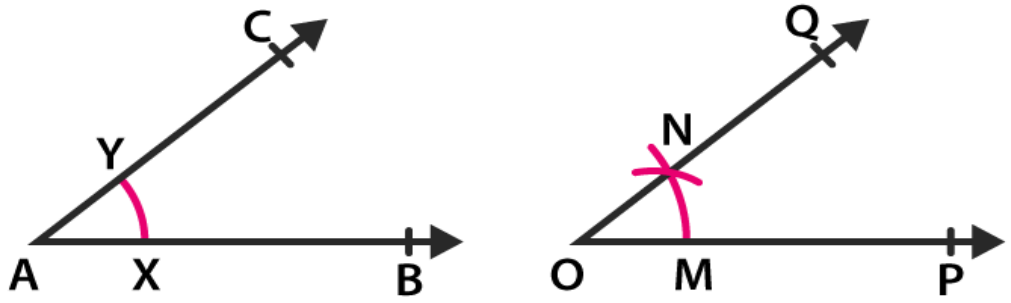
EXERCISE 19.5 PAGE: 19.13

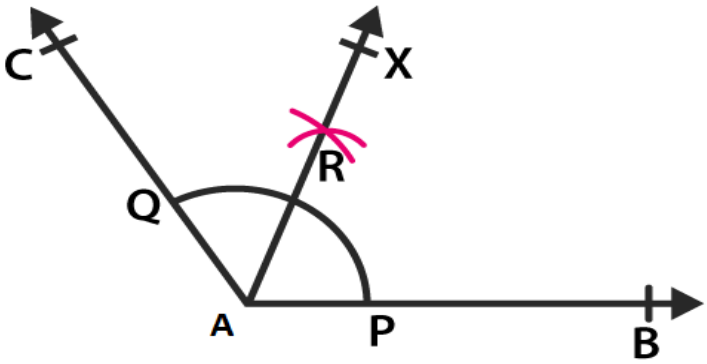
1. Draw an angle and label it as ∠BAC. Construct another angle, equal to ∠BAC.
Solution:

Construct an angle ∠BAC and draw a ray OP.
Taking A as centre and suitable radius, construct an arc which intersects AB and AC at points X and Y.
Taking O as centre and same radius, construct an arc which intersects the arc OP at the point M.
Now measure XY with the help of compass.
Taking M as centre and XY as radius construct an arc which intersects the arc which is drawn from O at the point N.
Now join the points O and N and extend it to the point Q.
Here, ∠POQ is the required angle.



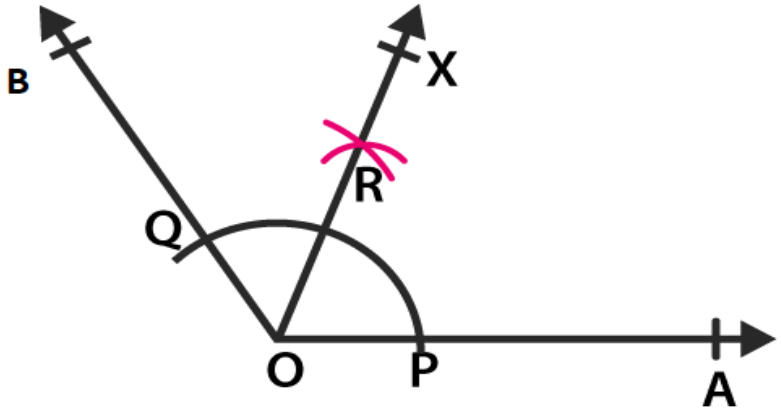
2. Draw an obtuse angle. Bisect it. Measure each of the angles so obtained.
Solution:

We know that obtuse angles are those which are greater than 90^o and less than 180^o.
Construct an obtuse angle ∠BAC.
Taking A as centre with appropriate radius construct an arc which intersects AB and AC at the points P and Q.
Taking P as centre and radius which is more than half of PQ construct an arc.
Taking Q as centre and same radius construct another arc which intersects the previous arc at the point R.
Now join A and R and extend it to the point X.
So the ray AX is the required bisector of ∠BAC.
By measuring ∠BAR and ∠CAR we get ∠BAR = ∠CAR = 65^o.



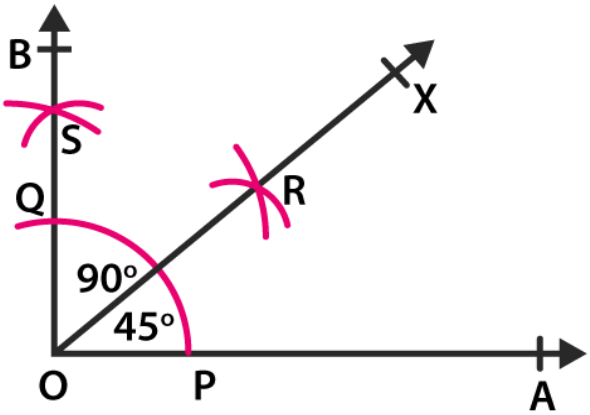
3. Using your protractor, draw an angle of measure 108^o. With this angle as given, drawn an angle of 54^o.
Solution:

Construct a ray OA.
Using protractor, draw an angle ∠AOB of 108^o where $108/2 = 54^o$
Hence, 54^o is half of 108^o.
In order to get angle 54^o, we must bisect the angle of 108^o.
Taking O as centre and convenient radius, construct an arc which cuts the sides OA and OB at the points P and Q.
Taking P as centre and radius which is more than half of PQ construct an arc.
Taking Q as centre and same radius construct another arc which intersects the previous arc at the point R.
Now join the points O and R and extend it to the point X.
Here, ∠AOX is the required angle of 54^o.



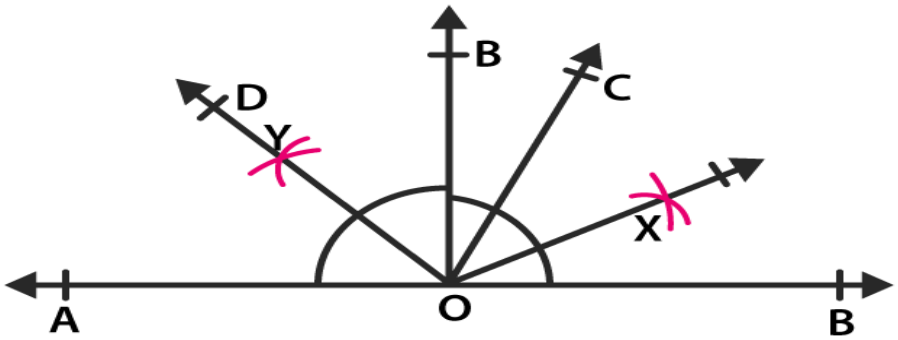
4. Using protractor, draw a right angle. Bisect it to get an angle of measure 45º.
Solution:

Construct a ray OA.
Using a protractor construct ∠AOB of 90^o.
Taking O as centre and convenient radius, construct an arc which cuts the sides OA and OB at the points P and Q.
Taking P as centre and radius which is more than half of PQ, construct an arc.
Taking Q as centre and same radius, construct another arc which intersects the previous arc at the point R.
Now join the points O and R and extend it to the point X.
Here, ∠AOX is the required angle of 45^o where ∠AOB = 90^o and ∠AOX = 45^o.



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

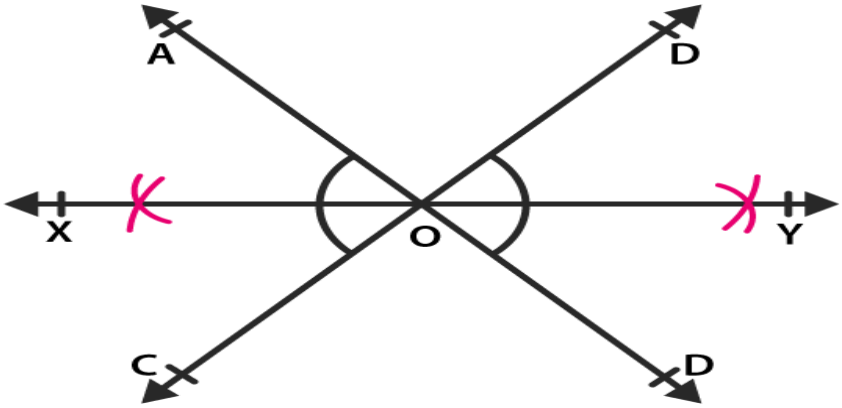
We know that the two angles which are adjacent and supplementary are known as linear pair of angles.
Construct a line AB and mark a point O on it.
By constructing an angle ∠AOC we get another angle ∠BOC.
Now bisect ∠AOC using a compass and a ruler and get the ray OX.
In the same way bisect ∠BOC and get the ray OY.
We know that
∠XOY = ∠XOC + ∠COY
It can be written as
∠XOY = 1/2 ∠AOC + 1/2 ∠BOC
So we get
∠XOY = 1/2 (∠AOC + ∠BOC)
We know that ∠AOC and ∠BOC are supplementary angles
∠XOY = 1/2 (180) = 90^o



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

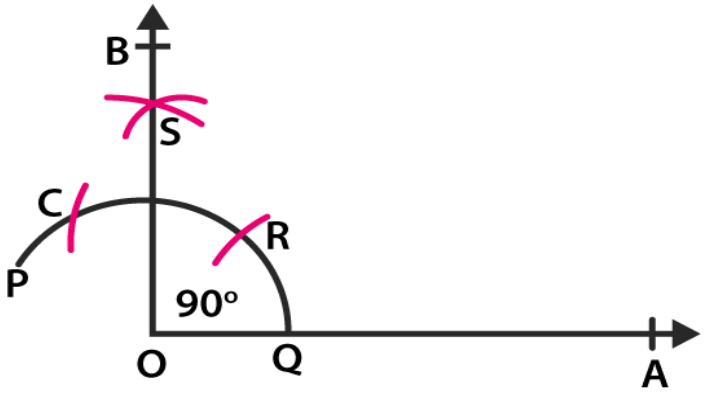
Construct two lines AB and CD which intersects each other at the point O
Since vertically opposite angles are equal we get
∠BOC = ∠AOD and ∠AOC = ∠BOD
Now bisect angle AOC and construct the bisecting ray as OX.
In the same way, we bisect ∠BOD and construct bisecting ray OY.
We get
∠XOA + ∠AOD + ∠DOY = 1/2 ∠AOC + ∠AOD + 1/2 ∠BOD
We know that ∠AOC = ∠BOD
∠XOA + ∠AOD + ∠DOY = 1/2 ∠BOD + ∠AOD + 1/2 ∠BOD
So we get
∠XOA + ∠AOD + ∠DOY = ∠AOD + ∠BOD

AB is a line
We know that ∠AOD and ∠BOD are supplementary angles whose sum is equal to 180^o.
∠XOA + ∠AOD + ∠DOY = 180^o
The angles on one side of a straight line is 180^o and the sum of angles is 180^o
Here, XY is a straight line where OX and OY are in the same line.



7. Using ruler and compasses only, draw a right angle.
Solution:

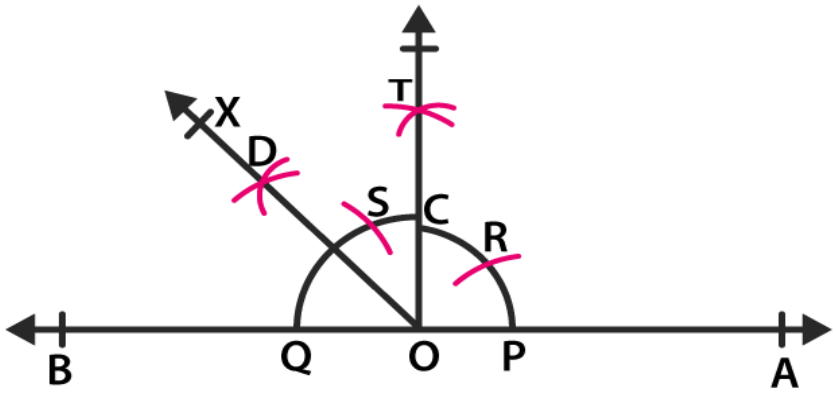
Construct a ray OA.
Taking O as centre and convenient radius construct an arc PQ using a compass intersecting the ray OA at the point P.
Taking P as centre and same radius construct another arc which intersects the arc PQ at the point R.
Taking R as centre and same radius, construct an arc which cuts the arc PQ at the point C opposite to P.
Using C and R as the centre construct two arcs of radius which is more than half of CR which intersects each other at the point S.
Now join the points O and S and extend it to the point B.
Here, ∠AOB is the required angle of 90°.



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

Construct a line AB and mark a point O on it.
Taking O as centre and convenient radius, construct an arc PQ using a compass which intersects the line AB at the point P and Q.
Taking P as centre and same radius, construct another arc which intersects the arc PQ at the point R.
Taking Q as centre and same radius, construct another arc which intersects the arc PQ at the point S which is opposite to P.
Considering S and R as centres and radius which is more than half of SR, construct two arcs which intersect each other at the point T.

Now join the points O and T which intersects the arc PQ at the point C.
Considering C and Q as centres and radius which is more than half of CQ, construct two arcs which intersect each other at the point D.
Now join the points O and D and extend it to point X to form the ray OX.
Here, ∠AOX is the required angle of 135°.



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

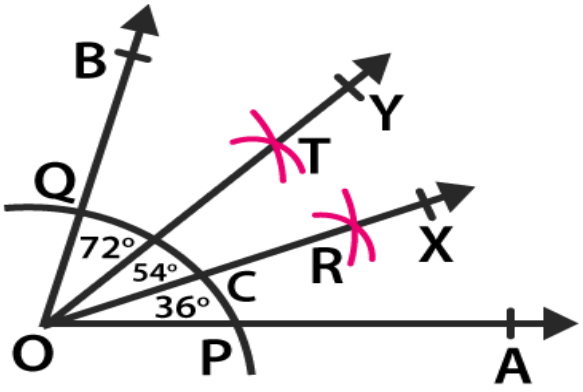
Construct a ray OA.
Using protractor construct ∠AOB of 72°
Taking O as centre and convenient radius, construct an arc which cut sides OA and OB at the point P and Q.
Taking P and Q as centres and radius which is more than half of PQ, construct two arcs which cuts each other at the point R.
Now join the points O and R and extend it to the point X.
Here, OR intersects the arc PQ at the point C.
Taking C and Q as centres and radius which is more than half of CQ, construct two arcs which cuts each other at point T.
Now join the points O and T and extend it to the point Y.

OX bisects ∠AOB
It can be written as
∠AOX = ∠BOX = 72/2 = 36°

OY bisects ∠BOX
It can be written as
∠XOY = ∠BOY = 36/2 = 18°

We know that
∠AOY = ∠AOX + ∠XOY = 36° + 18° = 54°

Here, ∠AOX is the required angle of 36° and ∠AOY is the required angle of 54°.


B
Y
T
Q
72°
54°
36°
C
R
X
O
P
A