

**Tishk International University**  
**Engineering Faculty**  
**Petroleum and Mining Engineering Department**



# **Engineering Drawing**

## **Lecture 3: Geometrical Construction (Part II)**

**First Grade- Fall Semester 2020-2021**

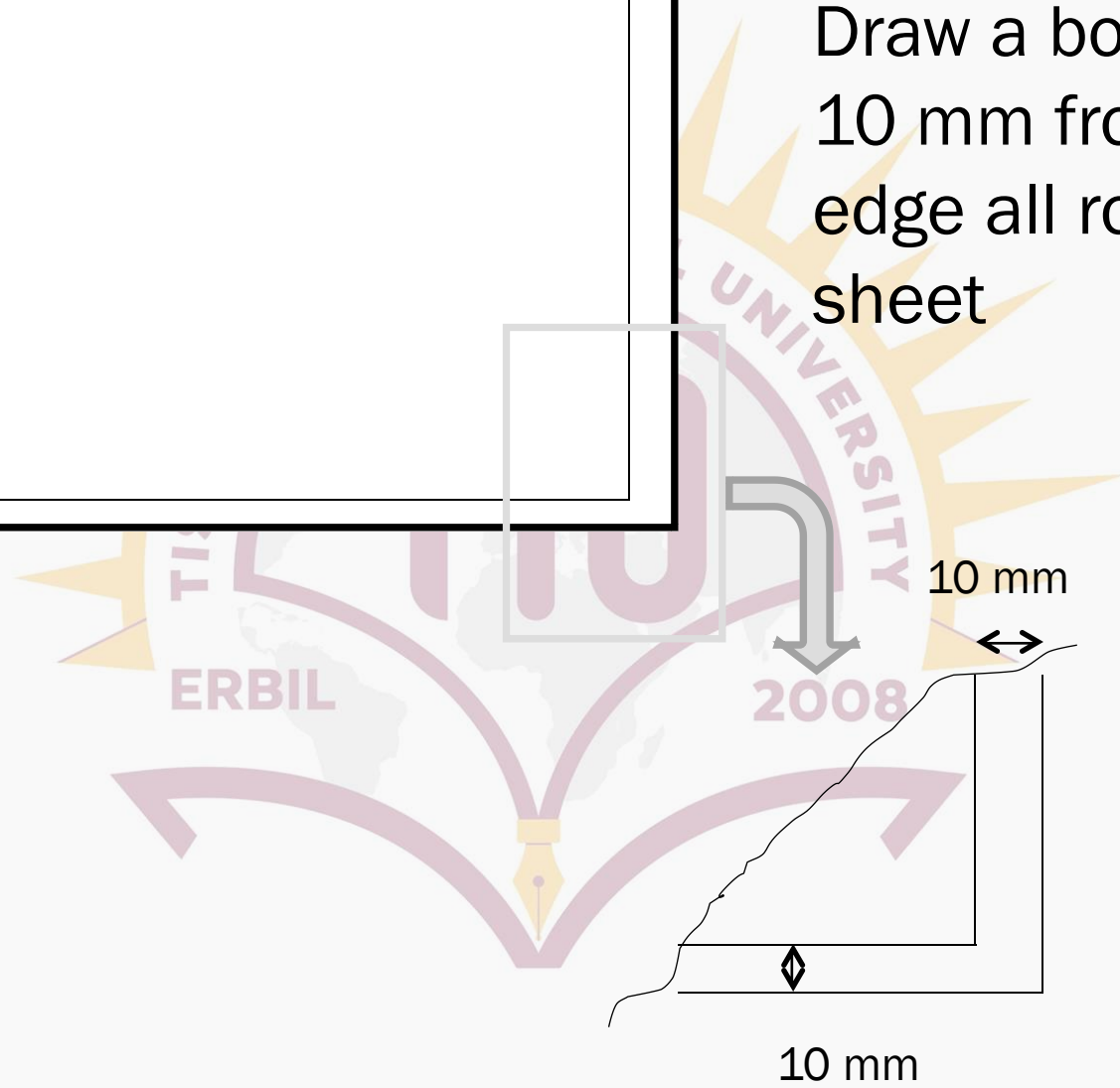
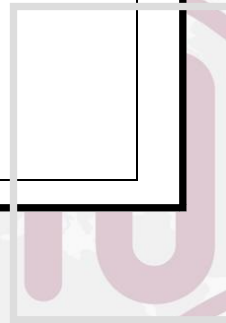
**Instructor: Sheida Mostafa Sheikheh**

# Content:

- Construct a Hexagon
- Construct a Pentagon
- Construct a Regular Polygon
- Inscribe a Square in a Circle
- Inscribe a Hexagon in a Circle
- Inscribe a Regular Polygon in a Circle
- Inscribe a Square in a Triangle
- circumscribe a hexagon on a Circle



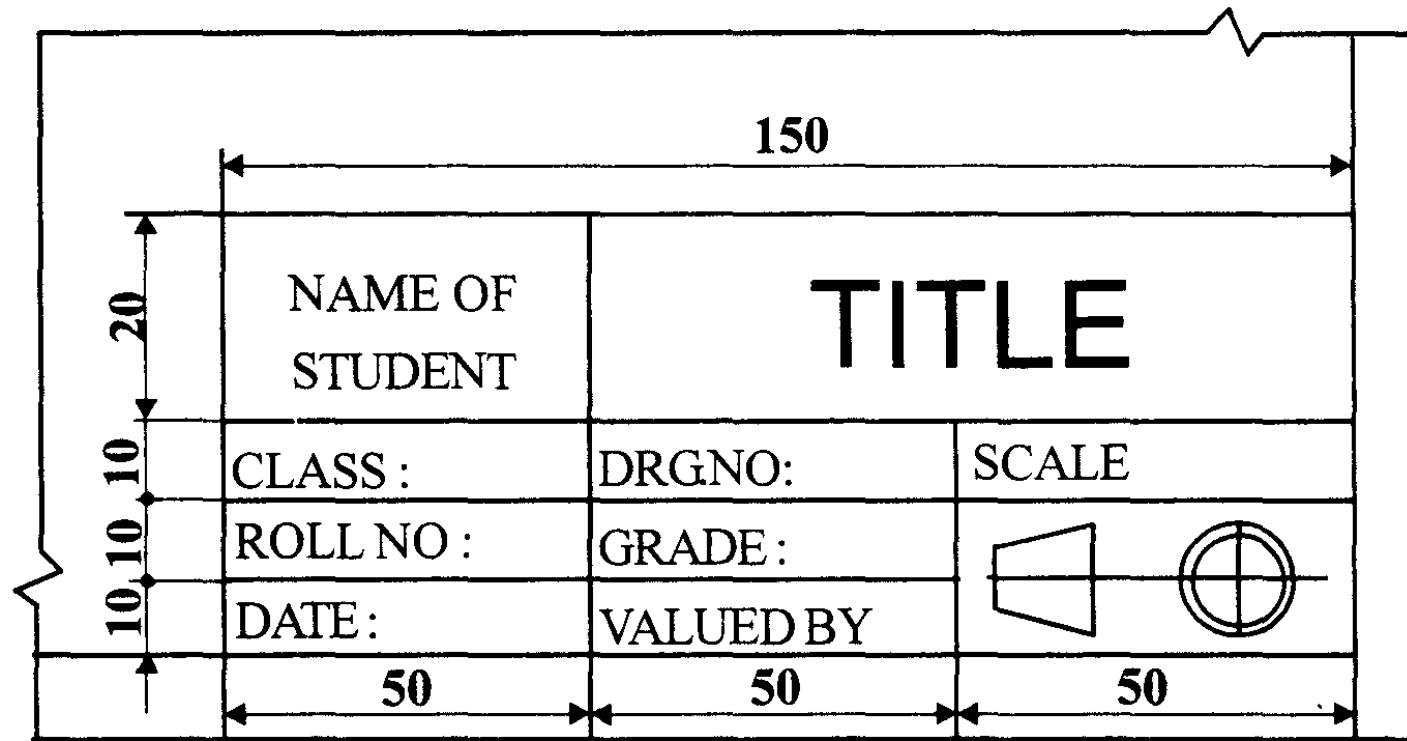
Draw a border line  
10 mm from the  
edge all round the  
sheet



10 mm

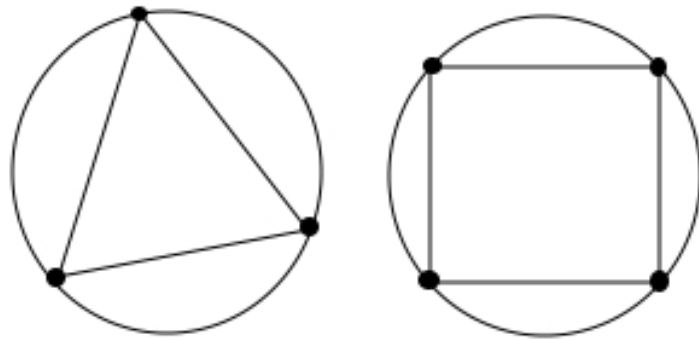
10 mm

# Title Block:

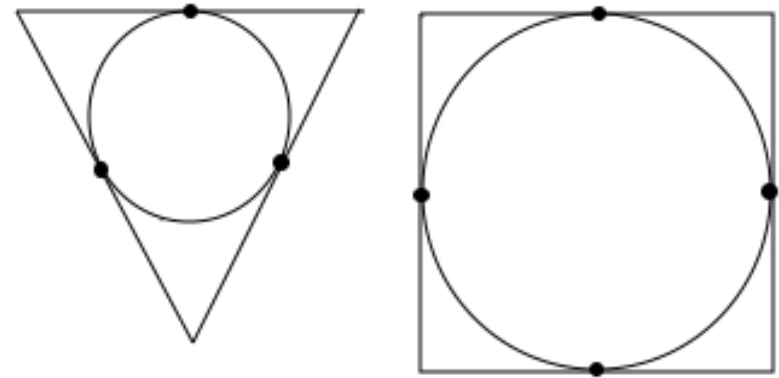


# Definitions:

- **Circumscribe:** A circumscribed circle surrounds another shape, touching every vertex (corner) of the shape.
- **Inscribe:** An inscribed circle is inside another shape, touching each side at exactly one point.



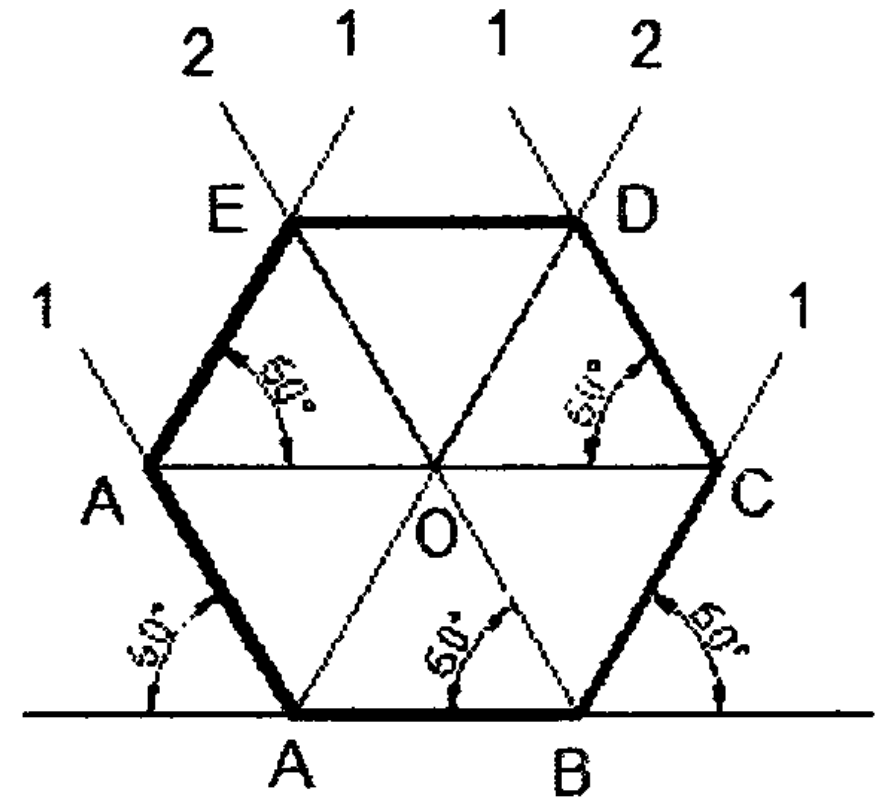
Circumscribed circles



Inscribed circles

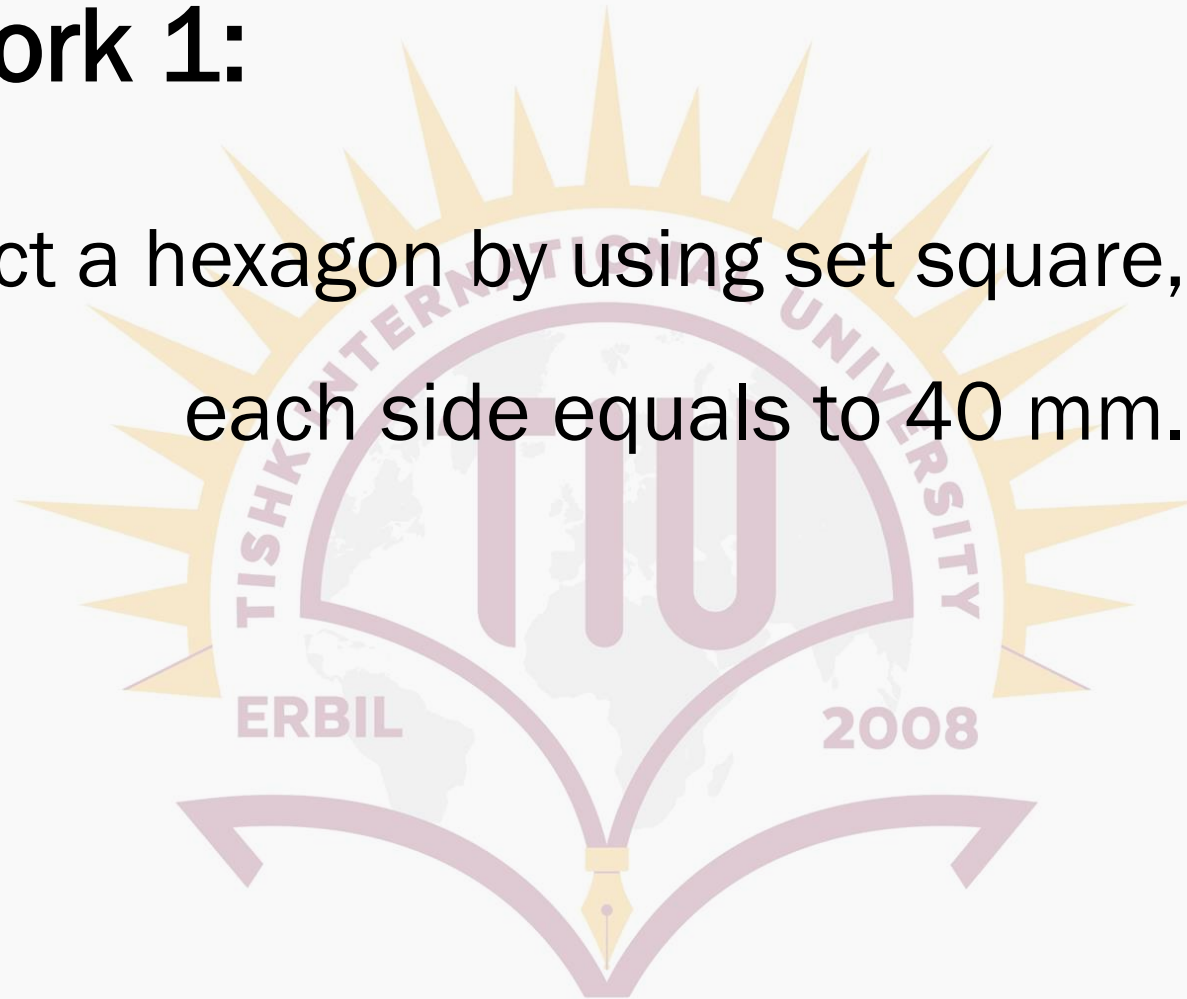
# Construct a Hexagon:

- To construct a hexagon, given the length of the side.
- A- Construction Using set square:
  1. Draw a line AB equal to the side of the hexagon.
  2. Using  $30^\circ - 60^\circ$  set-square draw lines A1, A2, and B1, B2.
  3. Through O, the point of intersection between the lines A2 at D and B2 at E.
  4. Join D,E
  5. ABC D E F is the required hexagon.



# Classwork 1:

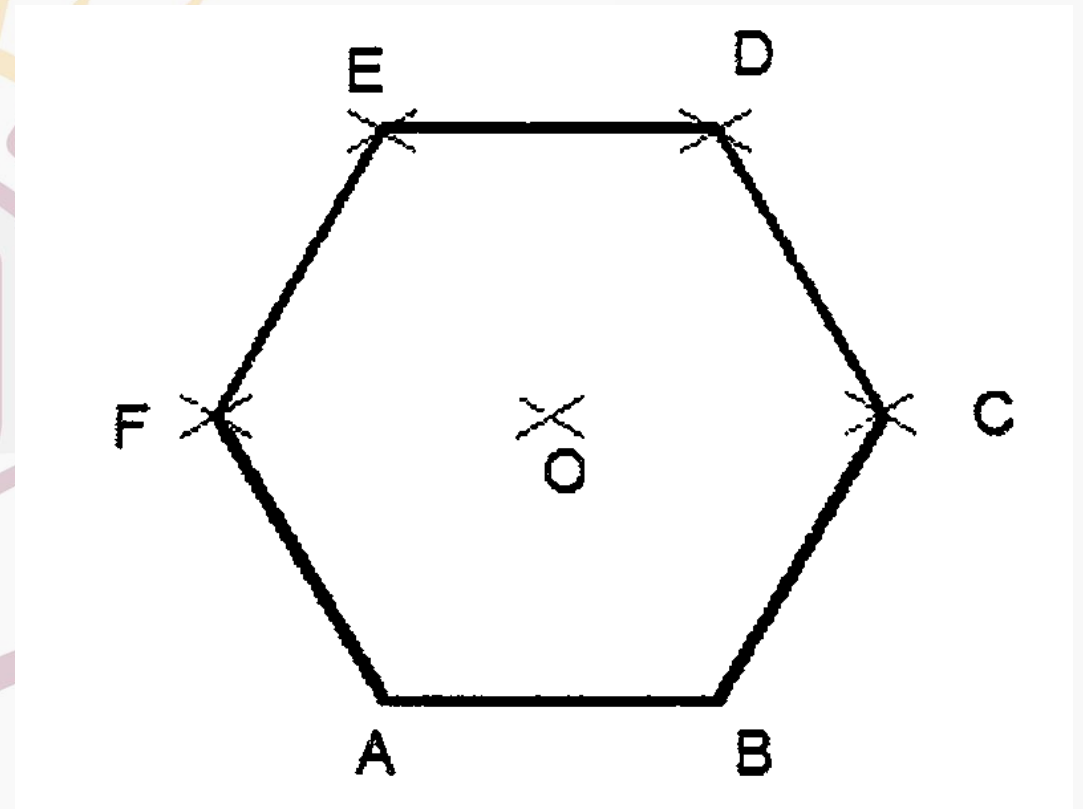
Construct a hexagon by using set square, the length of each side equals to 40 mm.



# Construct a Hexagon:

## ■ B- By using compass:

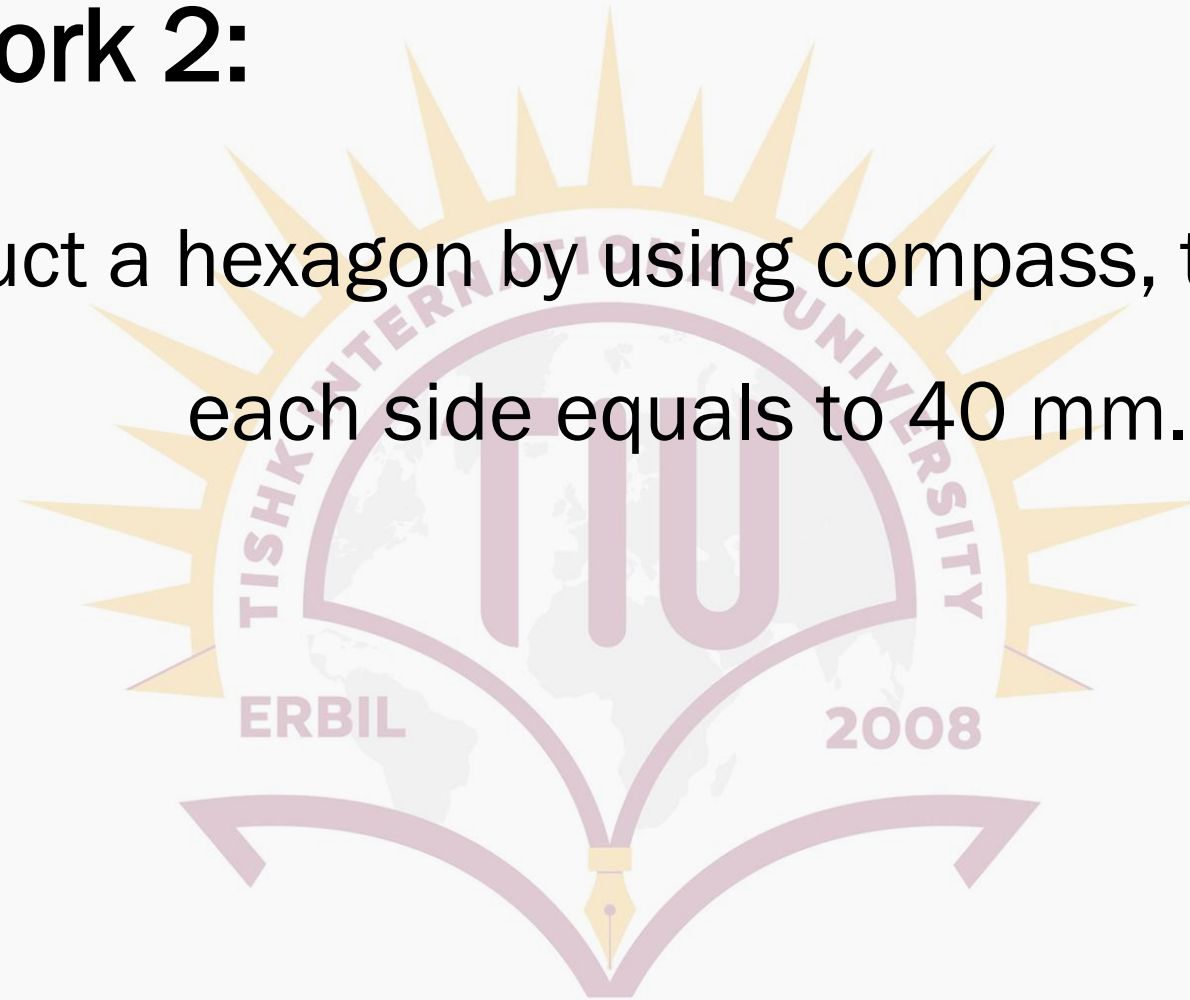
1. Draw a line AB equal to the of side of the hexagon.
2. With centres A and B and radius AB, draw arcs intersecting at O, the centre of the hexagon.
3. With centres O and B and radius OB (=AB) draw arcs intersecting at C.
4. Obtain points D, E and F in a similar manner.





## Classwork 2:

Construct a hexagon by using compass, the length of each side equals to 40 mm.

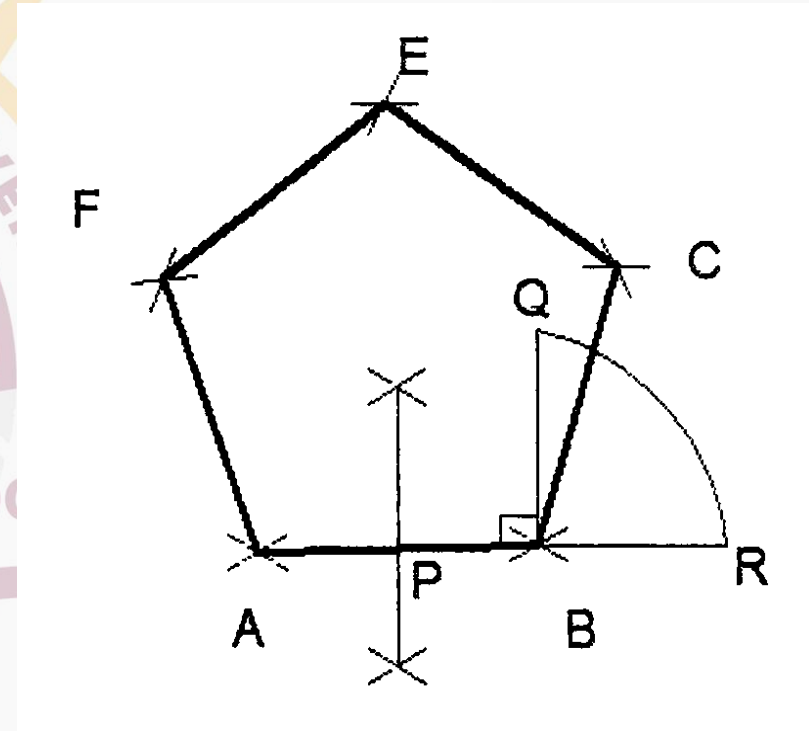


# Construct a Pentagon:

- A. To construct a pentagon, given the length of side:

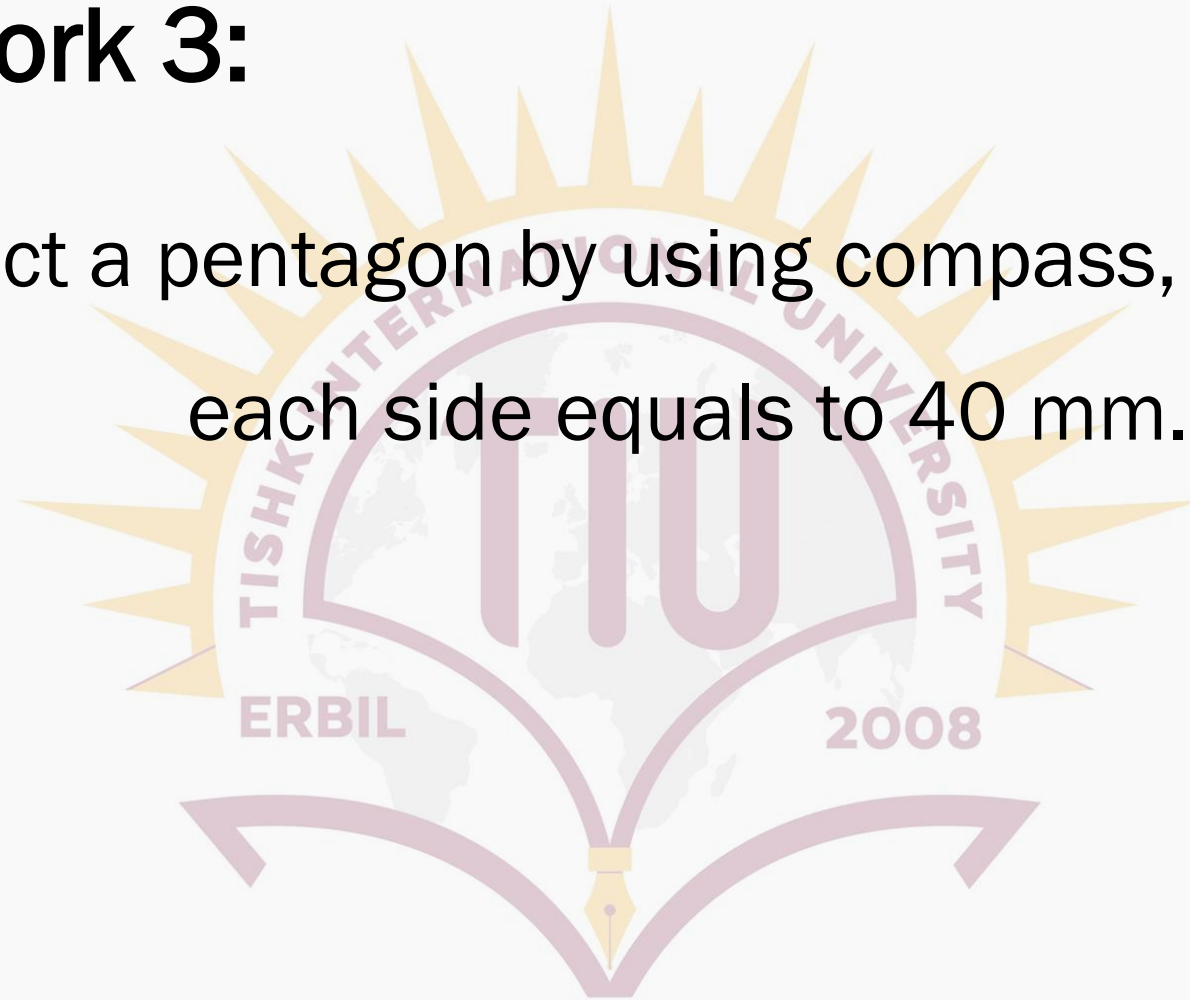
1. Draw a line AB equal to the given length of side.
2. Bisect AB at P.
3. Draw a line BQ equal to AB in length and perpendicular to AB.
4. With centre P and radius PQ, draw an arc intersecting AB produced at R. AR is equal to the diagonal length of the pentagon.
5. With centres A and B and radii AR and AB respectively draw arcs intersecting at C.
6. With centres A and B and radius AR draw arcs intersecting at E.
7. With centres A and B and radii AB and AR respectively draw arcs intersecting at F.

- ABCE is the required pentagon.



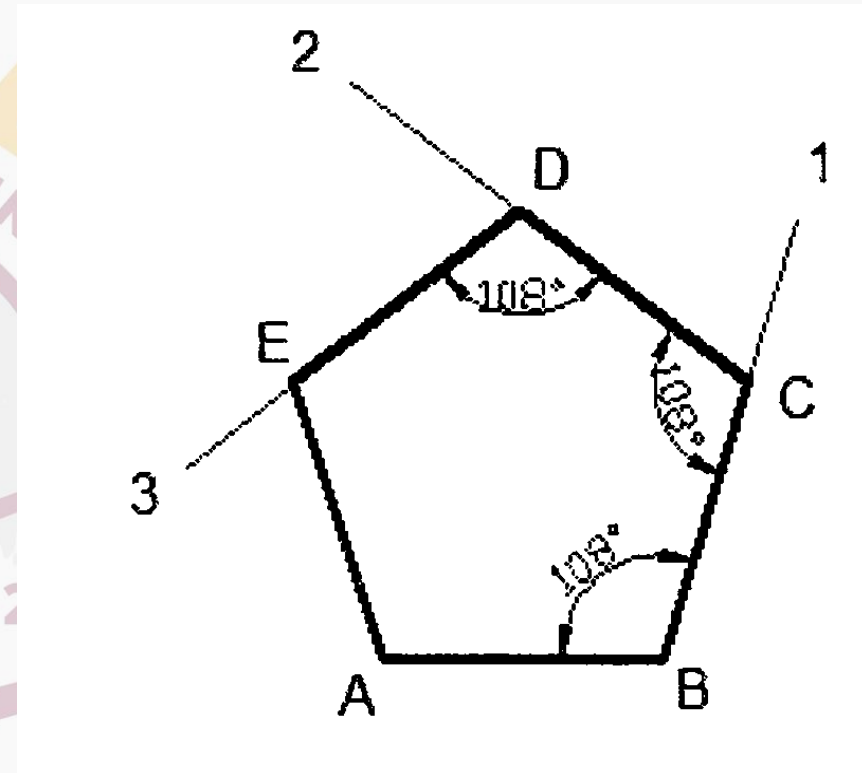
## Classwork 3:

Construct a pentagon by using compass, the length of each side equals to 40 mm.



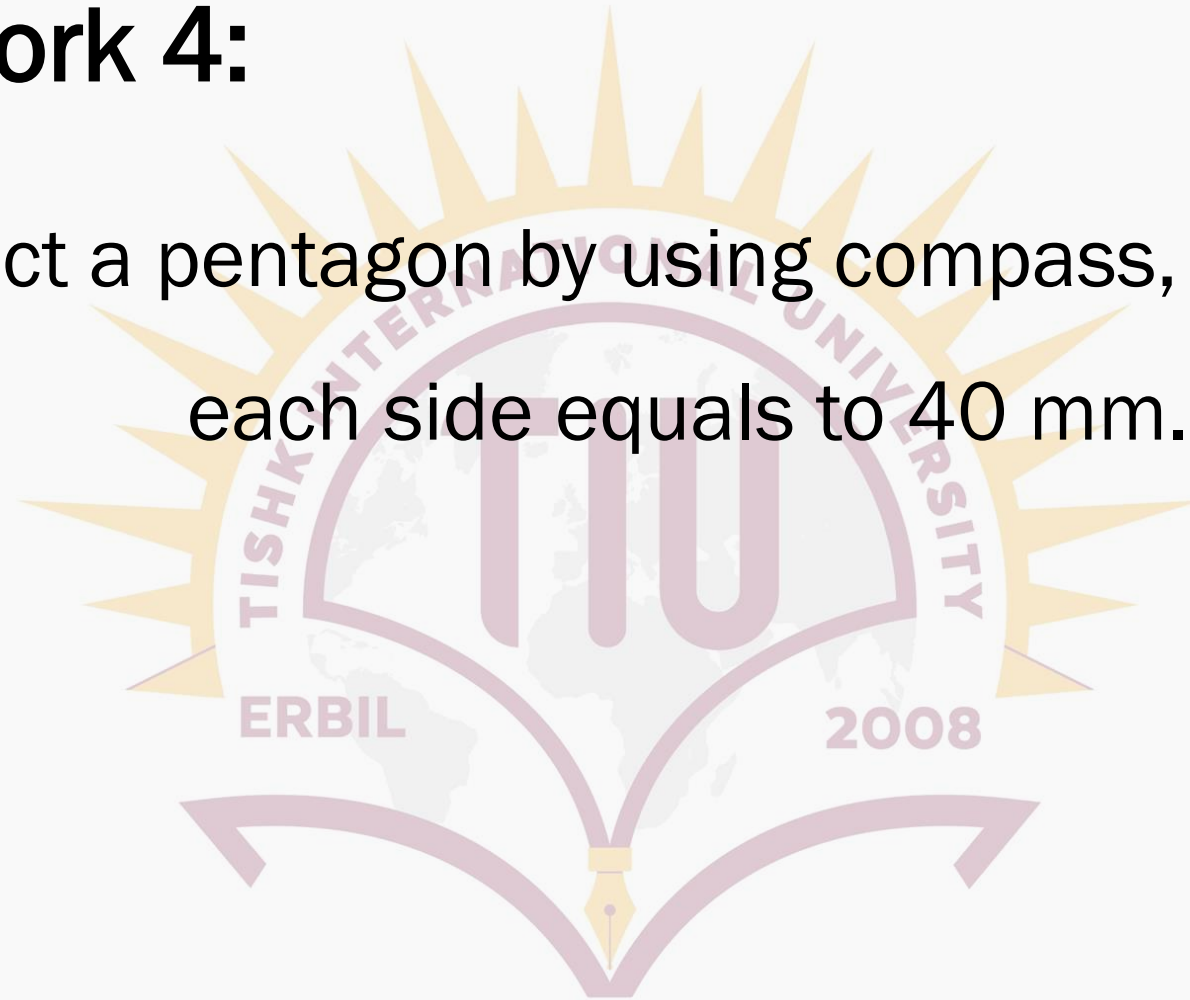
# Construct a Pentagon:

- B- By included angle method:
  1. Draw a line AB equal to the length of the given side.
  2. Draw a line B 1 such that  $\angle AB 1 = 108^\circ$  (included angle).
  3. Mark C on B1 such that  $BC = AB$
  4. Repeat steps 2 and 3 and complete the pentagon ABCDE.



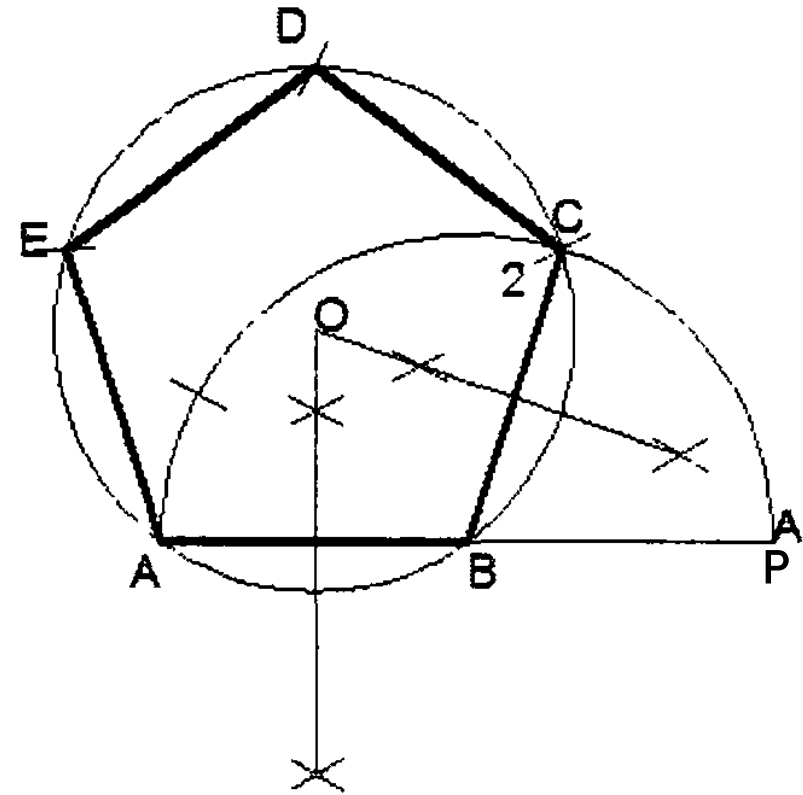
## Classwork 4:

Construct a pentagon by using compass, the length of each side equals to 40 mm.



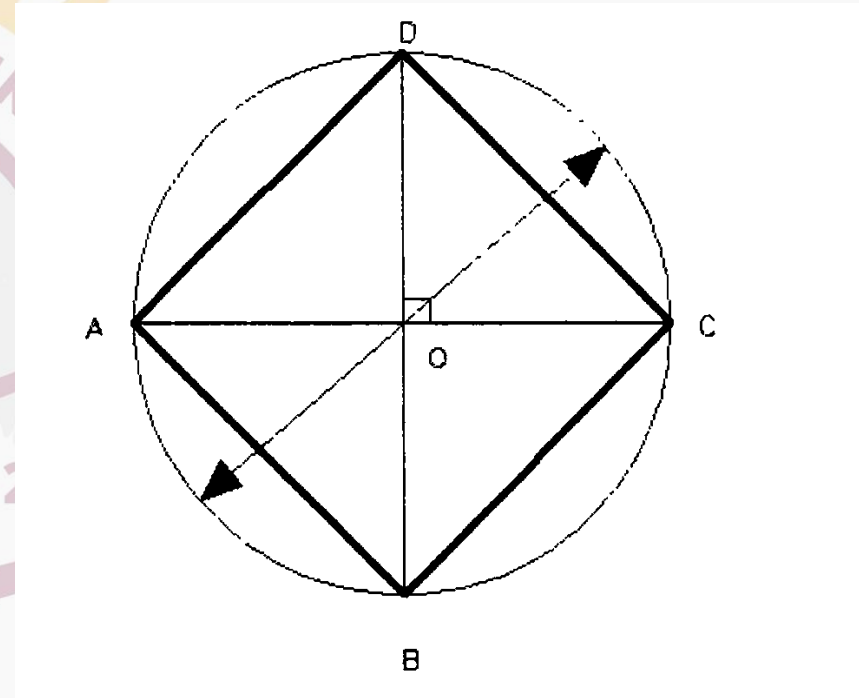
# Construct a Regular Polygon:

- To construct a regular polygon (say a pentagon) given the length of the side:
  1. Draw a line AB equal to the side and extend to P such that  $AB = BP$
  2. Draw a semicircle on AP and divide it into 5 equal parts by trial and error.
  3. Join B to second division.
  4. Irrespective of the number of sides of the polygon B is always joined to the second division.
  5. Draw the perpendicular bisectors of AB and B2 to intersect at O.
  6. Draw a circle with O as centre and OB as radius.
  7. With AB as radius intersect the circle successively at D and E. Then join CD. DE and EA.



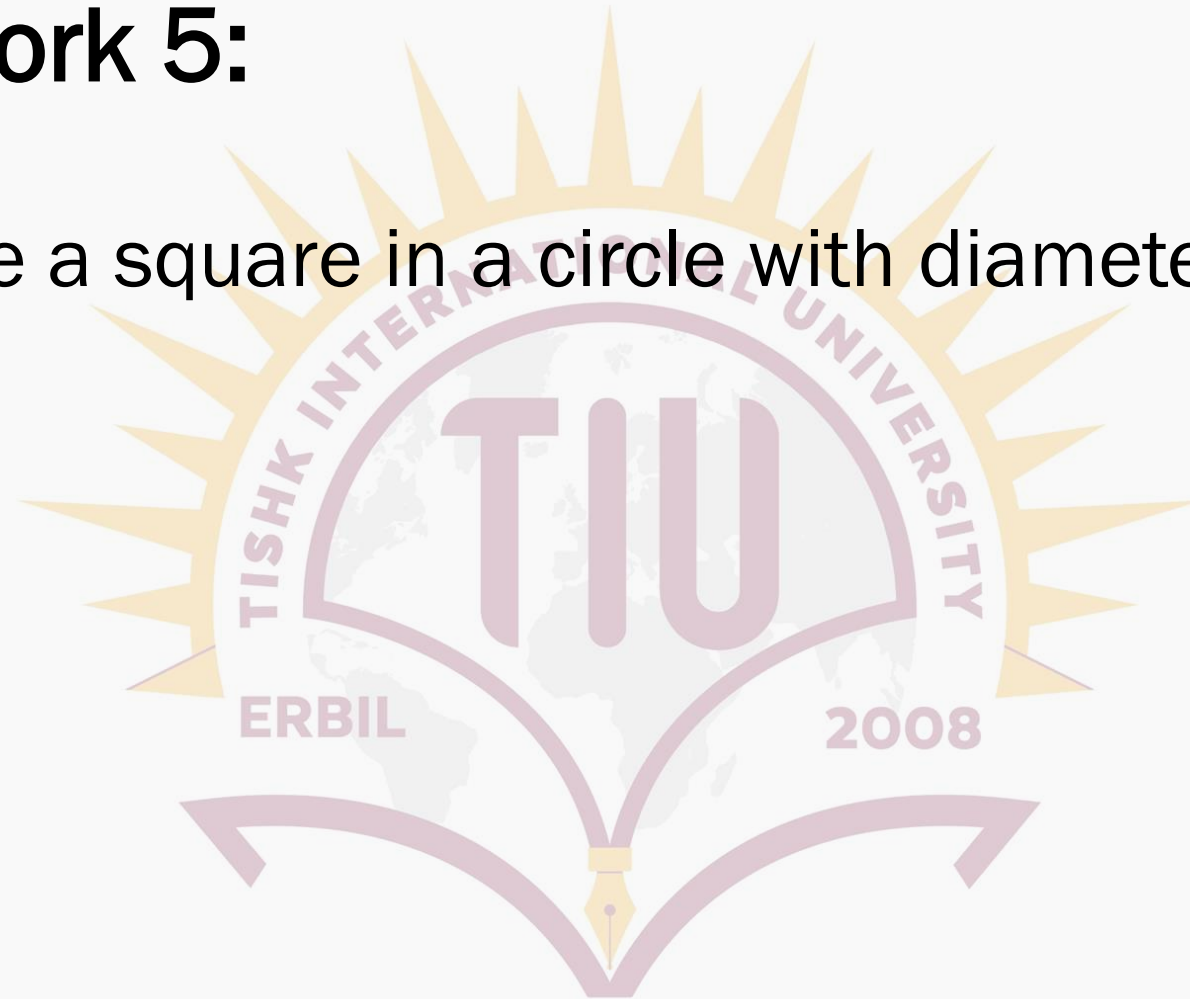
# Inscribe a Square in a Circle:

- To inscribe a square in a given circle:
  1. With centre  $O$ , draw a circle of diameter  $D$ .
  2. Through the centre  $O$ , draw two diameters, say  $AC$  and  $BD$  at right angle to each other.
  3. Join  $A$ - $B$ ,  $B$ - $C$ ,  $C$ - $D$ , and  $D$ - $A$ .  $ABCD$  is the required square.



# Classwork 5:

Inscribe a square in a circle with diameter of 80 mm.



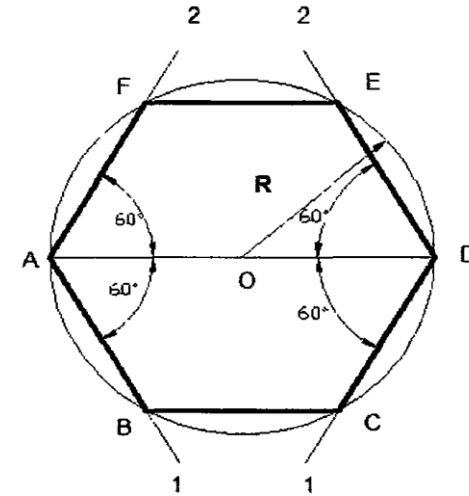
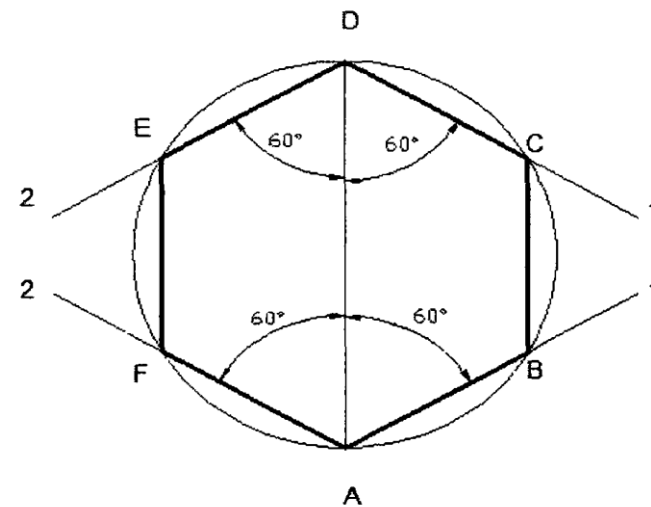


# Inscribe a Hexagon in a Circle:

- To inscribe a hexagon in a given circle.

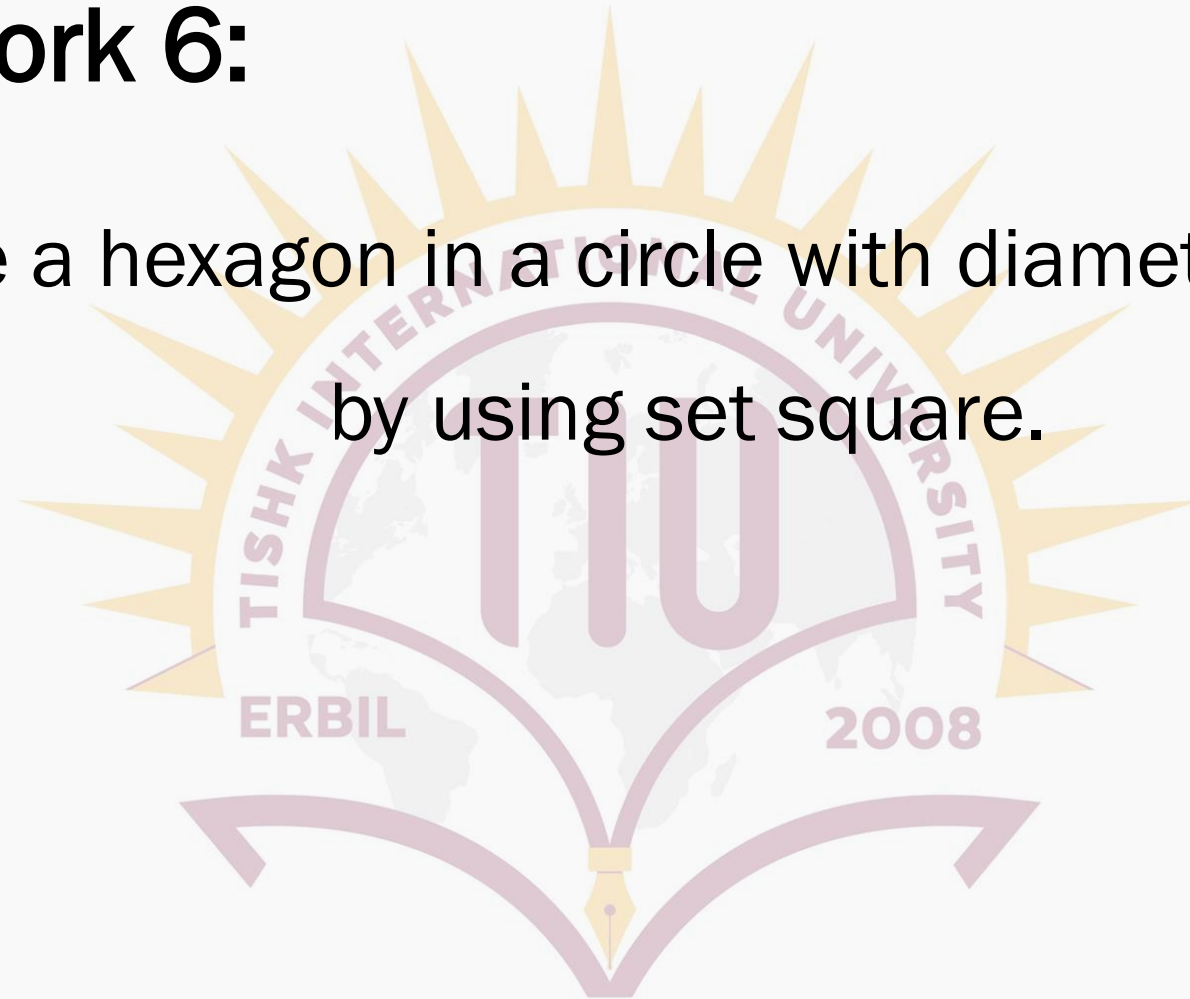
A- Construction by using a set-square or mini-draughter:

1. With centre  $O$  and radius  $R$  draw the given circle.
2. Draw any diameter  $AD$  to the circle.
3. Using  $30^\circ - 60^\circ$  set-square and through the point  $A$  draw lines  $A_1, A_2$  at an angle  $60^\circ$  with  $AD$ , intersecting the circle at  $B$  and  $F$  respectively.
4. Using  $30^\circ - 60^\circ$  and through the point  $D$  draw lines  $D_1, D_2$  at an angle  $60^\circ$  with  $DA$ , intersecting the circle at  $C$  and  $E$  respectively. By joining  $A, B, C, D, E, F$ , and  $A$  the required hexagon is obtained.



# Classwork 6:

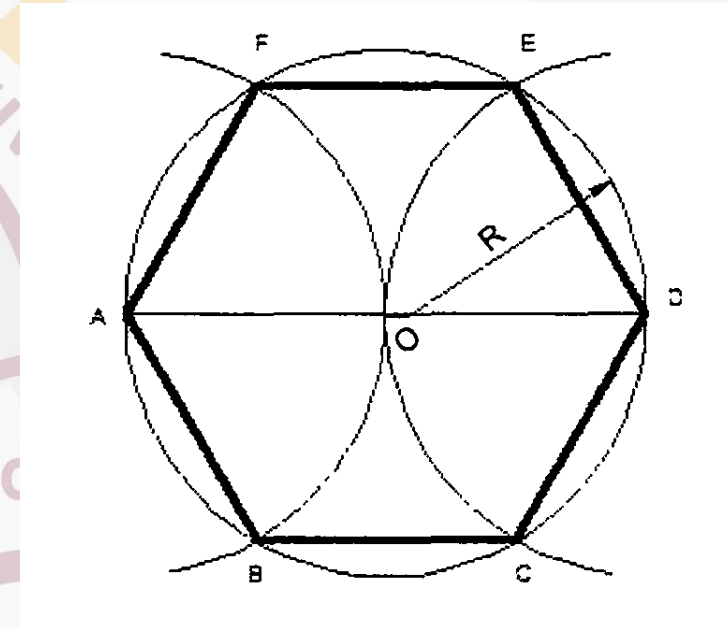
Inscribe a hexagon in a circle with diameter of 80 mm  
by using set square.



# Inscribe a Hexagon in a Circle:

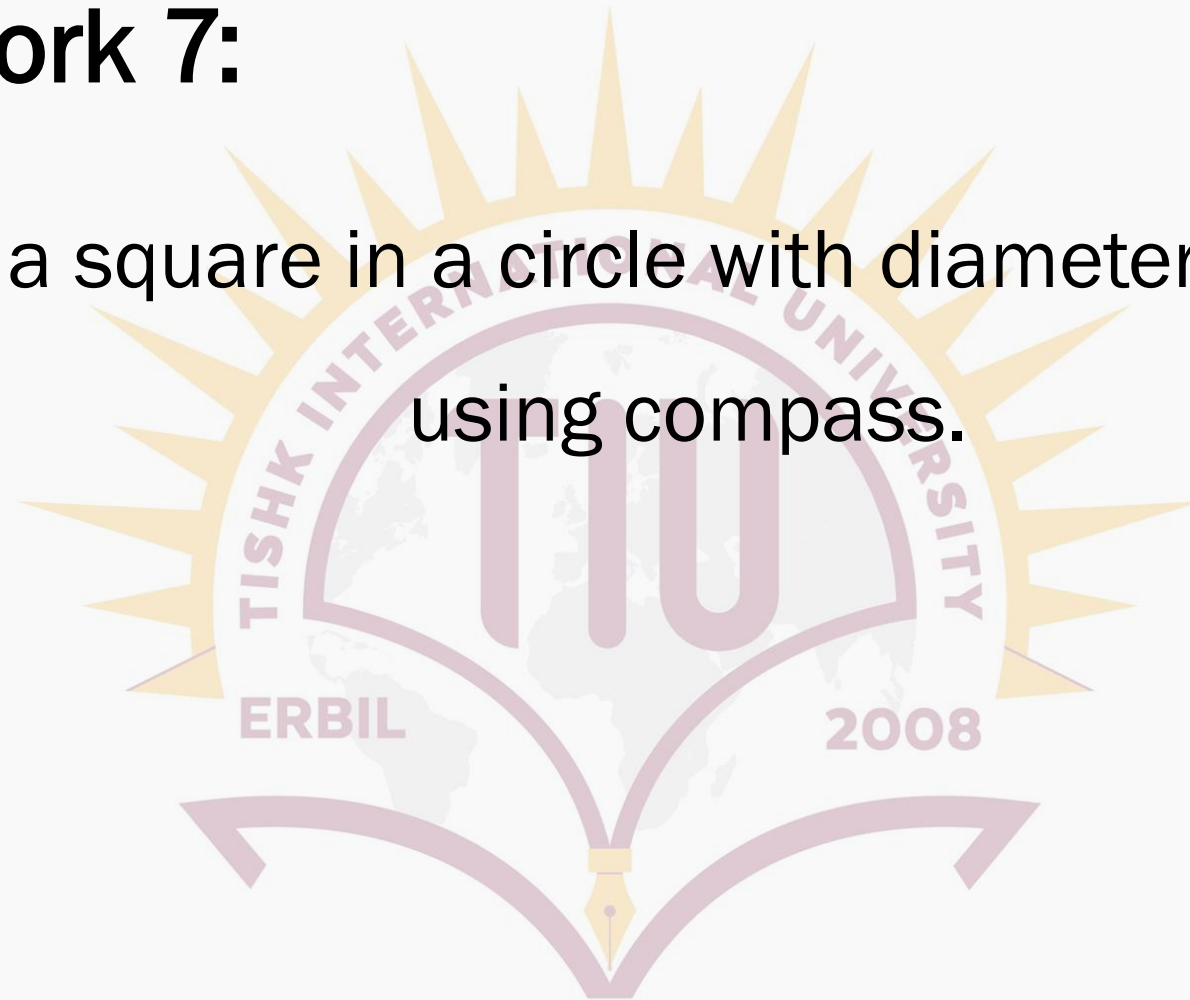
B- Construction By using compass:

1. With centre  $O$  and radius  $R$  draw the given circle.
2. Draw any diameter  $AD$  to the circle.
3. With centres  $A$  and  $D$  and radius equal to the radius of the circle draw arcs intersecting the circle at  $B, F, C$  and  $E$  respectively.
4.  $ABCDEF$  is the required hexagon.



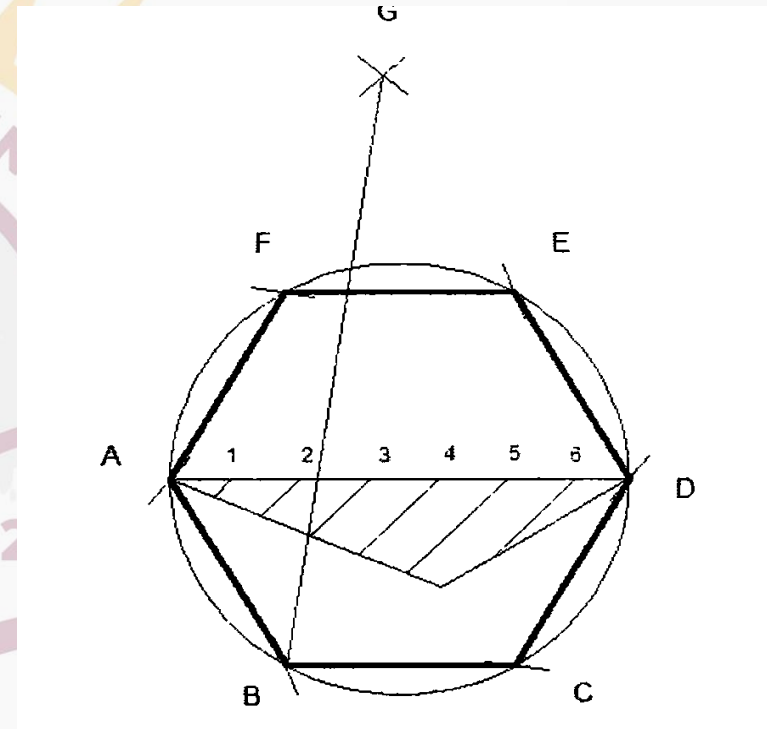
# Classwork 7:

Inscribe a square in a circle with diameter of 80 mm by using compass.



# Inscribe a Regular Polygon in a Circle:

- To inscribe a regular polygon of any number of sides in a given circle:
  1. Draw the given circle with AD as diameter.
  2. Divide the diameter AD into N equal parts say 6.
  3. With AD as radius and A and D as centres, draw arcs intersecting each other at G.
  4. Join G-2 and extend to intersect the circle at B.
  5. Join A-B which is the length of the side of the required polygon.
  6. Set the compass to the length AB and starting from B mark off on the circumference of the circles, obtaining the points C, D, etc.
  7. The figure obtained by joining the points A,B, C etc., is the required polygon.

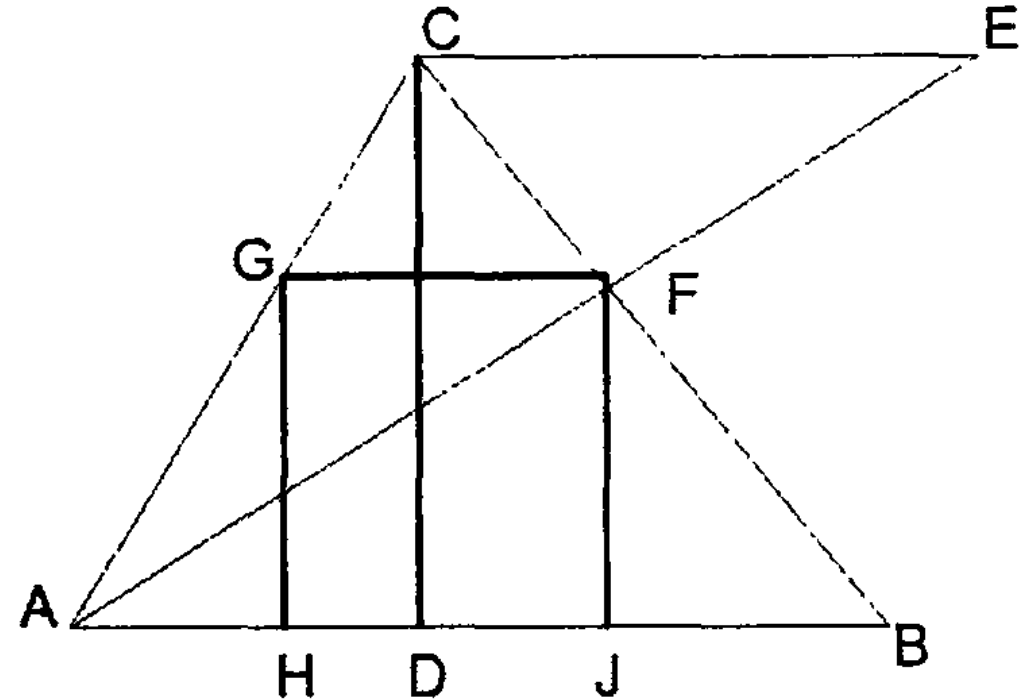


# Inscribe a Square in a Triangle:

■ To inscribe a square in a triangle:

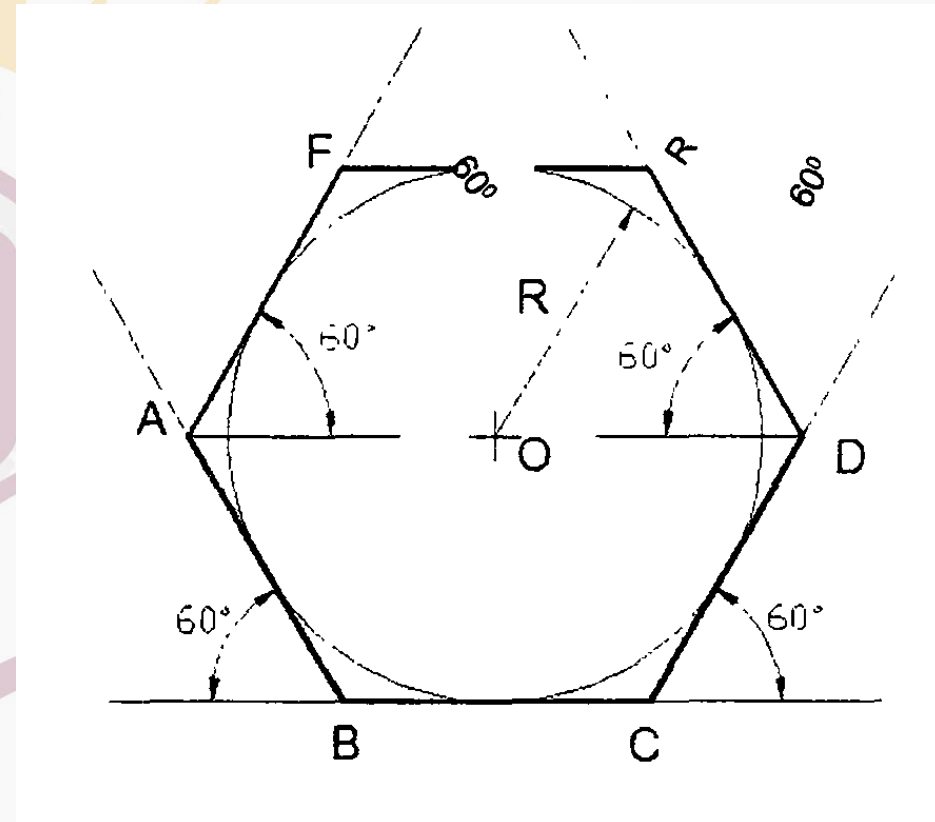
1. Draw the given triangle ABC.
2. From C drop a perpendicular to cut the base AB at D.
3. From C draw CE parallel to AB and equal in length to CD.
4. Draw AE and where it cuts the line CB mark F.
5. From F draw FG parallel to AB.
6. From F draw FJ parallel to CD.
7. From G draw GH parallel to CD.
8. Join H to 1.

■ Then HJFG is the required square.



# circumscribe a hexagon on a Circle:

- To circumscribe a hexagon on a given circle of radius  $R$ .
1. With centre  $O$  and radius  $R$  draw the given circle.
  2. Using  $60^\circ$  position of the mini draughter or  $30^\circ - 60^\circ$  set square, circumscribe the hexagon as shown.

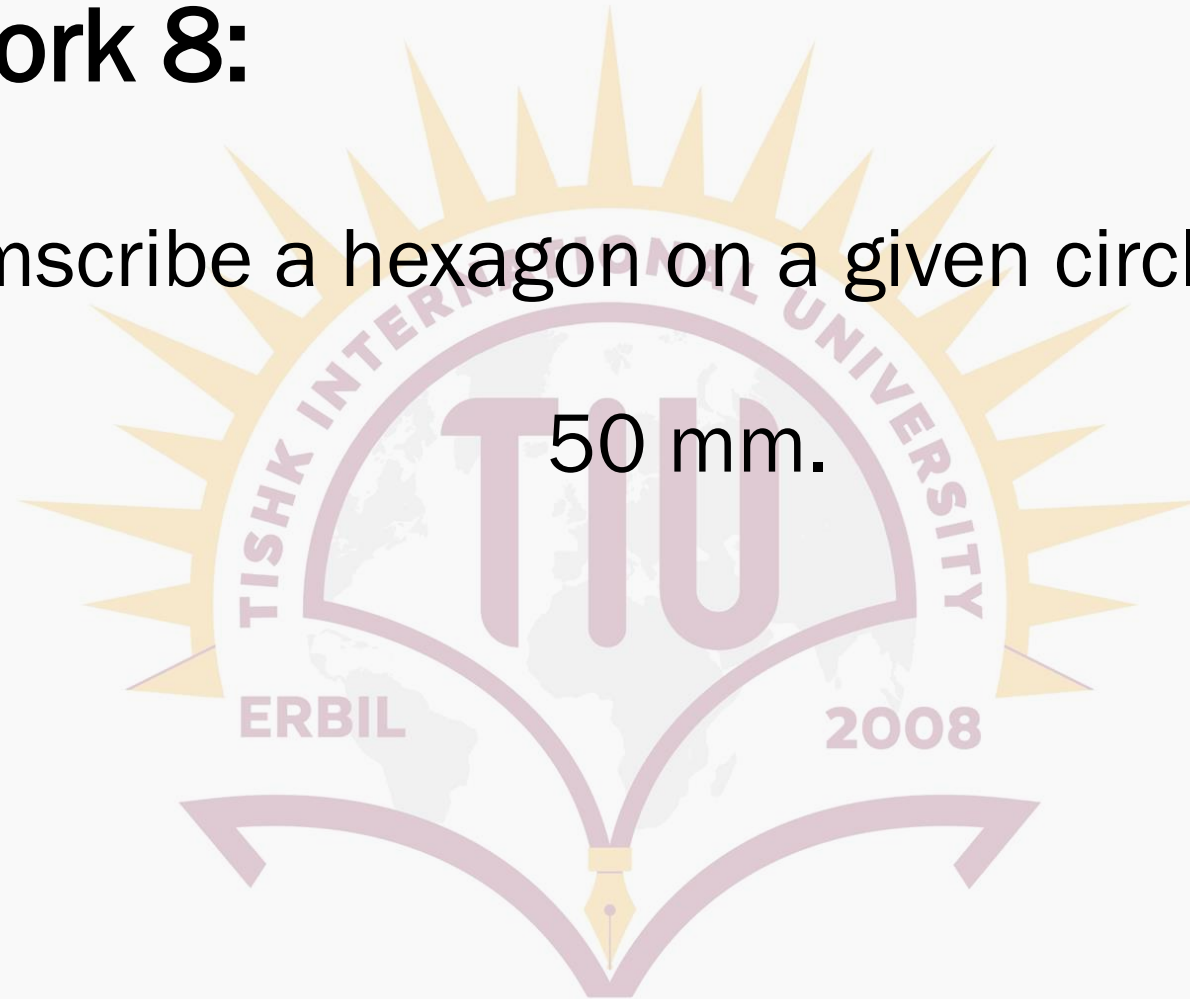




# Classwork 8:

circumscribe a hexagon on a given circle of radius

50 mm.





# Homework 3:

1. Construct a pentagon with the length of one side equal to 50 mm by using semicircle method.
2. Construct a pentagon with the length of one side equal to 50 mm by using compass and arc method.
3. Construct a hexagon by using set square, the length of each side equals to 50 mm.
4. Construct a hexagon by using compass, the length of each side equals to 50 mm.
5. Inscribe a square in a circle with diameter of 100 mm.
6. Inscribe a hexagon in a circle with diameter of 100 mm by dividing the diameter into 6 equal parts.
7. Inscribe a square in a triangle. The angles of the triangle are 45 and 60 degrees when the length of the base of the triangle is 100 mm.
8. circumscribe a hexagon on a given circle of diameter 100 mm.