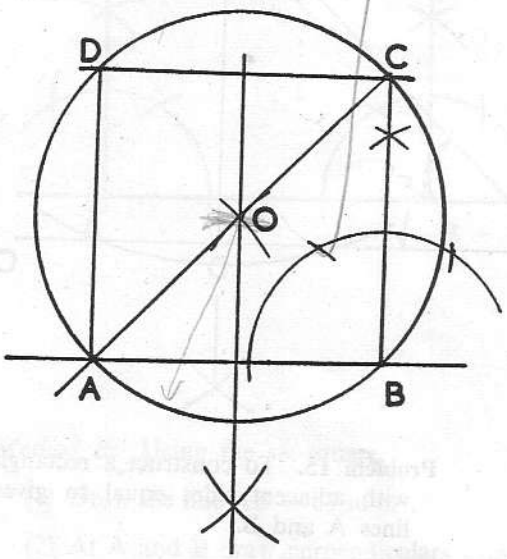
To construct a regular polygon, one must be given the length of its side and the number of sides it has to consist of.

Polygons are more easily constructed when they are inscribed in circles and the following problem will illustrate methods for drawing regular polygons.



Problem 16: To construct a square with side 38 mm by inscribing it in a circle.

Method:

(1) Draw AB = 38 mm and at B erect the perpendicular BC equal to AB (revise problem 5). Join AC.

(2) Bisect AB (revise problem 1) and let the bisector meet AC in O.

(3) With O as centre and OA as radius describe a circle to pass through AB and C.

(4) With A as centre and AB as radius draw an arc to cut the circle in D.

(5) Join AD and CD to give the square ABCD

Problem 17: To construct a hexagon with side 38 mm by inscribing it in a circle.

Method:

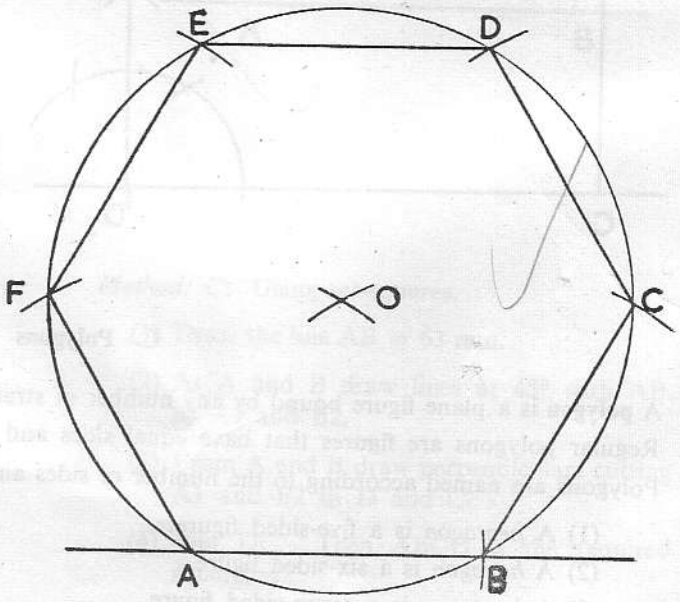
(1) Draw AB = 38 mm.

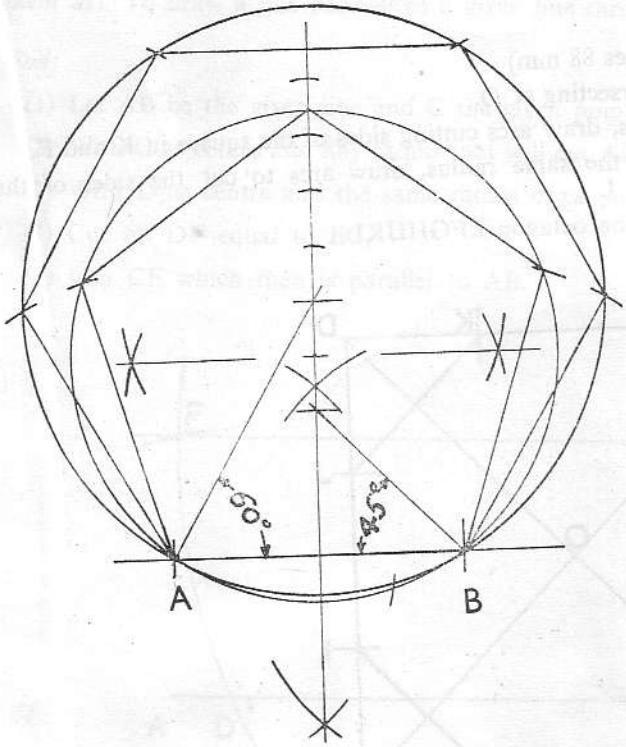
(2) With A and B as centres and AB as radius, draw arcs intersecting at O.

(3) With O as centre and AB as radius draw a circle to pass through A and B.

(4) Starting with B as centre and AB as radius, draw arcs at equal distances on the circumference of the circle cutting it in C, D, E, and F.

(5) Join BC, CD, DE, EF, and FA. to give the hexagon ABCDEF.





Problem 18: To construct a regular polygon on a line AB which is 38 mm long.

Method A:

(1) Draw the line AB = 38 mm.

(2) Bisect AB and produce the bisector to the top.

(3) From B draw a line at 45° to AB meeting the bisector in C. Then C is the centre of a square based on AB.

(4) From A draw a line at 60° to AB meeting the bisector in D. Then D is the centre point of a hexagon based on AB.

(5) Bisect CD in E. Then E is the centre of a pentagon based on AB.

(6) From D upwards step off distances equal to DE which will then give consecutively the centres for a heptagon, octagon, etc., based on AB.

Method B:

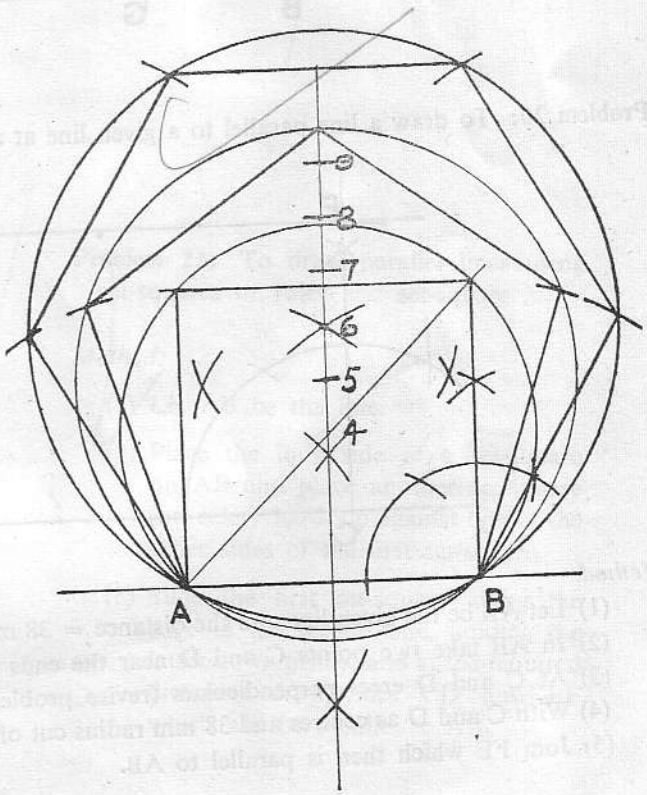
(1) Draw the line AB = 38 mm.

(2) Find the centre for the circle to contain the square on AB (revise problem 16). Mark the centre 4.

(3) Find the centre for the circle to contain the hexagon on AB (revise problem 15). Mark the centre 6.

(4) Bisect the distance between the centres for the square (4), and the hexagon (6). This will give the centre for the circle to contain a pentagon on AB. Mark it 5.

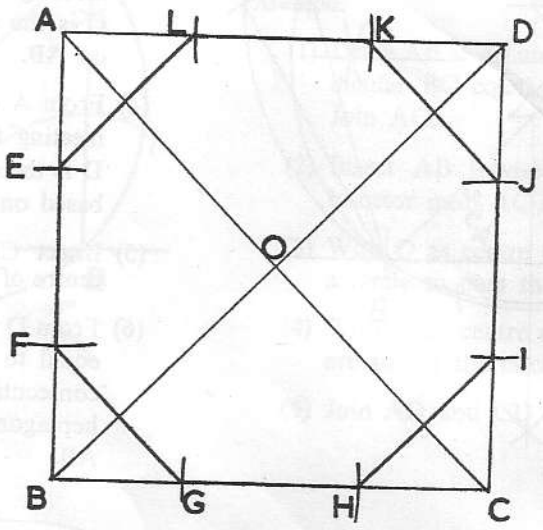
(5) With 6 as centre and 6—5 (or 5—4) as radius, cut off equal segments on the bisector of AB and mark them 7, 8 and 9. These points are the centres for other regular polygons on AB.



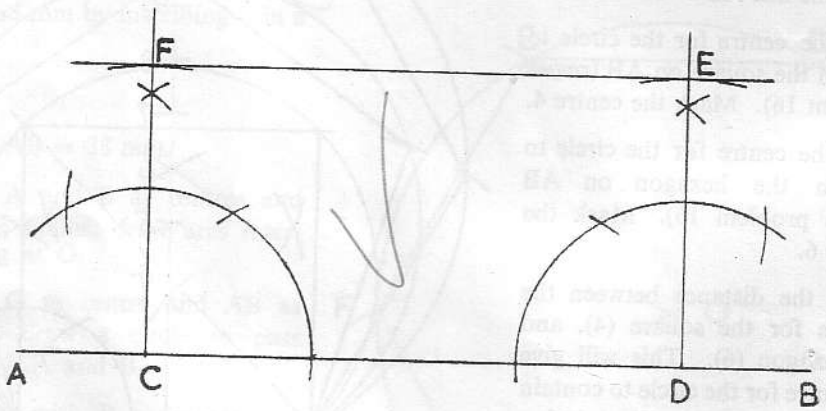
Problem 19: To construct an octagon within a given square.

Method:

(1) Let ABCD be the given square. (Sides 88 mm)
(2) Draw the diagonals AC and BD intersecting at O.
(3) With A as centre and AO as radius, draw arcs cutting sides of the square in K and F.
(4) With B, C, and D as centres and the same radius, draw arcs to cut the sides of the square in E and H, G and J, L and I.
(5) Join EL, KJ, IH, and GF giving the octagon EFGHIJKL.



Problem 20: To draw a line parallel to a given line at a given distance.



Method:

(1) Let AB be the given line and the distance = 38 mm.
(2) In AB take two points C and D near the ends of the line.
(3) At C and D erect perpendiculars (revise problem 5).
(4) With C and D as centres and 38 mm radius cut off CF and DE.
(5) Join FE which then is parallel to AB.

The *major axis* (Fig. 22) of an ellipse is the longest line that can be drawn across the figure. It is also called the *transverse diameter*.

The *minor axis* (Fig. 22) bisects the major axis and is perpendicular to it. It is also called the *conjugate diameter*.

An ellipse is symmetrical about the two axes which are at right angles to each other.

The major axis contains two points called *foci* (Fig. 22). These points are determined by describing an arc with half the major axis as radius and an extremity of the minor axis as centre, cutting the major axis in two points.

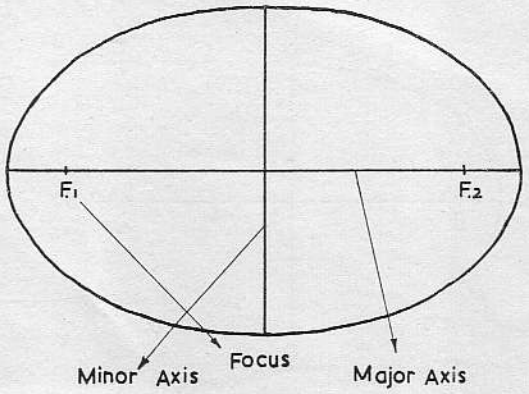


FIG. 22

EXERCISE 14

To draw an ellipse being given the major and the minor axes.

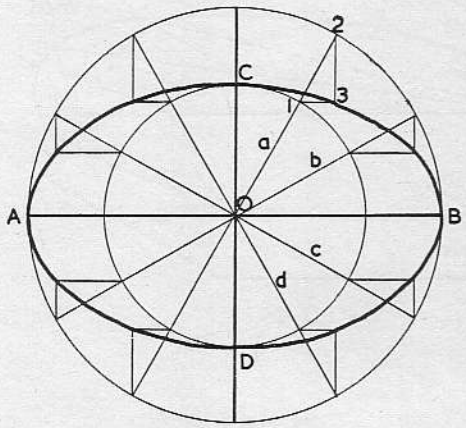


FIG. 23

Method A (Fig. 23):

1. Let AB be the major axis and CD the minor axis intersecting at O.
2. With O as centre and OA as radius draw a circle.
3. With O as centre and OC as radius draw a concentric circle as shown in Fig. 23.
4. Through O draw a series of diameters *a*, *b*, *c*, *d*, *e*, etc., common to both circles.
5. Diameter *a* cuts the two circles in points 1 and 2.
6. From 2 draw a line parallel to the minor axis and from 1, draw a line parallel to the major axis intersecting the former line in 3. Then 3 is one point in the ellipse.
7. Draw similar parallel lines through the points where the other diameters *b*, *c*, *d*, *e*, etc. cut the two circles to find more points in the ellipse.
8. By joining the points determined above, the required ellipse can be drawn.

Method B (Fig. 24):

1. Let PQ and RS be the major and the minor axes respectively intersecting in O.
2. Through P and Q draw lines parallel to the minor axis and through R and S draw lines parallel to the major axis to form a rectangle that will enclose the ellipse.
3. Divide PT into any number of equal parts (say 4) and join thesepoints to R.
4. Divide PO into the same number of equal parts, join them to S and produce them to cut the lines joined to R.
5. The points thus found are points in the required ellipse and by repeating the process the remaining portion of the ellipse can be determined.

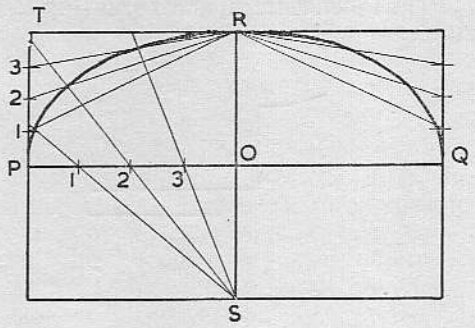


FIG. 24

Method C (Fig. 25):

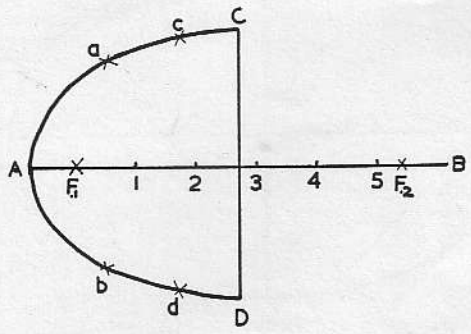


FIG. 25

1. Let AB and CD be the major and the minor axes respectively.
2. Determine the foci and mark them F_1 and F_2.
3. Take a series of points in the major axis AB (between F_1 and F_2) and number them as 1, 2, 3, 4, etc.
4. With F_1 as centre and A_1 as radius describe an arc on either side of AB. Then with F_2 as centre and 1-B as radius describe arcs cutting the former arcs in *a* and *b*.
5. With F_1 as centre and A-2 as radius describe two more arcs and with F_2 as centre and 2-B as radius describe arcs to cut the previous arcs in *c* and *d*.
6. More points in the ellipse can be determined as described in 4 and 5 until the whole curve can be drawn.

Method D (Fig. 26):

This is a mechanical method of drawing an ellipse based on method C and is used for setting it out in practical work.

1. Draw the major and the minor axes of the ellipse and determine the foci.
2. Stick two strong drawing pins in the foci and stretch a piece of thin line round the pins so that the loop reaches to the extremity C of the minor axis.
3. Take a pencil and put the point inside the loop on the point C.
4. By moving the pencil point round inside the loop keeping it taut all the time, the ellipse can be traced.

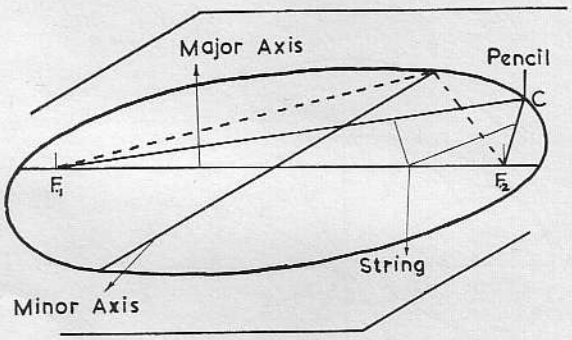
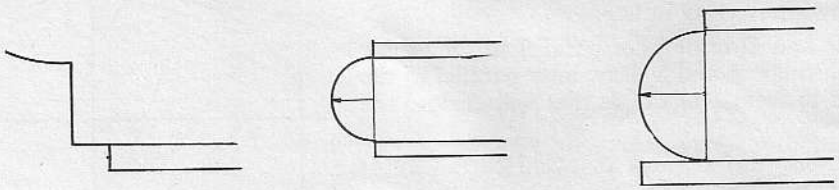


FIG. 26

EXERCISE 15

The mouldings in use at the present time are all based on those used by the Greeks and the Romans Both used the same eight fundamental mouldings, namely: (*a*) Fillet; (*b*) Astragal; (*c*) Torus; (*d*) Ovolo; (*e*) Cavetto; (*f*) Scotia; (*g*) Cyma Recta or Ogee; (*h*) Cyma Reversa or Reverse Ogee.

The Fillet, astragal and Torus (Fig. 27) are common to both Grecian and Roman both in type and outline.



(a) (b) (c)

FIG. 27

The other five mouldings (Fig. 28) are common to both in type only but differ in outline. Whereas the Romans used Circles and arcs, the Grecian mouldings are based on the ellipse.

The various mouldings are generally used in combination, according to circumstances.

WOODWORK DRAWING

AND

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—for—

JUNIOR SECONDARY STANDARDS (VI—VIII)

1968 Syllabus

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