Chapter 14

Practical Geometry

Introduction to Practical Geometry

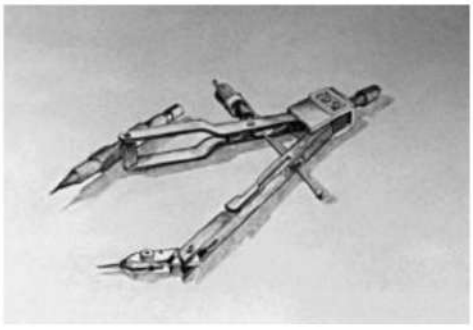
Introduction

Here, let us see some of the tools and their usage:-

1. The Ruler

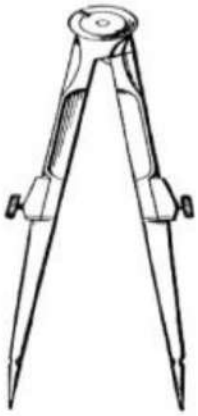
Usage: It is used to draw line segments and to measure line segments.

2. The Compass



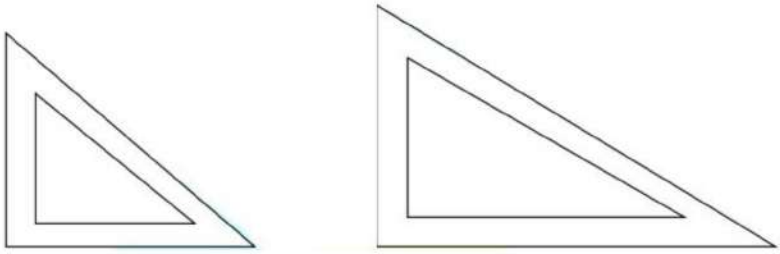
Usage: To mark off the end and measure them. To draw arcs and circles.

3. The divider



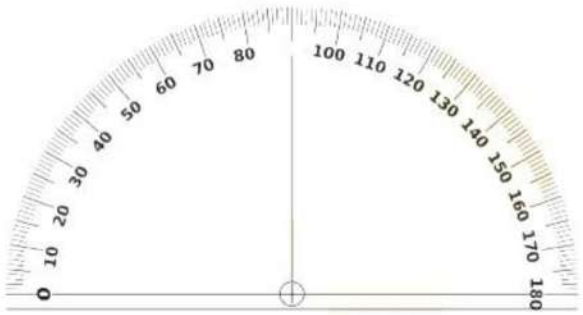
Usage: To compare lengths.

4. Set squares



Usage: To draw parallel and perpendicular lines.

5. The Protractor

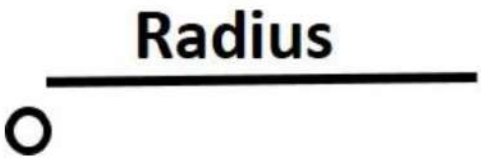


Usage: To measure and draw angles

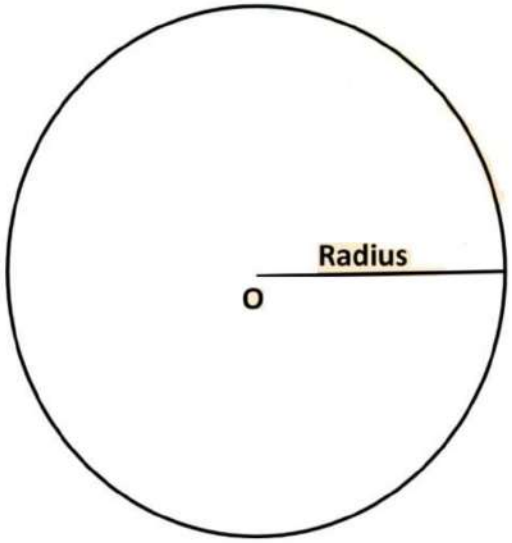
Circle

Construction of circle

Step 1: Open the compasses for the required radius.
Step 2: Mark a point with a sharp pencil where we want the center of the circle to be. Name it as O.



Step 3: Place the pointer of the compasses on O.
Step 4: Turn the compasses slowly to draw the circle. Be careful to complete the move around in one instant.



Line Segment

Construction of line segment of a given length

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 desired 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 given line segment

Step 1 Given 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.

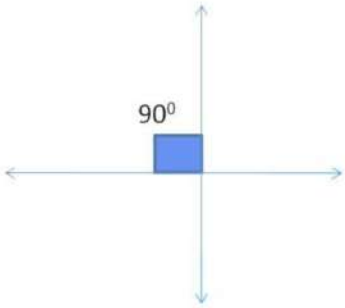
Step 3 Draw any line l. Choose a point C on l. Without changing the compasses setting, place the pointer on C.

Step 4 Swing an arc that cuts l at a point, say, D.

Now CD is a copy of AB.

Perpendicular to Line

Two lines are said to be perpendicular if they intersect each other at 90°.



Construction of perpendicular to a line through a point on it

Method 1: Using a set square

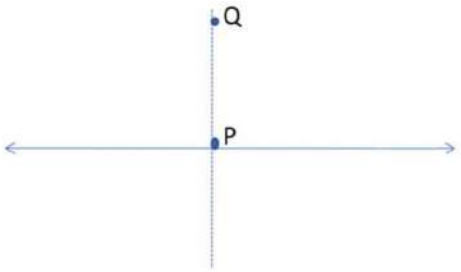
Step 1 A line l and a point P are given. Note that P is on line l.

Step 2 Place a ruler with one of its edges along l. Hold this firmly.

Step 3 Place a set-square with one of its edges along the already aligned edge of the ruler such that the right-angled corner is in contact with the ruler.

Step 4 Slide the set-square along the edge of the ruler until its right-angled corner coincides with P.

Step 5 Hold the set-square firmly in this position. Draw PQ along the edge of the set-square.



Method 2: Using a ruler and compass

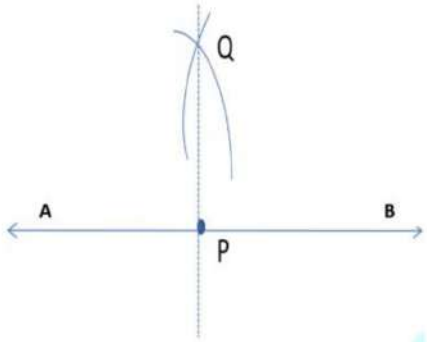
Step 1 Given a point P on a line l.

Step 2 With P as the center and a convenient radius, construct an arc intersecting the line l at two points A and B.

Step 3 With A and B as centers and a radius greater than AP construct two arcs, which cut each other at Q.

Step 4 Join PQ. Then PQ is perpendicular to l.

We write PQ ⊥ l.



Construction of perpendicular to a line through a point not on it

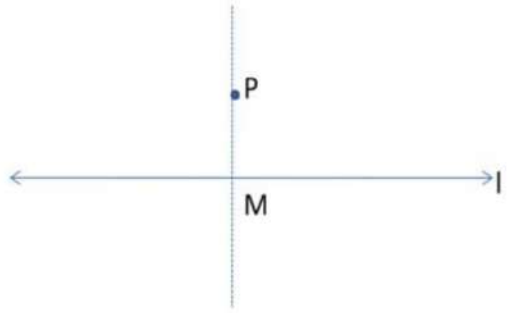
Method 1: Using a set square

Step 1 Let l be the given line and P be a point outside l.

Step 2 Place a set-square on l such that one arm of its right angle aligns along l.
Step 3 Place a ruler along the edge opposite to the right angle of the set-square.
Step 4 Hold the ruler fixed. Slide the set-square along the ruler till the point P

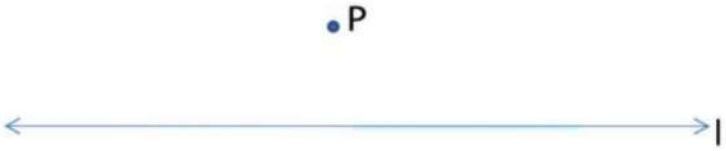
touches the other arm of the set-square.
Step 5 Join PM along the edge through P, meeting l at M.

Now, PM⊥l.

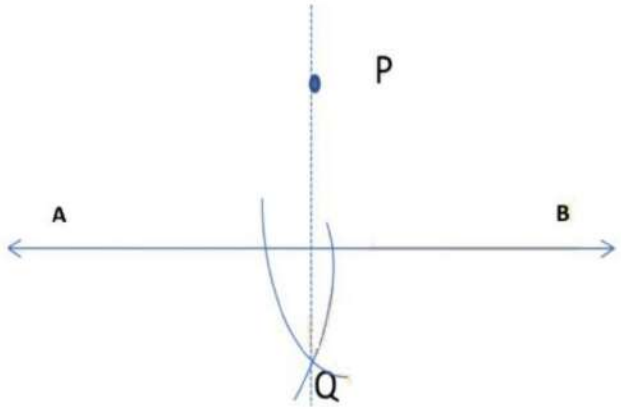


Method 2: Using a ruler and compass

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



Step 2 With P as the center, draw an arc that 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.



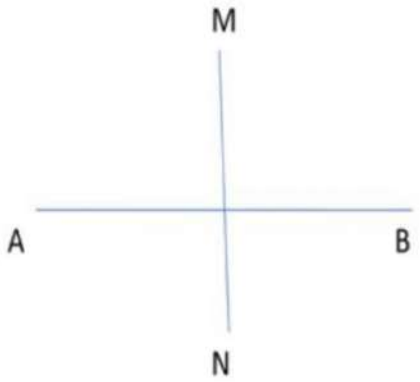
Perpendicular Bisector of Line Segment of Given Length

Segment

Method 1

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 endpoints A and B.
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.

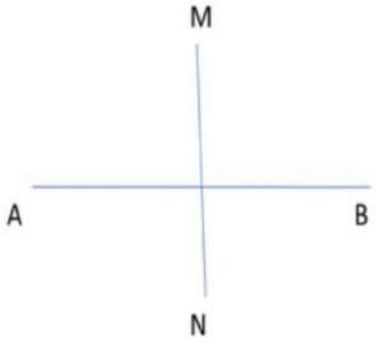


Method 2: Using a ruler and compass

Step 1 Draw a line segment AB of any length.

Step 2 With A as the center, using compasses, draw a circle. Theradius of your circle should be more than half the length of AB.
Step 3 With the same radius and with B as center, draw another circle using compasses. Let it cut the previous circle at M and N.

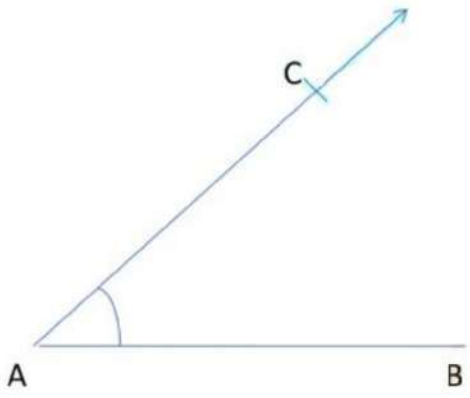
Step 4 Join MN. It cuts AB at O. Use your divider to verify that O is the midpoint of AB.
∠MOA and ∠MOB are right angles. Therefore, MN is the perpendicular bisector of AB.



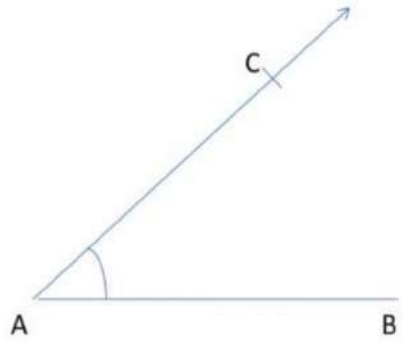
Angle of Given Measure

Angle
Constructing an angle of a given measure
Here are the steps to follow:
Step 1 Draw AB of any length

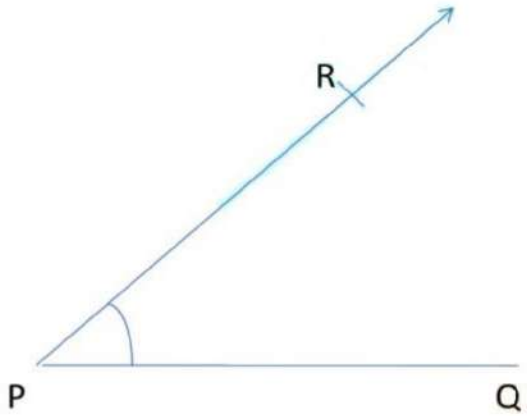
Step 2 Place the center of the protractor at A and the zero edge along with AB.
Step 3 Start with zero near B. Mark point C at given measure.
Step 4 Join AC. ∠BAC is the required angle.



Constructing a copy of an angle
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 the center, cutting l in Q.
Step 4 Set your compasses to the length BC with the same radius.

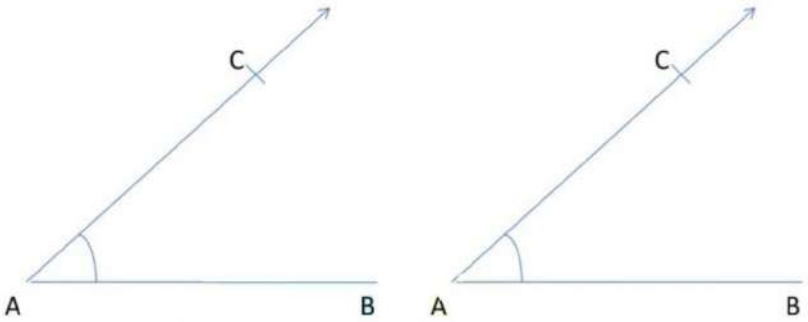


Step 5 Place the compasses pointer at Q and draw the arc to cut the arc drawn earlier in R.
Step 6 Join PR. This gives us ∠P. It has the same measure as ∠A. This means ∠QPR has the same measure as ∠BAC.

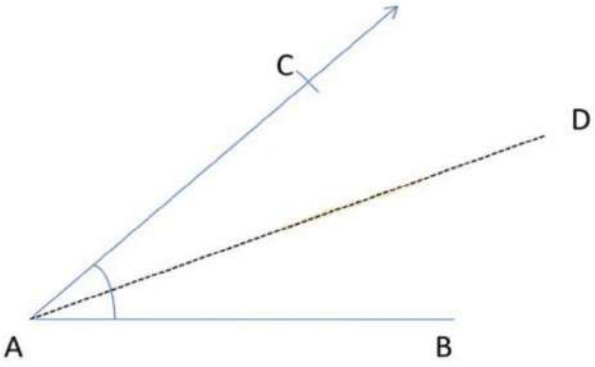


Bisector of Angle

Step 1 With A as a center and using compasses, draw an arc that cuts both rays of ∠A.
Label the points of intersection as B and C.



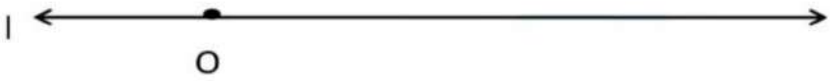
Step 2 With B as center, draw (in the interior of ∠A) an arc whose radius is more than half the length BC.
Step 3 With the same radius and with C as the center, draw another arc in the interior of ∠A. Let the two arcs intersect at D. Then AD is the required bisector of ∠A.



Some Special Angles

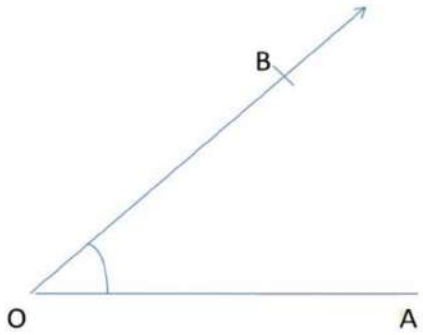
Constructing a 60° angle

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 center), 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°.



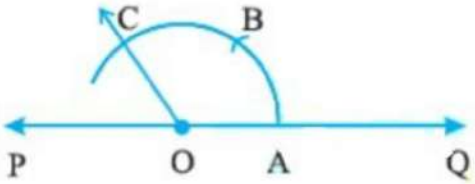
Constructing a 30° angle

Construct an angle of 60° as shown earlier. Now, bisect this angle.
Each angle is 30°

Constructing a 120° angle

An angle of 120° is nothing but twice 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 the center which cuts the first arc at B.
Step 4 Again without disturbing the radius on the compasses and with B as center, draw an arc that cuts the first arc at C.
Step 5 Join OC, ∠COA is the required angle whose measure is 120°.



(IMAGE REFERENCE: NCERT)

Constructing a 90° angle Construct a perpendicular to a line from a point lying on it, as discussed earlier. This is the required 90° angle.