Chapter 14

Practical Geometry

SOLUTIONS:

Exercise 14.1

1. Draw a circle of radius 3.2 cm.

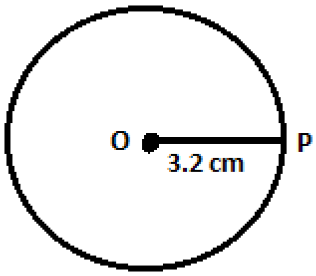
Solution:

Step 1: We mark point O as a centre.

Step 2: Open compass up to the given radius 3.2 cm.

Step 3: Place the pointer of compasses on 'O'.

Step 4: Now, turn the compasses slowly to draw the required circle.



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

Solution:

Step 1: We mark point O as centre.

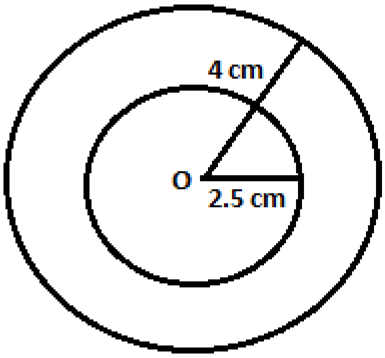
Step 2: Open the compasses and measure 4 cm.

Step 3: Place a pointer of compasses on 'O'.

Step 4: Turn the compasses slowly to draw the circle.

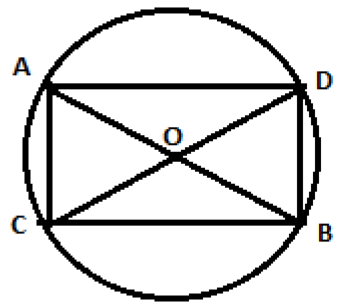
Step 5: Next, open the compasses and measure 2.5 cm.

Step 6: Again place a pointer of compasses on 'O' and turn the compasses slowly to draw the circle.

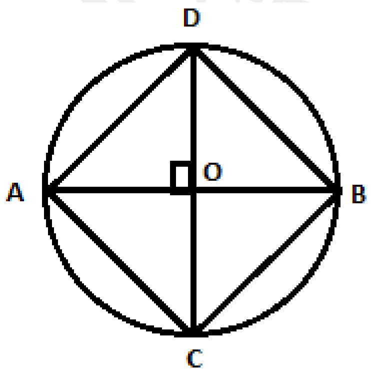


3. Draw a circle and any two of its diameters. If you join the ends of these diameters, what is the figure obtained? What figure is obtained if the diameters are perpendicular to each other? How do you check your answer?

Solutions:



Here, AB and CD are the two diameters of the circle. O is the centre. By joining the ends of the diameter i.e. AD, DB, BC and CA we get a figure of rectangle ADBC.



If the diameters are perpendicular to each other then we get a figure of square ADBC.

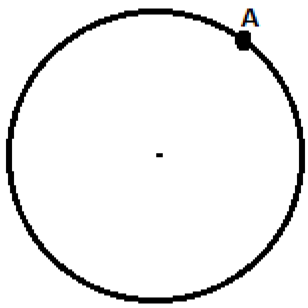
We can check the answer by measuring length of sides.

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

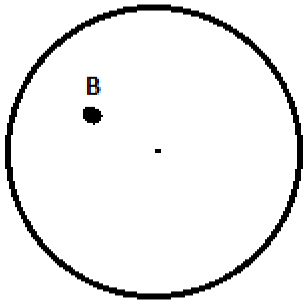
a) A is on the circle.
b) B is in the interior of the circle.
c) C is in the exterior of the circle.

Solutions:

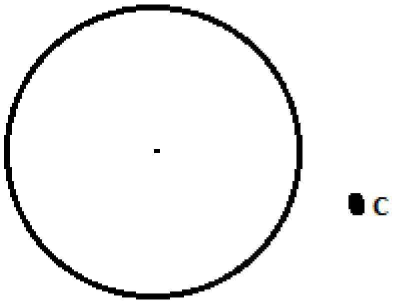
a)



b)

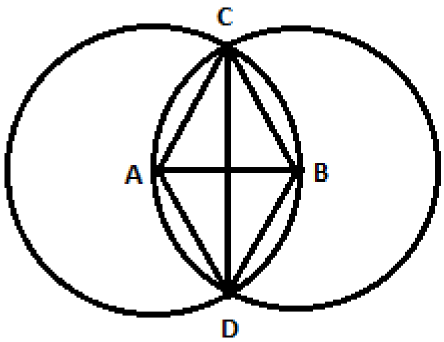


c)



5. Let A, 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.

Solution:



Here, points A and B are the centres of these circles and these circles are intersecting each other at points C and D respectively.

Now in quadrilateral ADBC, we may observe that, AD = AC [radius of circle centered at A]

And BC = BD [radius of circle centered at B]

As radius of both the circles are equal.

Therefore AD = AC = BC = BD Hence quadrilateral ADBC is a rhombus and in rhombus diagonals bisect each other at 90°. Therefore **$\overline{AB}$ and $\overline{CD}$ are at right angles.**

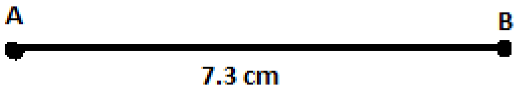
Exercise 14.2

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

Solution:

Steps to draw line segment of 7.3 cm using a ruler are as follows:

1. A point A is marked on the sheet
2. Place the start of scale 0 at point A
3. Mark point B at 7.3 cm from A.
4. Join AB.



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

Solution:

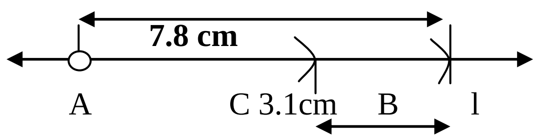
Steps to draw line segment of 5.6 cm using ruler and compass are as follows:

1. A line l is drawn and marked a point A on this line l.
2. On the zero mark of the ruler, place the compasses. Now extend the compasses to place the pencil up to the 5.6 cm and mark.
3. Place the pointer of compasses on point A and draw an arc to cut l at B. Now, $\overline{AB}$ is the line segment of 5.6 cm length.

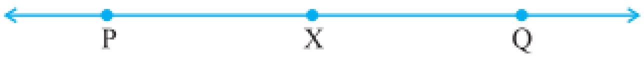
3. Construct $\overline{AB}$ of length 7.8 cm. From this, cut off $\overline{AC}$ of length 4.7 cm. Measure $\overline{BC}$.

Solution:

1. We draw a line l and mark a point A on it.
2. Using compass draw an arc of 7.8 cm cut at B from A.
3. Again using compass draw an arc of 4.7 cm cut at C from A.
4. By measuring $\overline{BC}$ using a scale we found that $\overline{BC}$ = 3.1 cm.



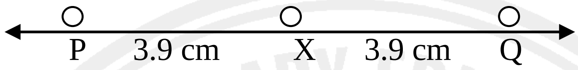
4. Given $\overline{AB}$ of length 3.9 cm, construct $\overline{PQ}$ such that the length of $\overline{PQ}$ is twice that of $\overline{AB}$. Verify by measurement.



(Hint: Construct $\overline{PX}$ such that length of $\overline{PX}$ = length of $\overline{AB}$; then cut off $\overline{XQ}$ such that $\overline{XQ}$ has also the length of $\overline{AB}$.)

Solution: $\overline{AB}$ = 3.9 cm

A 3.9 cm B



Steps of construction:

1. A line l is drawn.
2. We construct $\overline{PX}$ such that $\overline{PX}$ = $\overline{AB}$
3. Then cut of $\overline{XQ}$ such that $\overline{XQ}$ = $\overline{AB}$
4. The length of $\overline{PX}$ and $\overline{XQ}$ added together make twice length of $\overline{AB}$.

By measuring we find that PQ = 7.8 cm.

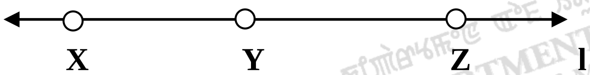
5. Given AB of length 7.3 cm and CD of length 3.4 cm, construct a line segment XYsuch that the length of XYis equal to the difference between the lengths of AB and CD. Verify by measurement.

Solutions:

Given, AB = 7.3 cm CD = 3.4 cm

A 7.3 cm B

C 3.4 cm D



Steps of construction:

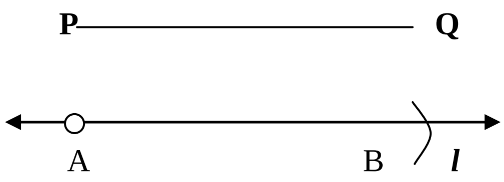
1. We draw a line l and take a point X on it.
2. Construct XZ which is equal to AB = 7.3 cm.
3. Then cut ZY = length of CD = 3.4 cm
4. Thus length of XY = length of AB – length of CD

By measuring we find that length of XY = 3.9 cm = 7.3 cm – 3.4 cm = AB – CD.

Exercise 14.3

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

Solution:

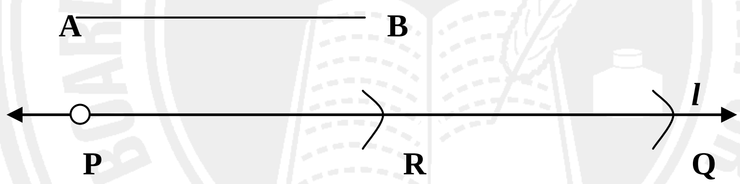


Steps of construction:

1. Given a line segment $\overline{PQ}$.
2. Using compass measure $\overline{PQ}$ fixing the compass pointer at P.
3. Draw any line l and mark point A on it.
4. Place the pointer on A and draw an arc cut at B on line ***l.***
5. $\overline{AB}$ is the required line segment.

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 $\overline{AB}$.

Solutions:



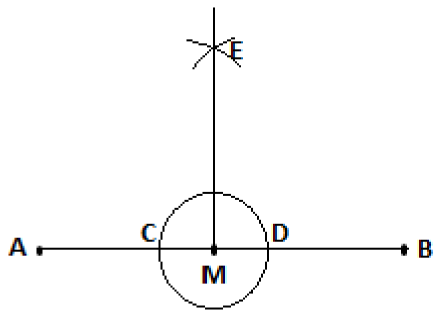
Steps of construction:

1. Given a line segment AB whose length is not known
2. Fix the compass pointer at A and measure B. Now instrument give length of AB.
3. Draw a line l and mark point P on it. From P draw an arc R without changing the length of the instrument.
4. From R draw another arc Q without changing the length.
5. Now PQ is the required length which is twice that of AB.

Exercise 14.4

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)

Solutions:

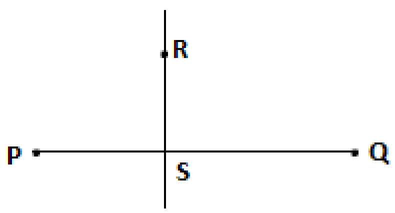


Steps of construction:

1. Line segment $\overline{AB}$ is the given line.
2. A point M is marked in the middle of AB.
3. With M as a centre draw an intersecting arc which intersect $\overline{AB}$ at C and D respectively.
4. With C and D as a centre and radius more than CM construct two arcs which intersect at E.
5. Join E and M. Now $\overline{EM}$ is perpendicular to $\overline{AB}$.

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)

Solution:



Steps of construction:

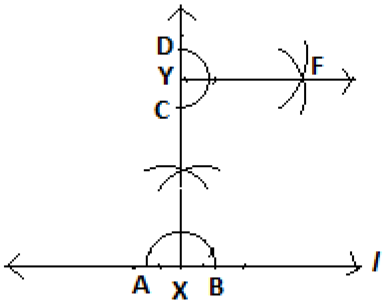
1. We draw the given line segment $\overline{PQ}$.
2. We mark point R outside the line segment $\overline{PQ}$.
3. Place a set square on $\overline{PQ}$ such that one arm of its right angle aligns along $\overline{PQ}$.
4. Now, place the ruler along the edge opposite to right angle of set square.

5. Hold the ruler fixed. Slide the set square along the ruler such that the point R touches the other arm of set square.
6. Draw a line along this edge of set square which passes through point R. Now, RS is the required line perpendicular to PQ.

3. Draw a line l and a point X on it. Through X, draw a line segment perpendicular to l.

Now draw a perpendicular to XY at Y. (use ruler and compasses)

Solutions:



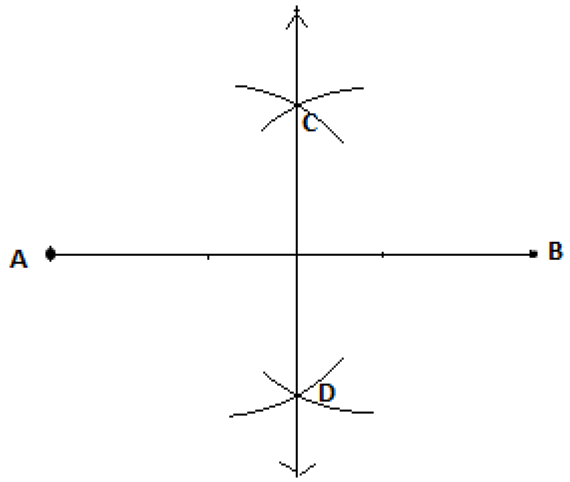
Steps of construction:

1. We draw a line l and mark a point X on it.
2. By taking X as centre and with a convenient radius, draw an arc intersecting the line l at points A and B respectively.
3. With A and B as centres and a radius more than AX, construct two arcs such that they intersect each other at point Y.
4. Join XY. Here XY is perpendicular to l.
5. Again by taking Y as centre and with a convenient radius, draw an arc intersecting at points C and D respectively.
6. With C and D as centres and a radius more than YC, construct two arcs such that they intersect each other at point F.
7. Join FY. Here FY is perpendicular to CD.

Exercise 14.5

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

Solutions:

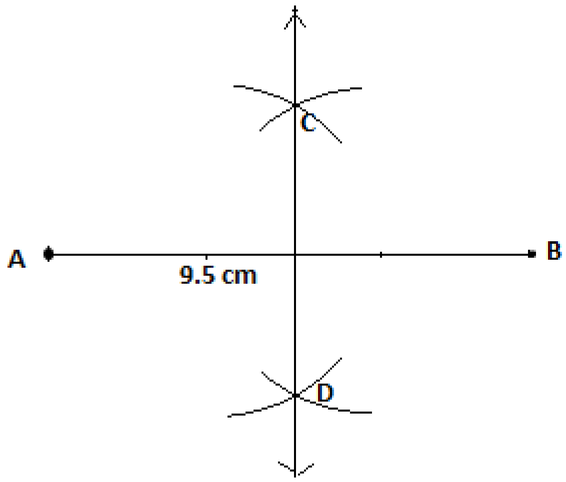


Steps of construction:

1. We construct $\overline{AB}$ of 7.3 cm.
2. Take A as centre and draw a circle by using compasses. The radius of circle should be more than half the length of $\overline{AB}$.
3. Now, take B as centre and draw another circle using compasses with the same radius as before. Let it cut the previous circle at points C and D.
4. Join CD. CD is the axis of symmetry.

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

Solution:



Steps of construction:

1. A line segment $\overline{AB}$ of 9.5 cm is drawn.
2. Taking A and B as centres and radius more than half of $\overline{AB}$ then draw two arcs which intersect at C and D.
3. Join CD.
4. Now CD is the perpendicular bisector of $\overline{AB}$.

3. Draw the perpendicular bisector of $\overline{XY}$ whose length is 10.3 cm.

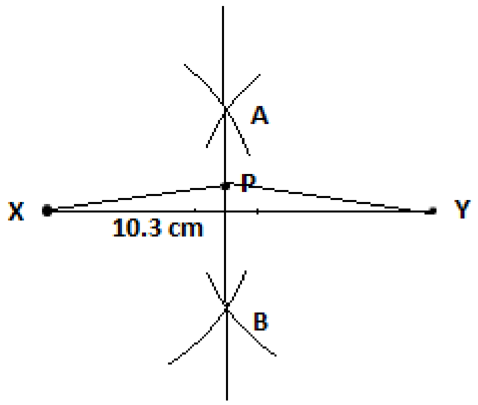
(a) Take any point P on the bisector drawn. Examine whether PX = PY.

(b) If M is the midpoint of $\overline{XY}$, what can you say about the lengths MX and XY?

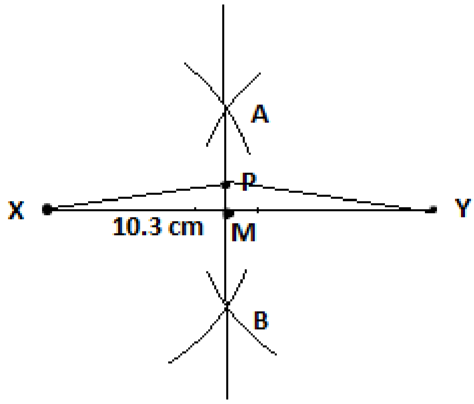
Solutions:

a) Steps of construction:

1. We draw a line segment $\overline{XY}$ of 10.3 cm
2. **2.** Take point X and Y as centres and draw circles by using compasses. The radius of circle should be more than half the length of XY.
3. **3.** The two circles intersect at A and B,
4. **4.** Join A and B. AB is the axis of symmetry.
5. **5.** Take any point P on AB. We may observe that the measure of lengths of PX and PY are same. AB being the axis of symmetry, any point lying on AB will be at same distance from the both ends of XY.



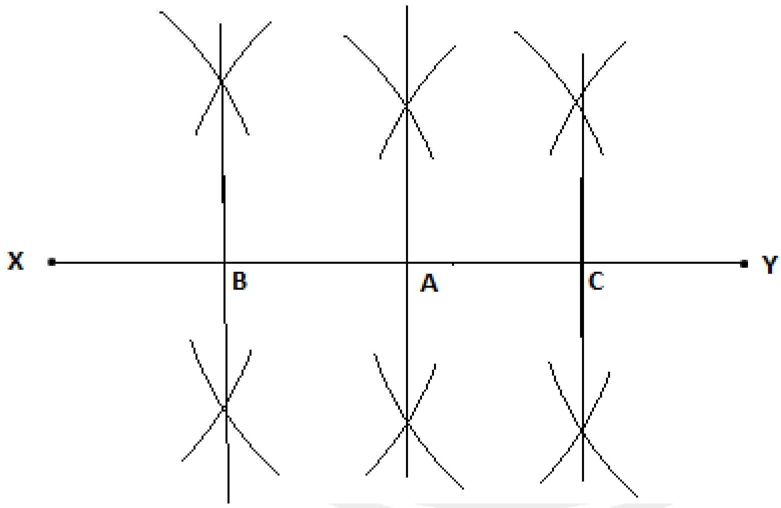
b)



M is the midpoint of XY. Perpendicular bisector AB will be passing through point M. Hence length of XY is double of MX.

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

Solution:

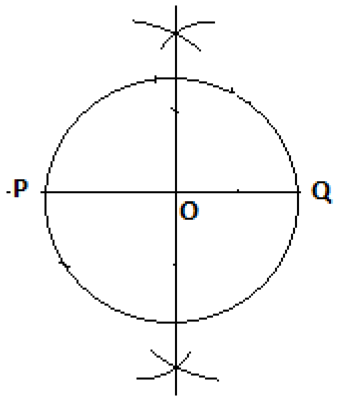


Steps of construction:

1. We draw a line segment $\overline{XY}$ of 12.8 cm
2. Draw the perpendicular bisector of $\overline{XY}$ which cuts at A.
3. A is the midpoint of $\overline{XY}$.
4. Draw the perpendicular bisector of $\overline{XA}$ which cuts at B.
5. Draw another perpendicular bisector of $\overline{AY}$ which cuts at C.
6. Now point B, A and C divides the line segment $\overline{XY}$ in four equal parts.
7. By measuring, we find $\overline{XB} = \overline{BA} = \overline{AC} = \overline{CY}$ = 3.2 cm.

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

Solutions:

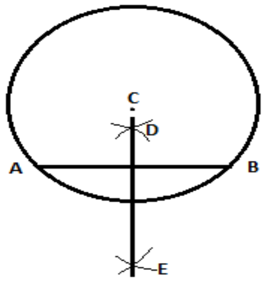


Step of construction:

1. We draw a line $\overline{PQ}$ which is of 6.1 cm.
2. Draw the perpendicular bisector of PQ which cuts at O.
3. 0 is the mid-point of PQ.
4. Taking O as centre and OP or OQ as radius draw a circle where diameter is the line segment PQ.

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

Solution:

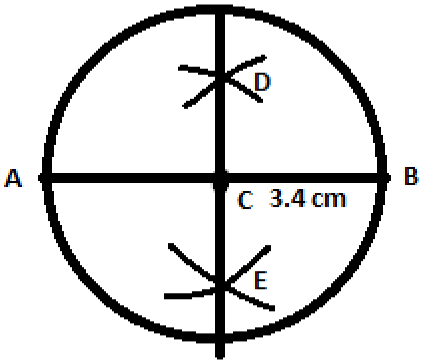


Steps of construction:

a. We mark any point C
b. Draw a circle of radius 3.4 cm from C.
c. Mark any chord AB in the circle.
d. Taking A and B as centres draw arcs on both sides of AB and intersect at point D and E.
e. Join DE. Now DE is the perpendicular bisector of AB.
f. Yes, it passes through C.
g.

7. Repeat Question 6, if **AB** happens to be a diameter.

Solutions:

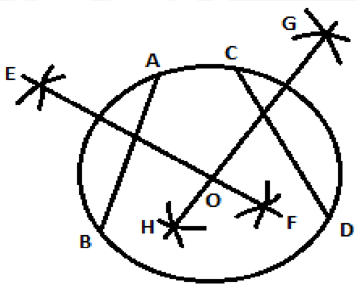


Steps of construction:

a. We mark any point C on the sheet.
b. Draw a circle of radius 3.4 cm from C.
c. Now draw diameter AB
d. Now taking A and B as centres, draw arcs on both sides of AB and cuts at D and E respectively.
e. Join DE, which is perpendicular bisector of AB.
f. Now we observe that DE is passing through centre C.

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?

Solution:

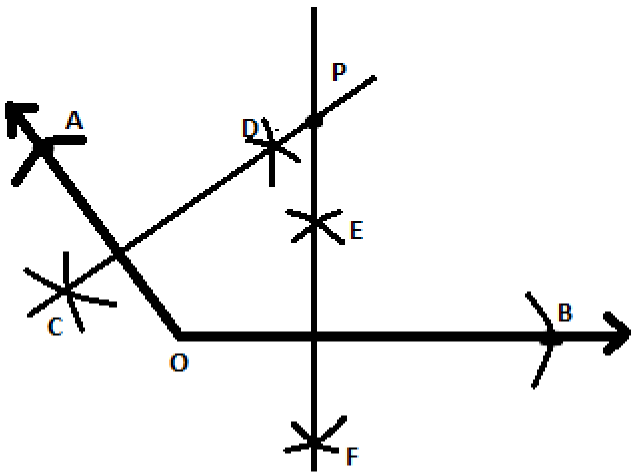


Steps of construction:

a. We draw the circle with O and radius 4 cm.
b. Draw any chords $\overline{AB}$ and $\overline{CD}$ in the circle.
c. Taking A and B as centres and radius more than half of AB, draw two arcs which intersect each other at E and F.
d. Join EF. EF is the perpendicular bisector of chord CD.
e. Draw GH which is the perpendicular bisector of chord CD.
f. The two perpendicular bisectors meet at O.

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?

Solutions:



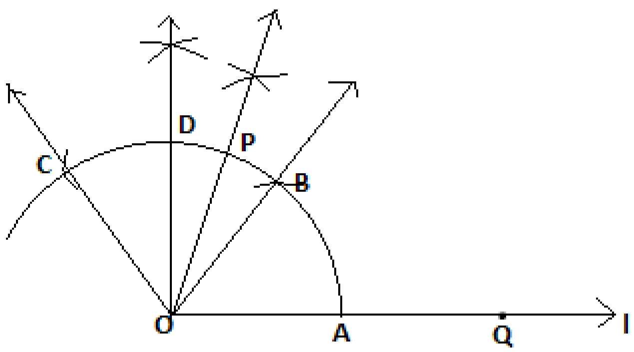
Steps of construction:

a. We draw any angle with vertex as O.
b. By taking O as centre and with convenient radius, draw arcs on both rays of this angle and mark points are A and B.
c. Now take O and A as centres and with radius more than half of OA, draw arcs on both sides of OA. Let these intersects at points C and D respectively. Join CD
d. Similarly we may find $\overline{EF}$ which is perpendicular bisector of $\overline{OB}$. These perpendicular bisectors $\overline{CD}$ and $\overline{EF}$ intersects each other at point P. After measuring PA and PB. We find they are in equal length.

Exercise 14.6

1. Draw ∠POQ of measure 75° and find its line of symmetry.

Solutions:

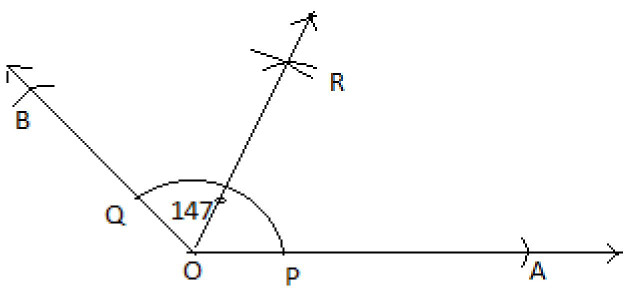


Steps of construction:

a. We draw a line l and mark a point O and Q on it.
b. Place the pointer of the compass at O and draw an arc which intersects at A.
c. With same radius and A as centre cut the arc at B.
d. Join OB, now ∠BOA = 60°
e. Taking same radius with centre B cut the previous arc at C. Join OC.
f. Draw bisector of ∠BOC and mark D. ∠BOD = 30°
g. Draw bisector of ∠DOB at P.
h. Now ∠POQ = 75°.

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

Solution**:**



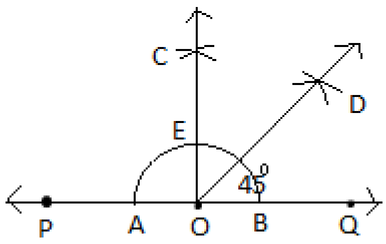
Steps of construction:

a. We draw a ray OA.
b. With the help of protractor , construct ∠AOB = 147°

c. Taking centre O and any convenient radius draw an arc which intersects the arms OA and OB at P and Q respectively.
d. Taking P as centre and radius more than half of PQ, draw an arc.
e. Taking Q as centre and with the same radius, draw another arc which intersects the previous at R.
f. Join OR. Thus, OR is the required bisector of ∠AOB.

3. Draw a right angle and construct its bisector.

Solution:

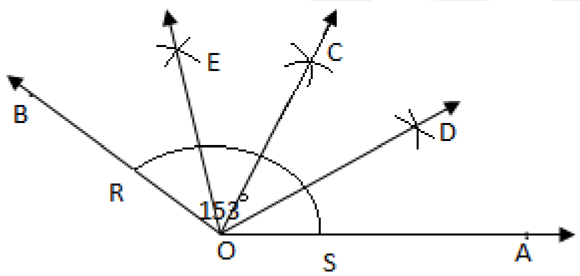


Steps of construction:

a. We draw a line PQ and draw a point O on it.
b. Taking O as centre and convenient radius, draw an arc which intersects PQ at A and B.
c. Taking A and B as centres and radius more than half of AB, draw two arcs which intersect each other at C.
d. Join OC. Thus ∠COQ is the required right angle.
e. Taking B and E as centres and radius more than half of BE, draw two arcs which intersect each other at D.
f. Join OD. Thus OD is the required bisector of ∠COQ.

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

Solutions:



Steps of construction:

a. A ray OA is drawn.
b. With the help of protractor draw ∠AOB of 153° by keeping centre of protractor at O.
c. With centre O draw an arc which cuts OB and OA at R and S respectively.

d. Construct bisector of ∠AOB by drawing arcs from R and S as centres and cut at point C.
e. Join OC.
f. Similarly construct bisector of ∠AOC and ∠BOC.
g. ∠AOC bisect by OD and ∠BOC by OE.
h. Now we divide ∠AOB into four equal parts.

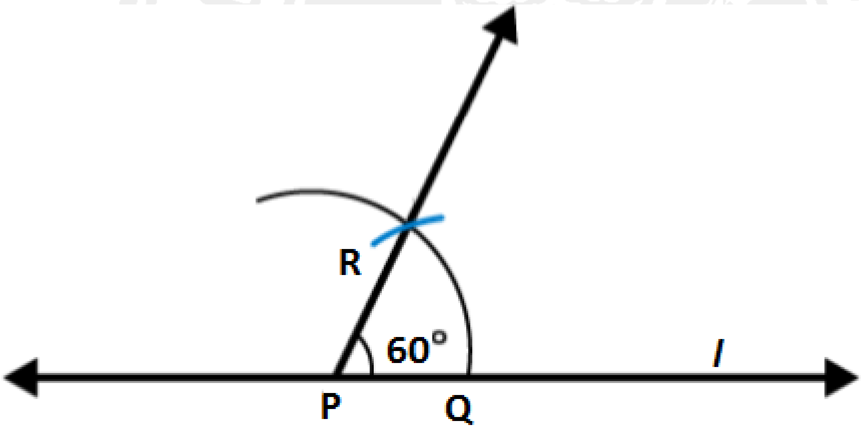
5. Construct with ruler and compasses, angles of following measures:

a) **60°**
b) **30°**
c) **90°**
d) **120°**
e) **45°**
f) **135°**

Solutions:

a) **60°**

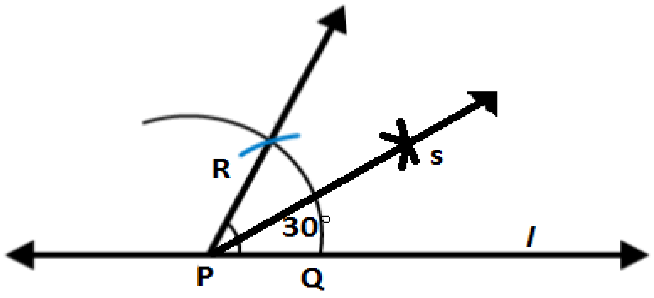
Steps of construction:



i. We draw a line l and mark a point P on it. Take P as centre and with convenient radius, draw an arc of a circle such that it intersects the line l at Q.
ii. Take Q as centre and with the same radius as before, draw an arc intersecting the previously drawn arc at point R.
iii. Join PR. PR is the required ray making 60^0 with the line l.

b) **30°**

Solution:

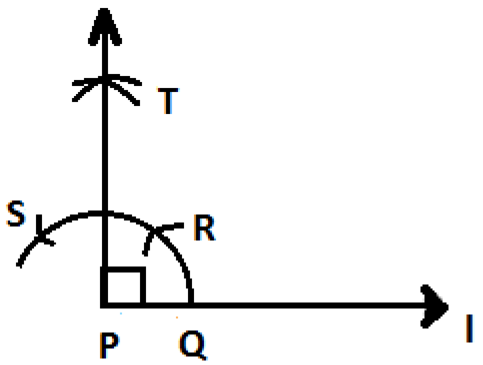


Steps of construction:

i. We draw a line l and mark a point P on it. Take P as centre and with convenient radius, draw an arc of a circle such that it intersects the line l at Q.
ii. Take Q as centre and with the same radius as before, draw an arc intersecting the previously drawn arc at point R.
iii. Join PR. Now ∠RPQ = 60°
iv. R as centre draw an arc. Similarly with Q as centre draw another arc which intersect at point S.
v. Join PS. Now ∠SPQ = 30° which is the r**equired angle.**

c) **90°**

Solution:



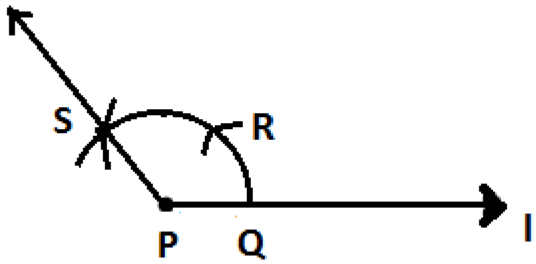
Steps of construction:

i. We draw a line l and mark a point P on it. Take P as centre and with convenient radius, draw an arc of a circle such that it is intersecting the line l at Q.
ii. Take Q as centre and with the same radius as before, draw an arc intersecting the previously drawn arc at R

iii. By taking R as centre and with the same radius as before, draw an arc intersecting the arc at S
iv. Now take R and S as centre, draw arc of same radius to intersect each other at T.
v. Join PT, which is the required ray making 90^0 with the line l.

d) 120°

Solution:

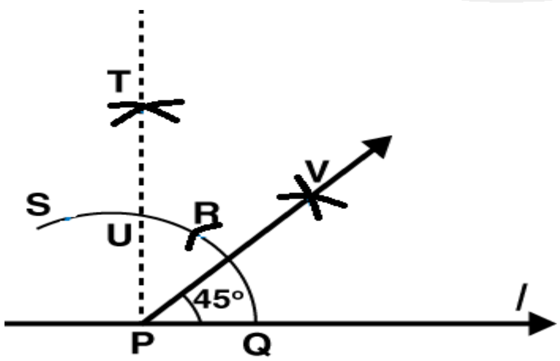


Steps of construction:

i. We draw a line l and mark a point P on it. Take P as centre and with convenient radius, draw an arc of a circle such that it is intersecting the line l at Q.
ii. Take Q as centre and with the same radius as before, draw an arc intersecting the previously drawn arc at R
iii. By taking R as centre and with the same radius as before, draw an arc intersecting the arc at S.
iv. Join PS.
v. Thus, **∠SPQ = 120° which is the required angle.**

e) **45°**

Solution:

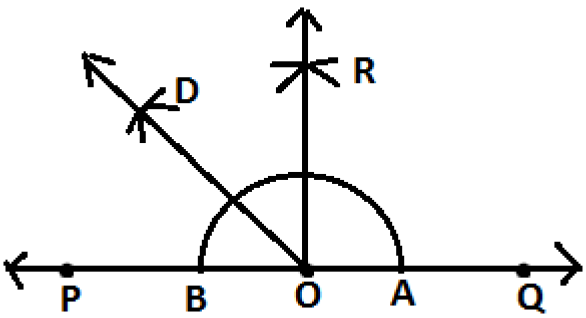


Steps of construction;

i. We draw a line l and mark a point P on it. Take P as centre and with convenient radius, draw an arc of a circle such that it is intersecting the line l at Q.
ii. Take Q as centre and with the same radius as before, draw an arc intersecting the previously drawn arc at R
iii. By taking R as centre and with the same radius, draw an arc such that it is intersecting the arc at S as shown in figure.
iv. Take R and S as centres and draw arcs of same radius such that they are intersecting each other at T
v. Join PT. Let this intersect the major arc at point U.
vi. Now take Q and U as centres and draw arcs with radius more than 1 / 2 QU to intersect each other at point V. Join PV.
vii. PV is the required ray making 45^0 with the line l.

f) **135°**

Solution:

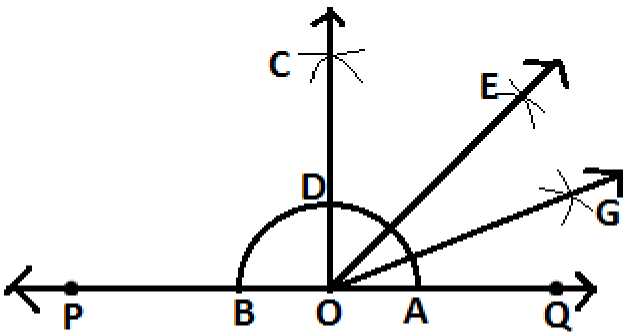


Steps of construction:

i. We draw a line PQ and take a point O on it.
ii. Taking O as centre and convenient radius, mark an arc, which intersects PQ at A and B.
iii. Taking A and B as centres and radius more than half of AB, draw two arcs intersecting each other at R.
iv. Join OR. Thus, ∠QOR = ∠POR = 90°.
v. Draw OD bisector of ∠POR. Thus ∠QOD is the required angle of 135°.

6. Draw an angle of measure 45° and bisect it.

Solutions:

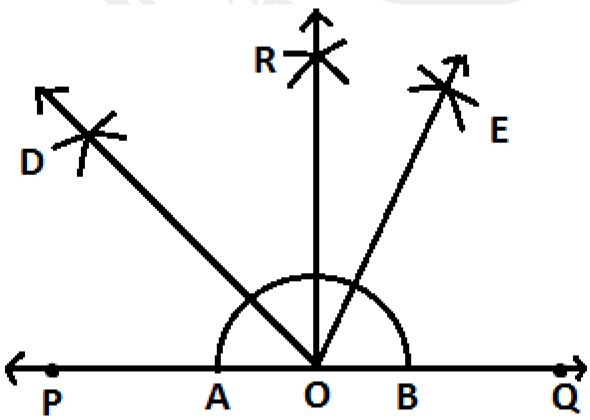


Steps of construction:

i. We draw a line PQ and take a point O on it.
ii. Taking O as centre and convenient radius, draw an arc which intersects PQ at two points A and B.
iii. Taking A and B as centres and radius more than half of AB, draw two arcs which intersect each other at C.
iv. Join OC. Then ∠COQ is an angle of 90°.
v. Draw OE as the bisector of ∠COQ. Thus QOE = 45°
vi. Again draw OG as the bisector of ∠QOE. Thus OG is the required bisector.

7. Draw an angle of measure 135° and bisect it.

Solutions:



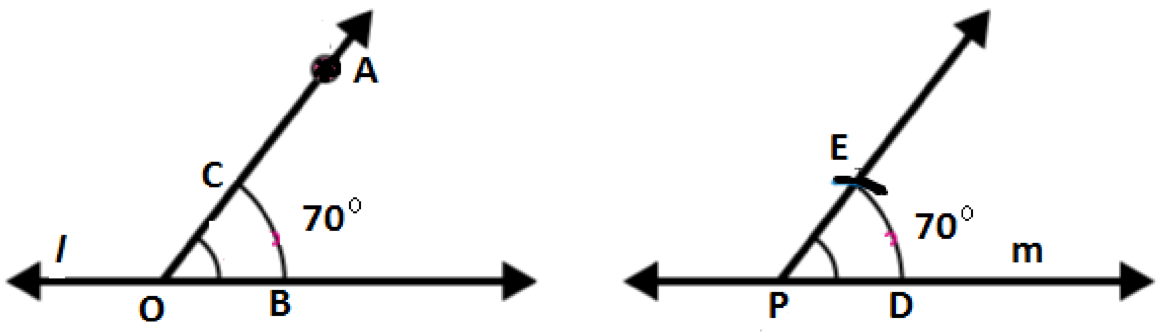
Steps of construction:

i. We draw a line PQ and take a point O on it.
ii. Taking O as centre and convenient radius mark an arc, which intersects PQ at A and B.

iii. Taking A and B as centres and radius more than half of AB, draw two arcs which intersect each other at R.
iv. Join OR. Thus ∠QOR =∠POR = 90°.
v. Draw OD bisector of ∠POR. Thus ∠QOD is the required angle of 135°.
vi. Now draw OE bisector of ∠ QOD.

8. Draw an angle of 70^0. Make a copy of it using only a straight edge and compasses.

Solutions:

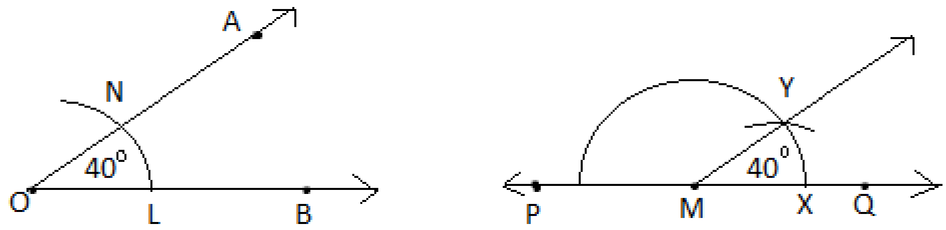


Steps of construction:

i. We draw a line l and mark a point O on it. Now place the centre of protractor at point O and the zero edge along line l.
ii. Mark a point A at an angle of measure 70^0. Join OA. Now OA is the ray making 70^0 with line l. With point O as centre, draw an arc of convenient radius in the interior of angle 70^0 . Let this intersects both rays of angle 70^0 at points B and C respectively.
iii. Draw a line m and mark a point P on it. Again draw an arc with same radius as before and P as centre. Let it cut the line m at point D
iv. Adjust the compasses up to the length of BC. With this radius draw an arc taking D as centre which intersects the previously drawn arc at point E.
v. Join PE. Here PE is the required ray which makes same angle of measure 70° with the line m.

9. Draw an angle of 40°. Copy its supplementary angle.

Solutions:



Steps of construction:

i. We draw an angle AOB of 40° with the help of protractor.
ii. Place the compass at O and draw an arc to cut ∠AOB at L and N.
iii. Draw a line PQ and take any point M on PQ.
iv. With the same compass setting as in making arc L and N draw an arc being M as centre cutting MQ at X.
v. Set compass to length LN
vi. Place the compasses at X and draw the arc to cut the arc drawn earlier and name Y.
vii. Join YM. Thus, ∠QMY = 40° and ∠PMY is supplementary to it.