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Introduction to Engineering Drawing

Principles of Engineering Drawing/Graphics:

Definition: Engineering Drawing is the language of engineers.

It is a general principle of engineering drawings that they are projected using standardized, mathematically certain projection methods and rules (standards/conventions).

Projection methods:

- Orthogonal Projection
- Isometric Projection
- Perspective Projection

Drawing Instruments and Materials:

1. Drawing board
2. Drawing sheets
 - Back Up Sheet (any color other than white)
 - White color Sheet
3. Mini drafter
4. Protractor
5. Compass and divider
6. Scales
7. Pencils(HB,H& 2H Grades)
8. Eraser
9. Sharpener
10. Clips and Pins

Conventions in Drawing:

Conventions- commonly accepted practices and methods used in engineering drawing.

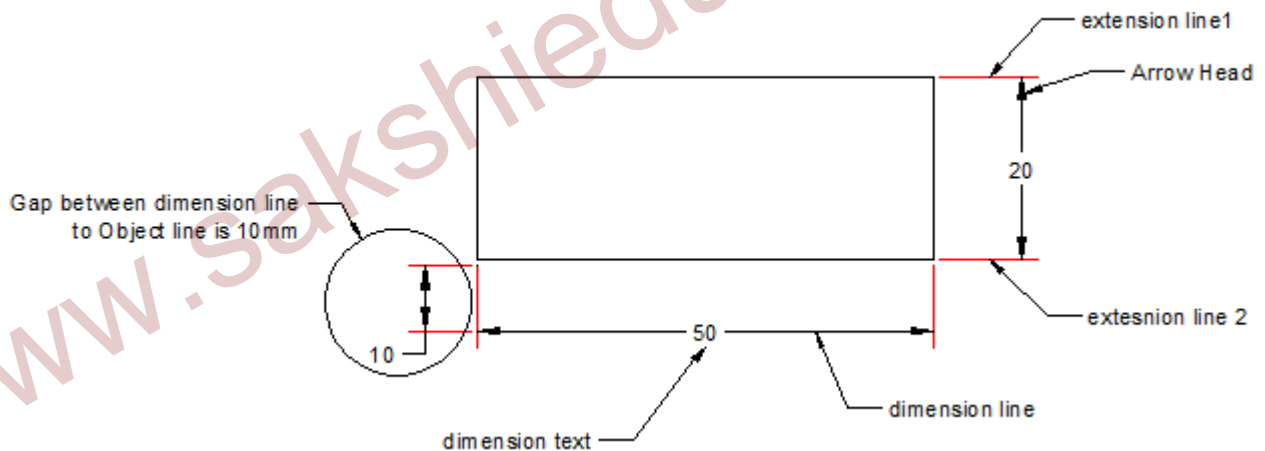
Conventions make the drawing simple and easy to draw. But it is difficult for untrained eyes to understand it easily. Drafting time should be reduced to cut drafting cost. Time must be saved in drafting. It will take a lot of time to draw the actual shape; hence, some conventions are standardized and used in the drawing to save the time. In 1935 the American Standard Association issued the first American standards, entitled “Drawing and Drafting Room Practice”. This standard advocated conventions in many ways, e.g. partial views, half views, symbols, lettering, lines, hatching lines, etc. These have been adopted as a standard convention by the Bureau of Indian Standards also.

Dimension rules:

No need of writing as mm for each dimension. Because in engineering drawing, all dimensions are consider in mm by default.

Dimensioning contains 4 features.

1. Dimension extension lines
2. Dimension line
3. Arrow head
4. Dimension text



Dimension extension lines:

1. To draw extension lines do not use scale, use drafter.
2. Use 2H pencil.
3. Should not touch the Object line. Leave 1 mm gap
4. Don't draw long extension lines beyond dimension line. Extend the extension line beyond dimension line 2-5 mm.

Dimension line:

1. Use HB pencil.
2. Gap between Object line and dimension line is 10mm.
3. Leave gap in middle for dimension text.
4. To draw dimension lines do not use scale, use drafter.

Arrow Head:

1. It should be in the ratio 1:3
2. Use HB pencil.

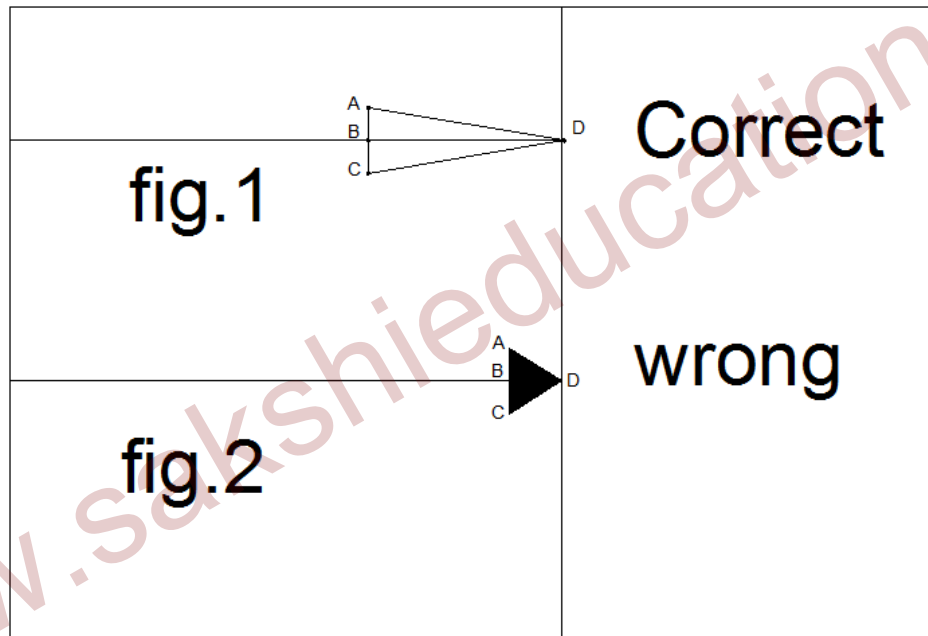
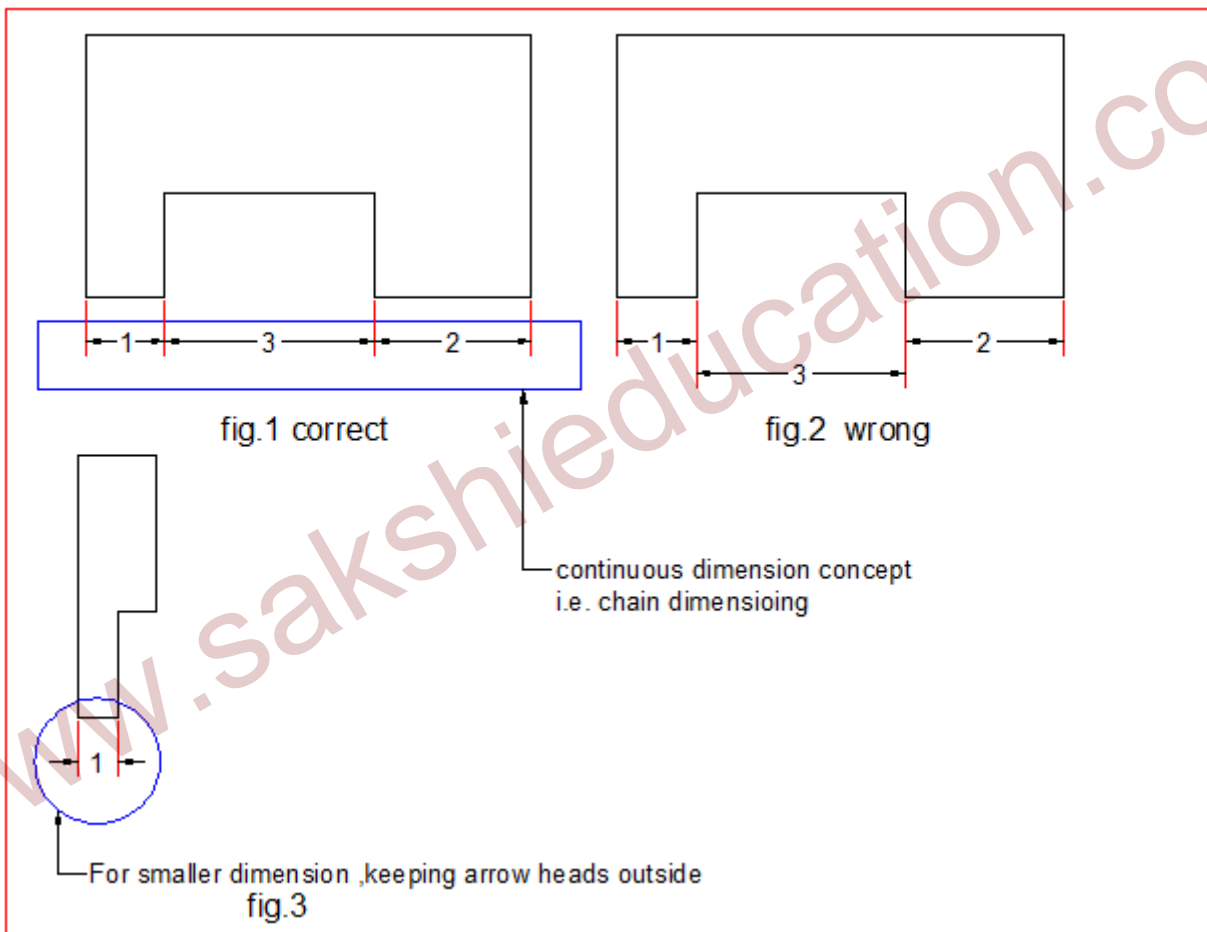


Fig.1. Arrow head ratio 1:3 is maintained. i.e., if AC is 2, BD should be 6.

Fig.2. Arrow head ratio is not maintained. i.e., wrong procedure.

Rules:

1. The gap between object lines to dimension line is 10mm, where as dimension line to dimension line is 8mm.
2. Smaller dimension line should keep inner side, to avoid the overlapping of extension lines.
3. For smaller dimensions the arrow heads can be drawn out.
4. Irrespective of the dimension line position (Inclined, horizontally and vertical) , the dimension text should be straight.
5. Continuous dimensions should be in – line.
6. 'mm' should not be specified in dimension text.



How to set the drafter:










1. The long scale of drafter set in-line with the paper bottom edge of the paper or border of the paper if it is there.
2. Then tight the screw of the drafter.

Scale Vs Mini drafter:

1. To draw a vertical line or Horizontal line with the scale, we require two points where as with the drafter one point is enough to draw vertical and horizontal lines. That is advantage with drafter to get exact Orthogonal lines.(Horizontal and Vertical lines)
2. So don't use the scale to draw horizontal and vertical lines on the drawing sheets. It is a bad practice.

Line types:

Each line on a drawing represents specific precise information regarding the components design.

Type: (thickness)	Example:	Application:
Continuous 0.7mm	A 	Visible outlines
Continuous (thin) 0.3mm	B 	Dimension lines
Short dashes 0.3mm	C 	Hidden detail
Long chain 0.3mm	D 	Center lines
Chain, thick at ends 0.7 – 0.3mm	E 	Section cutting planes
Short chain 0.3mm	F 	Developed views
Continuous wavy boundaries 0.3mm	G 	Broken
Straight zigzag 0.3mm	H 	Break lines
Straight lines with two short zigzags 0.3mm	I 	Dimension lines

Lettering practice:

Writing of titles, dimensions, notes, and other important particulars on a drawing is called lettering. Lettering is an important part of a drawing. However accurate and neat a drawing may be drawn, its appearance is spoiled and sometimes, its usefulness is impaired by poor lettering. Lettering should, therefore, be done properly in clear, legible and uniform style. **It should be in plain and simple style so that it could be done free hand and speedily.**

Different sizes of letters are used for different purposes:

Main titles – 7 mm (or) 10mm

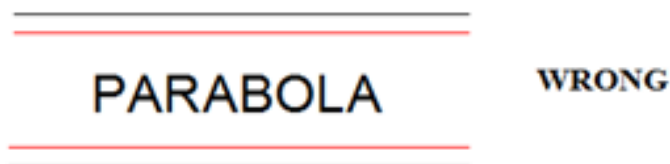
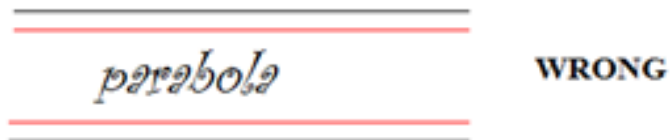
Sub titles – 5 mm (or) 7mm

Dimensions, notes etc, -- 3.5 (or) 5 mm



Note:

1. The text should touch the red line.
2. Don't use small letters for titles or sub titles.
3. Don't use any art for writing the text; write simply with free hand by touching the red line.
4. While placing letters or numbers for drawing, see that no overlap should occur with any line.(Construction ,object lines etc.,)



BIS Conventions: BIS- Bureau of Indian Standards

The ISO (International Standards Organization), has formulated and issued such international standards for engineering drawing, for which our country has given the approval and accordingly modified the Indian Standards. The ISI (Indian Standards Institution) is recently renamed as B.I.S., The EDC (engineering drawing committee) of BIS has adopted the standards of ISO since 1983. The following topics are applicable to the standards.

1. Methods of dimensioning
2. Drawing sheets
3. Lines
4. Lettering

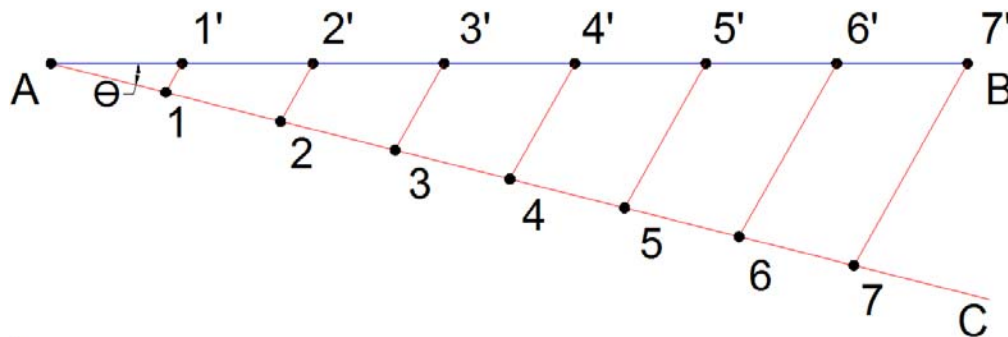
Geometrical Constructions:

1. Divide a line concept
2. Bisect a line
3. Polygons
4. Centre of a pentagon

1. **Divide a line concept:**

This concept is used in two cases

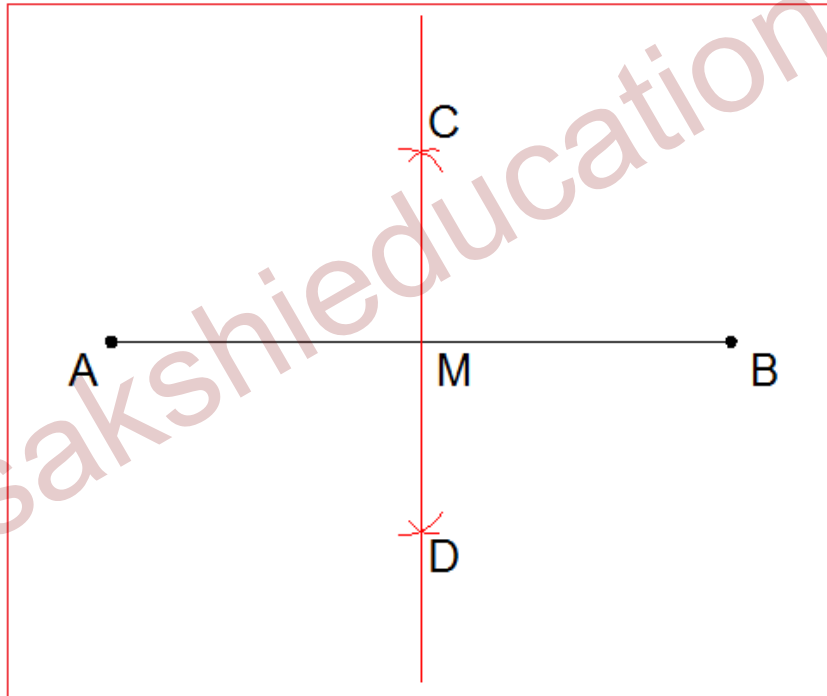
- When the length of line is not possible to divide into required number of parts by using a scale.
- When the length of a line is not known but need to divide the line into some number of equal parts.



Drawing procedure:

1. Draw the given AB length to be divided in to say 7 equal parts.
2. Draw a line AC of any length inclined at some convenient acute angle to AB.
3. From A and along AC, mark 7 equal parts by using a divider.
4. Join B and 7. By using Drafter only and tight the screw.
5. Without disturbing the drafter move the drafter on to the point 6.
6. Draw the line through 6 to cut the AB at 6'.
7. Similarly continue the steps 5 and 6 for the remaining points also.

2. Bisect a line:



Drawing Procedure:

1. Draw the straight line AB, with A as centre and radius greater than half AB, draw arcs on both sides of AB.
2. Similarly, with B as centre and radius greater than half AB, draw arcs on intersects the previous arcs at C and D.
3. Join C and D. The CD line cuts AB at M. This is midpoint of AB.
4. Therefore CD is the perpendicular bisector of AB.

3. Polygons:

Polygons can be drawn directly by direct method:

$$\theta = 180 - \frac{360}{n}$$

θ – Included angle between the sides of a polygon.

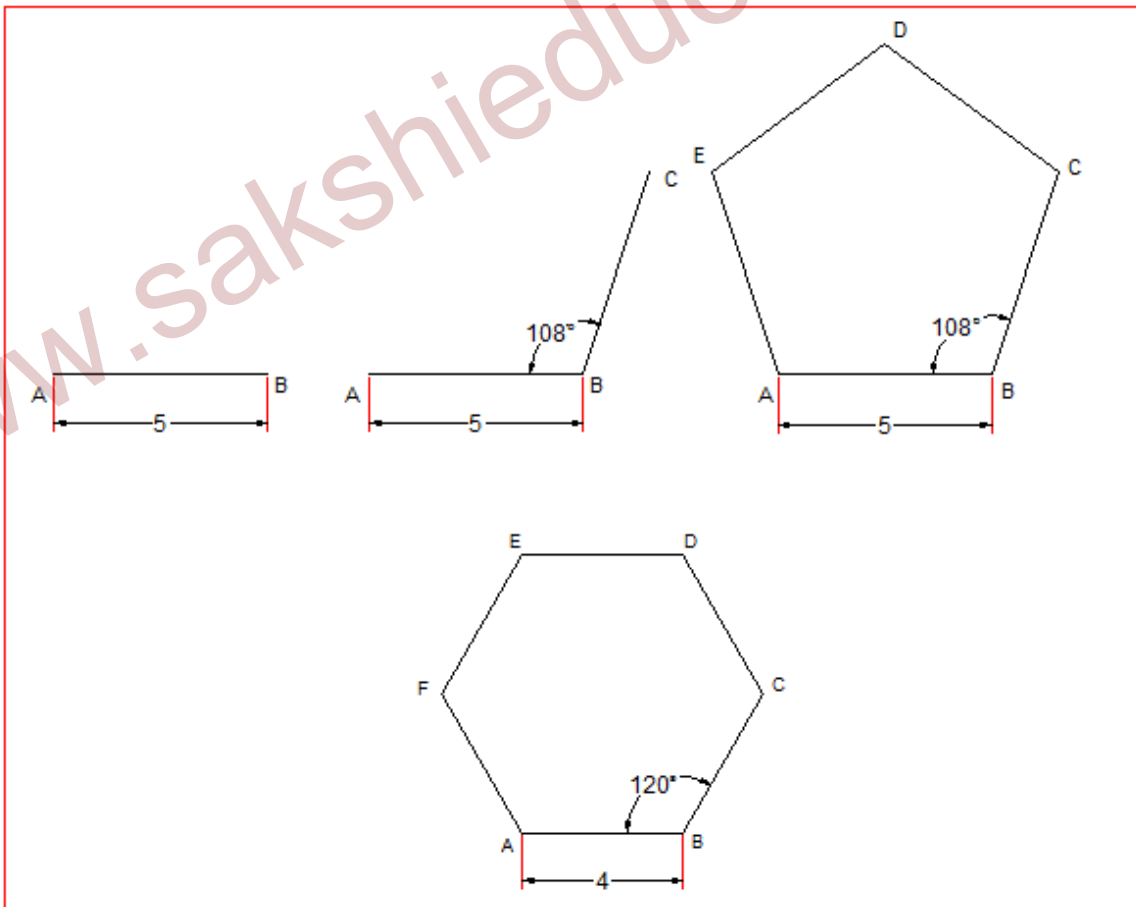
n – No .of sides of a polygon

Note: all sides of a polygon are equal length.

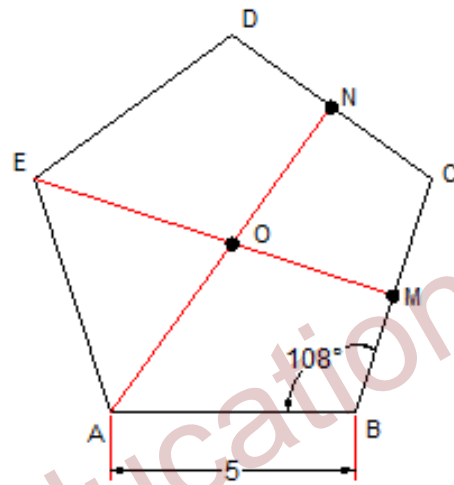
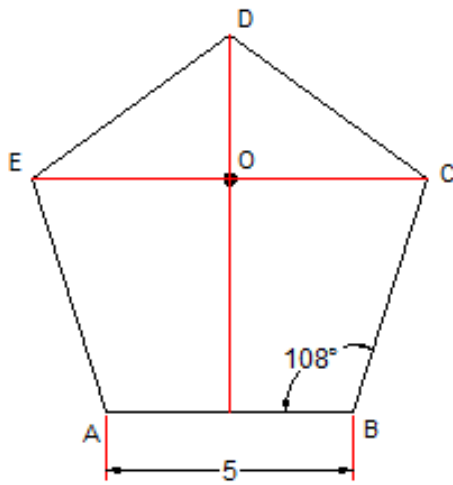
n = 4 the polygon is Square. Therefore θ is 90°

n = 5 the polygon is Pentagon. Therefore θ is 108°

n = 6 the polygon is Hexagon. Therefore θ is 120°



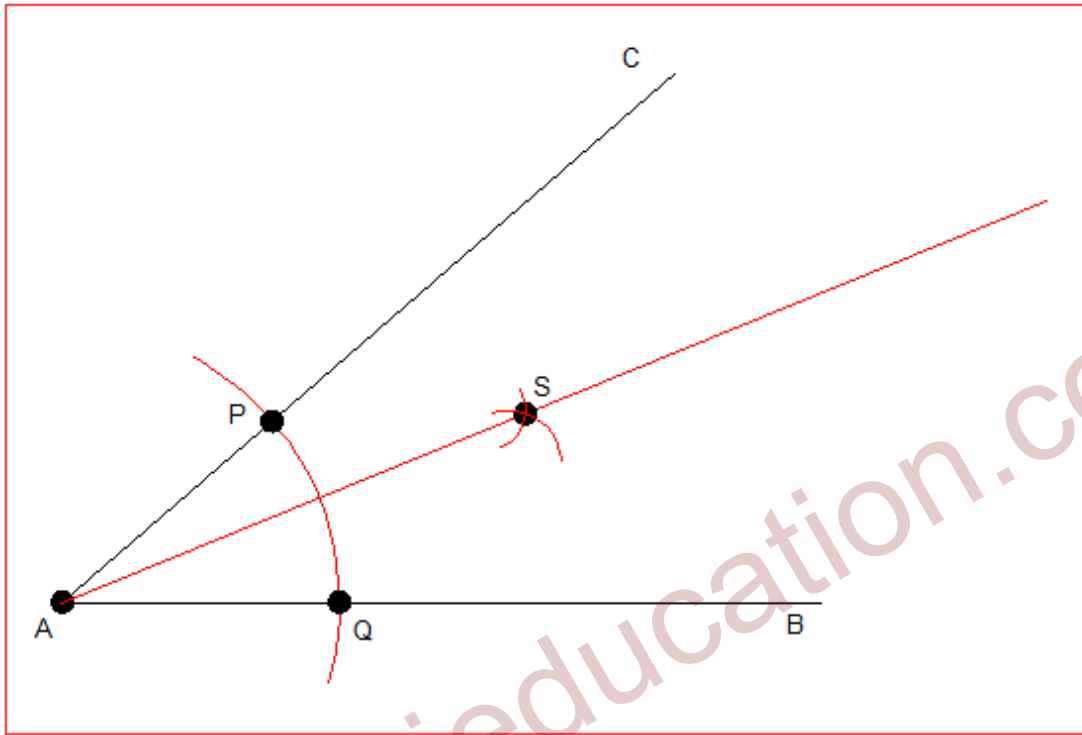
4. Centre of a Pentagon:



Drawing Procedure:

1. From any vertex draw a line to its opposite side midpoint.
2. The intersections of these lines are centre of the pentagon.

5. Angular bisector:



Drawing procedure:

1. Let angle BAC is angle.
2. Locate P and Q with some radius (say r_1) and A as centre on AC and AB respectively.
3. With another radius (say r_2), P as centre draw an arc .
4. Intersect the arc with r_2 radius and Q as centre. And mark S .
5. AS is the angular bisector of angle BAC .