S and R.

Consider the lines perpendicular to the points A and B be PQ and RS

We know that $\angle QAB = \angle ABR = 90^\circ$

Two alternate interior angles are equal when the two parallel lines are intersected by a third line.

Hence, PQ and RS are parallel.



11. Using a protractor, draw $\angle BAC$ of measure 45° . Take a point P in the interior of $\angle BAC$. From P draw line segments PM and PN such that $PM \perp AB$ and $PN \perp AC$, Measure $\angle MPN$.

Solution:

- (i) Construct a line segment AB on the line l .
- (ii) Place the protractor on the line segment AB such that it coincides with the line of the diameter of the protractor and the middle point of the line coincides with A .
- (iii) By counting from the right side, mark B as the point of 45° of protractor and construct AB .
- (iv) Taking P as centre and convenient radius draw an arc which intersects the line segment AB at points T and Q and AC at point R and S .
- (v) Taking T and Q as centres and same radius, draw two arcs which intersect at point G on the other side.

(vi) Taking R and S as centres and same radius, draw two arcs which intersect at point H on the other side.

(vii) Now join the points PG and PH which intersects the line segments AB and AC at points M and N.

By measuring $\angle MPN$ with the help of a protractor we get $\angle MPN = 135^\circ$.

