Circle

Line segment

Perpendicular

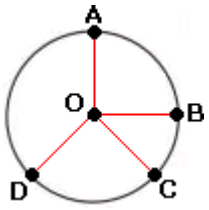
Angle

Circle

A Circle is the locus of all points that are at an equal distance from a given point (on the plane) called the center.

Example:

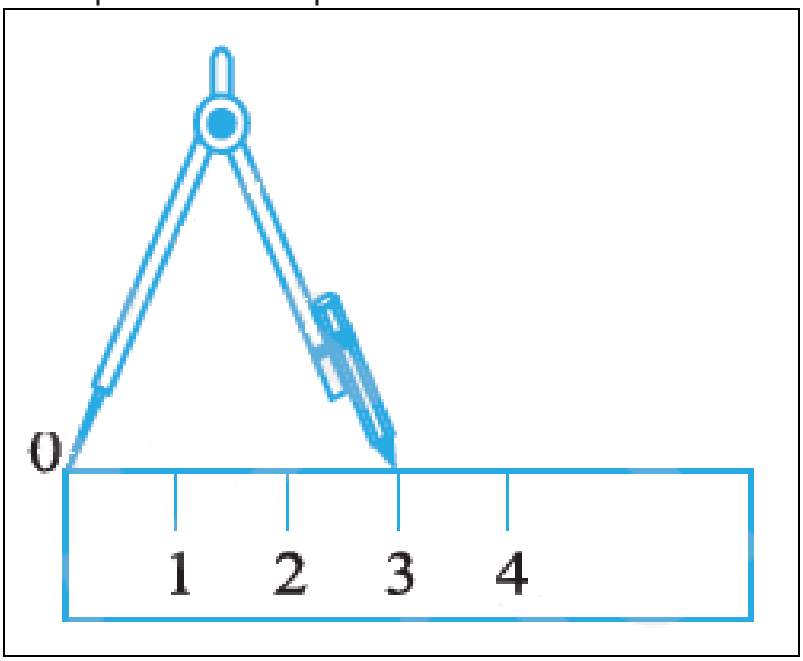
In the figure shown, O is the center of the circle. All points on the black ring, such as A, B, C, and D, are equidistant from O, the center. The length of the black ring is the circumference of the circle.



Construction of a circle when its radius is known

Suppose we want to draw a circle of radius 3 cm. We need to use our compass. Here are the steps to follow.

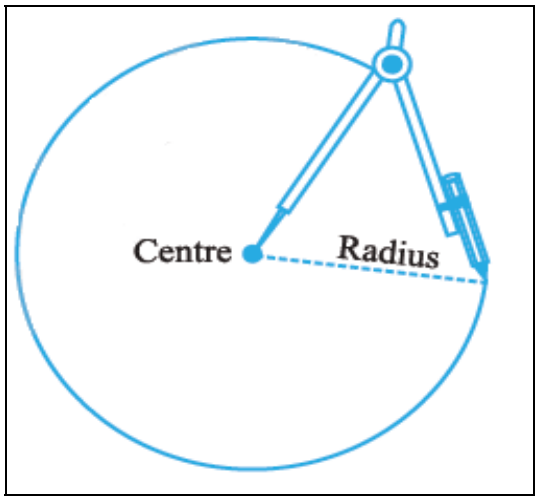
Step 1: Open the compass for the required radius of 3cm.



Step 2: Mark a point with a sharp pencil where we want the centre of the circle to be. Name it as O.

Step 3: Place the pointer of the compass on O.

Step 4: Turn the compass slowly to draw the circle. Be careful to complete the movement around in one instant.



Line segment

Line segment is the part of a line consisting of two endpoints.

Example:

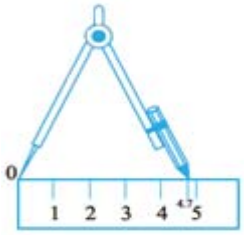
In the figure shown, PQ, PR, and RQ are line segments.

Construction of a line segment of a given length

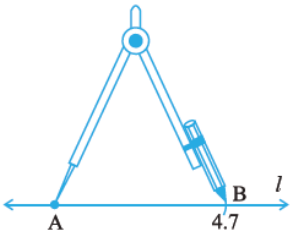
By use of ruler and compasses

Step 1: Draw a line l. Mark a point A on a line l.

Step 2: Place the compasses pointer on the zero mark of the ruler. Open it to place the pencil point up to the 4.7cm mark.



Step 3: 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.



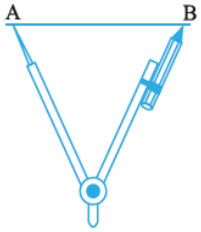
Step 4: AB is a line segment of required length.

Constructing a copy of a given line segment

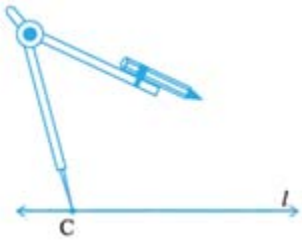
To make a copy of line segment AB

Steps1: Given line AB whose length is not known.

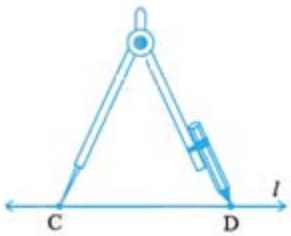
Step 2: Fix the compasses pointer on A and the pencil end on B. The opening of the instrument now gives the length of AB.



Step 3: Draw any line l. Choose a point C on l. Without changing the compasses setting, place the pointer on C.



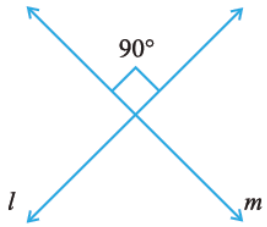
Step 4: Swing an arc that cuts l at a point, say, D. Now CD is a copy of AB.



Perpendicular

Two lines (or rays or segments) are said to be perpendicular if they intersect such that the angles formed between them are right angles.

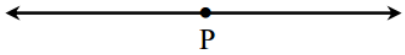
In the figure below, the lines l and m are perpendicular.



Perpendicular to a line through a point on it

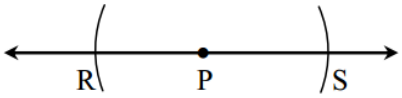
To construct a line perpendicular to a given line through a point on the line

Given: Point P on line l Construct QP ⊥ l.



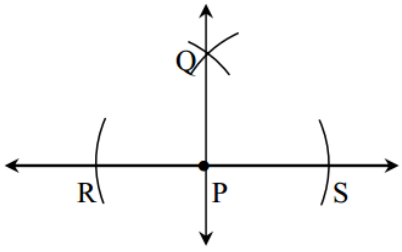
Step 1: Place compass point on P and construct arcs that intersect line l on both sides of P. Locate R & S.

Step 2: Set compass to distance greater than half of RS. Put point of compass on R and swing arc above l.



Step 3: Using same compass setting put compass on S and swings an arc intersecting arc from step 2. Locate Q.

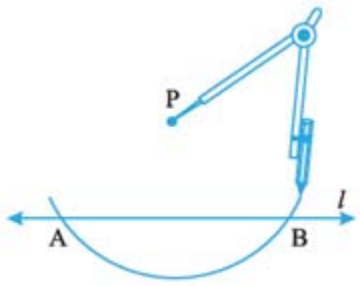
Step 4: Draw QP.



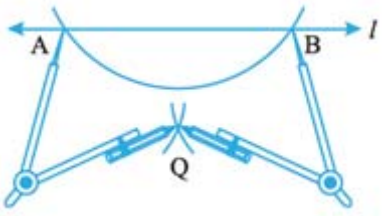
Perpendicular to a line through a point not on it

Step 1: Given a line l and a point P not on it.

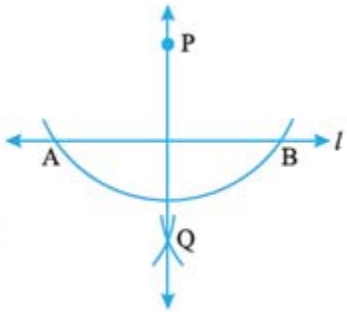
Step 2: With P as centre, draw an arc which intersects line l at two points A and B.



Step 3: Using the same radius and with A and B as centers, construct two arcs that intersect at a point, say Q, on the other side.



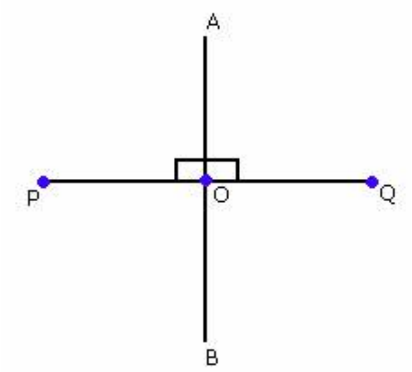
Step 4: Join PQ. Thus, PQ is perpendicular to l.



Perpendicular Bisector:

Perpendicular Bisector is a perpendicular line or a segment that passes through the midpoint of a line. A perpendicular bisector divides a line segment into two equal segments.

Example:

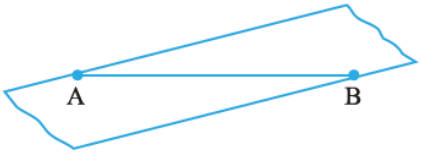


In the figure shown, AB is the perpendicular bisector of the line segment PQ passing through its midpoint 'O'.

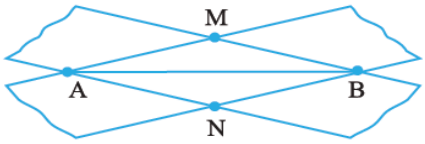
Perpendicular bisector of a line segment

Step 1: Draw a line segment AB.

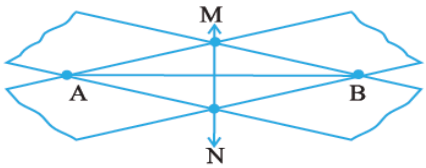
Step 2: Place a strip of a transparent rectangular tape diagonally across AB with the edges of the tape on the end points A and B, as shown in the figure.



Step 3: Repeat the process by placing another tape over A and B just diagonally across the previous one. The two strips cross at M and N.



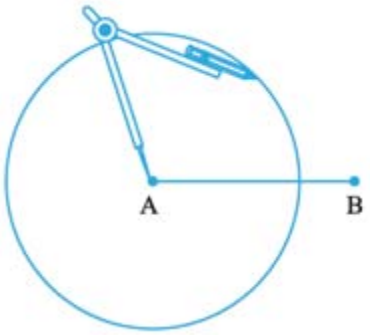
Step 4: Join M and N.



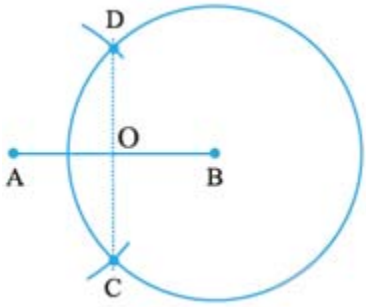
Construction using ruler and compasses

Step 1: Draw a line segment AB of any length.

Step 2: With A as centre, using compass draw a circle. The radius of your circle should be more than half the length of AB.



Step 3: With the same radius and with B as centre, draw another circle using compasses. Let it cut the previous circle at C and D.



Step 4 Join CD. It cuts AB at O. Use your divider to verify that O is the midpoint of AB. Also verify that $\angle COA$ and $\angle COB$ are right angles. Therefore, CD is the perpendicular bisector of AB.

Angles

Angles

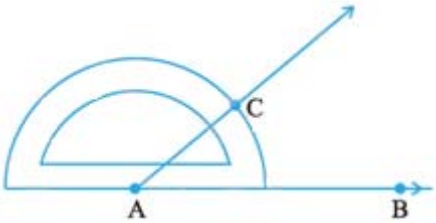
Suppose we want an angle of measure 40°.

Here are the steps to follow:

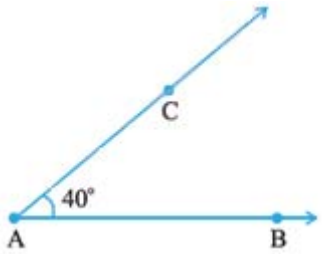
Step 1: Draw AB of any length.

Step 2: Place the centre of the protractor at A and the zero edge along AB.

Step 3: Start with zero near B. Mark point C at 40°.

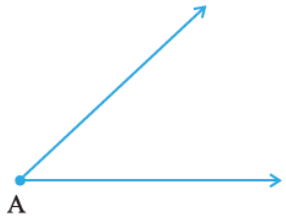


Step 4: Join AC. ∠BAC is the required angle.



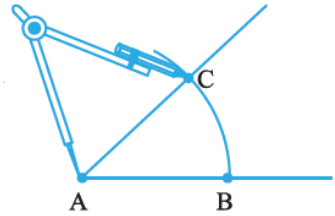
Constructing a copy of an angle of unknown measure

Given ∠A, whose measure is not known.

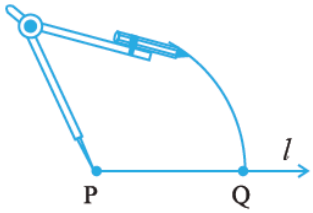


Step 1: Draw a line l and choose a point P on it.

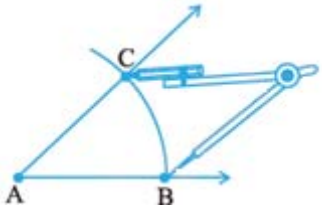
Step 2: Place the compasses at A and draw an arc to cut the rays of ∠A at B and C.



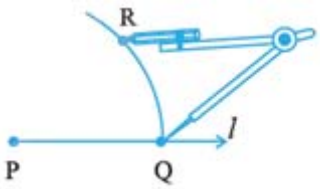
Step 3: Use the same compasses setting to draw an arc with P as centre, cutting l in Q.



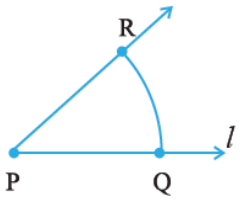
Step 4: Set your compasses to the length BC with the same radius.



Step 5: Place the compasses pointer at Q and draw the arc to cut the arc drawn earlier in R.



Step 6: Join PR. This gives us ∠P. It has the same measure as ∠A.
This means ∠QPR has same measure as ∠BAC.

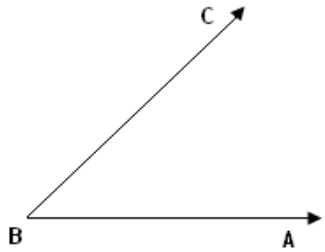


Bisector of an angle

Bisect means to divide into two equal sections or two equal halves.

Example:

Following steps are involved when we bisect an angle by using ruler and compass:

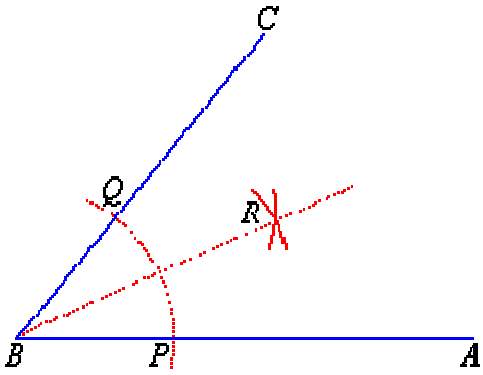


Draw an arc with B as the centre to cut the arms, BA and BC, of the angle at P and Q respectively.

Using the same radius, draw an arc centered at P.

Again, using the same radius, draw an arc centered at Q to cut the arc previously drawn at R.

Join, B, the vertex of the angle, to the point R.



BR bisects the angle ABC, and is called the **bisector of the angle ABC.**

Angles of special measures

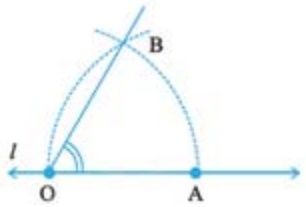
Constructing a 60° angle

Step 1: Draw a line l and mark a point O on it.

Step 2: Place the pointer of the compasses at O and draw an arc of convenient radius which cuts the line PQ at a point say, A.

Step 3: With the pointer at A (as centre); now draw an arc that passes through O.

Step 4: Let the two arcs intersect at B. Join OB. We get ∠BOA whose measure is 60°.



Constructing a 30° angle

We know that:

1/2 of 60° = 30°

So, to construct an angle of 30º, first construct a 60º angle and then bisect it. Often, we apply the following steps.

Step 1: Draw the arm PQ.

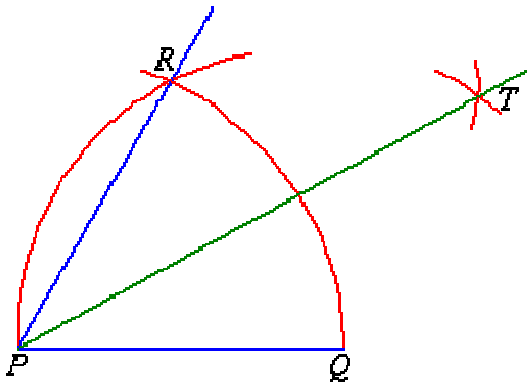
Step 2: Place the point of the compass at P and draw an arc that passes through Q.

Step 3: Place the point of the compass at Q and draw an arc that cuts the arc drawn in Step 2 at R.

Step 4: With the point of the compass still at Q, draw an arc near T as shown.

Step 5: With the point of the compass at R, draw an arc to cut the arc drawn in Step 4 at T.

Step 6: Join T to P. The angle QPT is 30º.



Constructing a 120° angle

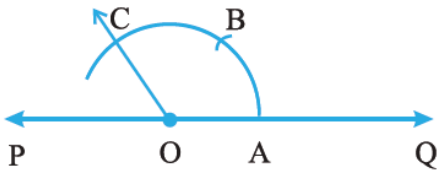
An angle of 120° is nothing but twice of an angle of 60°. Therefore, it can be constructed as follows:

Step 1: Draw any line PQ and take a point O on it.

Step 2: Place the pointer of the compasses at
O and draw an arc of convenient radius which cuts the line at A.

Step 3 Without disturbing the radius on the compasses, draw an arc with A as centre which cuts the first arc at B.

Step 4 Again without disturbing the radius on the compasses and with B as centre, draw an arc which cuts the first arc at C.



Constructing a 90° angle

We can construct a 90º angle either by bisecting a straight angle or using the following steps.

Step 1: Draw the arm PA.

Step 2: Place the point of the compass at P and draw an arc that cuts the arm at Q.

Step 3: Place the point of the compass at Q and draw an arc of radius PQ that cuts the arc drawn in Step 2 at R.

Step 4: With the point of the compass at R, draw an arc of radius PQ to cut the arc drawn in Step 2 at S.

Step 5: With the point of the compass still at R, draw another arc of radius PQ near T as shown.

Step 6: With the point of the compass at S, draw an arc of radius PQ to cut the arc drawn in step 5 at T.

Step 7: Join T to P. The angle APT is 90º.