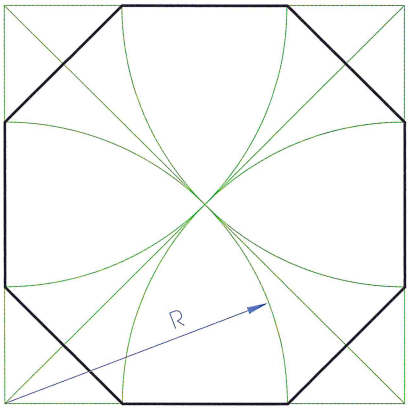
Constructing a Regular Octagon in a Given Square

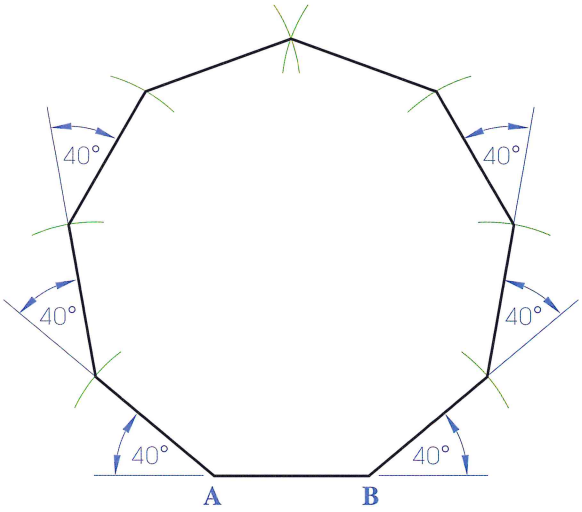


Example
Construct a **regular octagon** in a square of side 90 mm.

1. Construct the square of side 90 mm and draw the diagonals.
2. Using each vertex of the square as centre and half the diagonal as radius, draw the four arcs as shown in the figure over.
3. Join the points where the arcs intersect the sides of the square to obtain the required octagon.

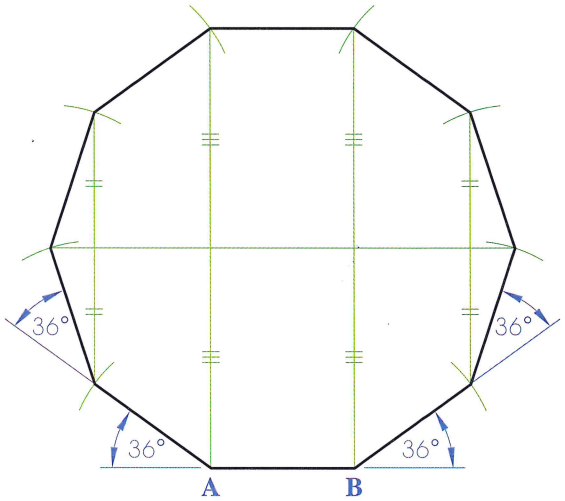
Constructing a Regular Nonagon and a Regular Decagon

Example 1
Construct a **regular nonagon** of side 35 mm.



1. Draw the base AB of length 35 mm.
2. The **exterior angle** of a regular nonagon is 360° ÷ 9 = 40°. Using the protractor, draw 40° lines from A and B. Mark off the two sides of length 35 mm.
3. Extend these two sides. Construct exterior angles of 40° as shown. Draw these two inclined sides of length 35 mm.
4. Complete the nonagon using the protractor to draw the next two inclined sides, and the compass to locate the final vertex.

Example 2
Construct a **regular decagon** of side 32 mm.



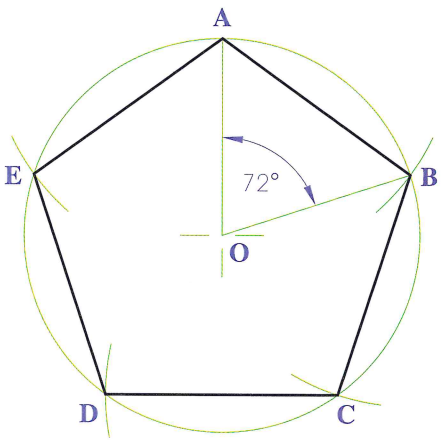
1. Draw the base AB of length 32 mm.
2. The exterior angle of a regular decagon is 360° ÷ 10 = 36°. Using the protractor, draw 36° lines from A and B. Mark off the two sides of length 32 mm.
3. Extend these two sides. Construct exterior angles of 36° as shown. Draw these two inclined sides of length 32 mm.
4. Complete the decagon using the protractor to draw the remaining inclined sides, or by means of an **axial symmetry** (see page 151).

Answer Worksheet 6A

Regular Polygons in a Circle

Example 1

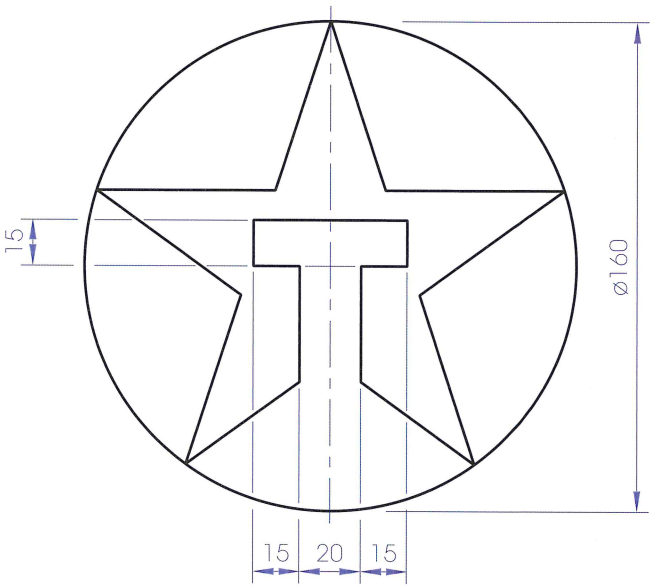
Inscribe a **regular pentagon** in a given circle.



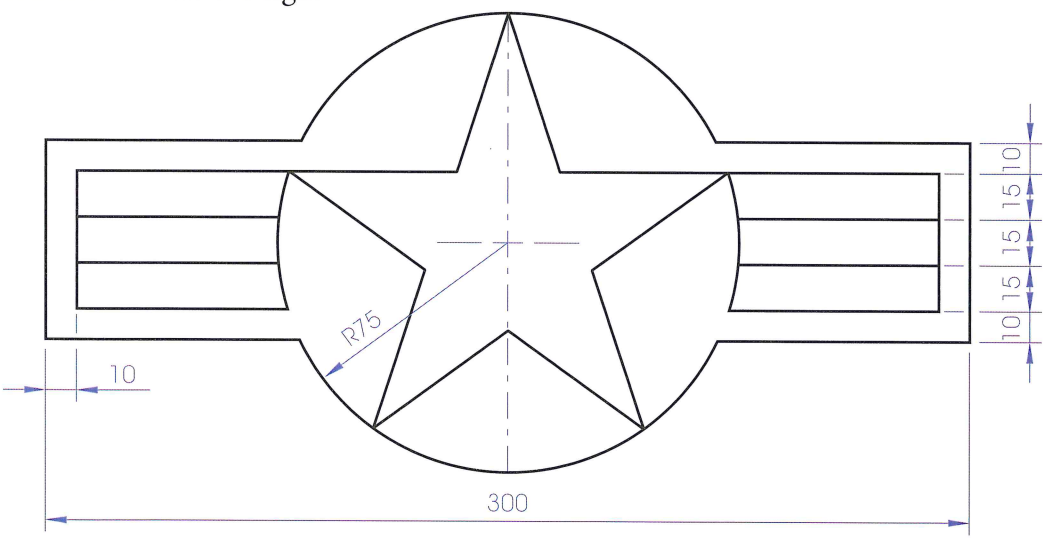
1. Draw any radius OA of the circle. The angle at the centre (called the **central angle**) equals 360° ÷ 5 = 72°. Draw radius OB at 72° to the radius OA. Join AB. This is one side of the required pentagon.
2. With radius AB mark off the remaining vertices of the pentagon around the circumference of the circle as shown. Draw the required pentagon ABCDE.

Exercises

1. The **Texaco** logo is based on a **regular pentagon** inscribed in a circle. Reproduce this drawing to the given dimensions, showing all construction lines.

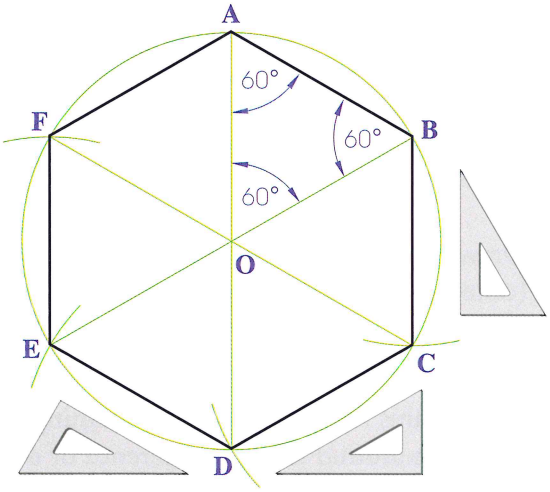


2. The **United States Air Force** sign is shown in the figure below. It is based on a **regular pentagon** inscribed in a circle. Draw the sign.



Example 2

Inscribe a **regular hexagon** in a given circle.



1. Draw any radius OA of the circle. The **central angle** equals 360° ÷ 6 = 60°. Draw radius OB at 60° to the radius OA. Join AB. This is one side of the hexagon.
2. With radius AB mark off the remaining vertices of the hexagon around the circumference of the circle as shown. Draw the required hexagon ABCDEF using the 30°/60° set square as shown.

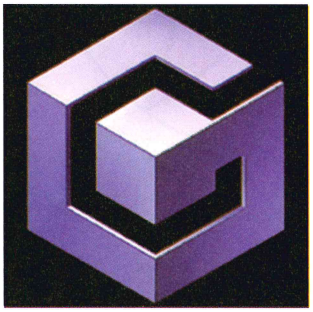
When a regular hexagon is inscribed in a circle:

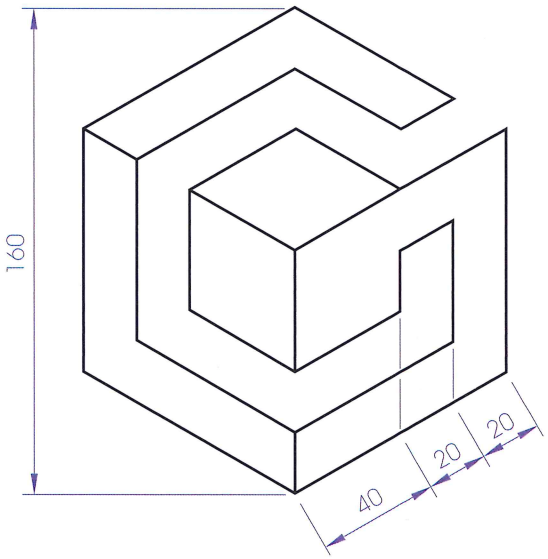
- the diagonals divide the hexagon into 6 equilateral triangles.
- the radius of the circle is equal to the side of the hexagon.

Exercises

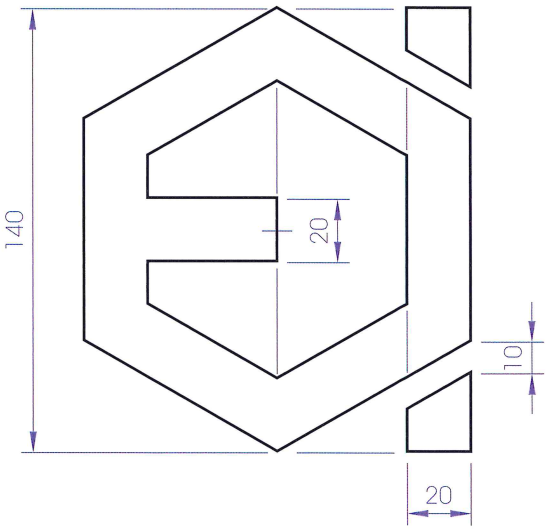
1. A drawing of the **Nintendo Gamecube** emblem is shown in the figure over. It is based on a **regular hexagon** of side 80 mm.

   Reproduce this drawing to the given dimensions.

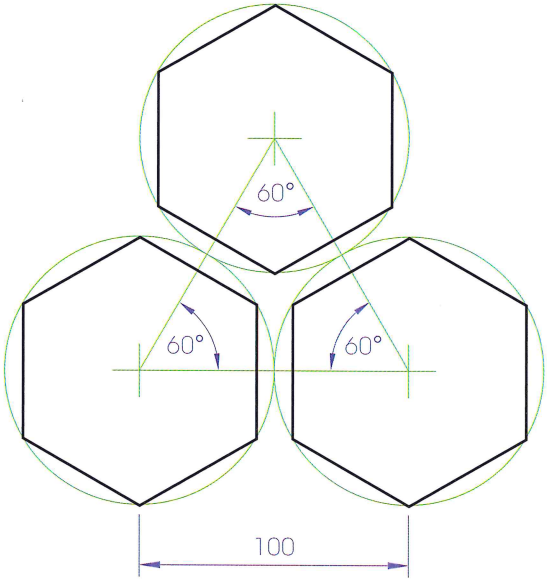




2. The **Electro Automation Ltd** card for a multistorey car park contains a symbol based on a **regular hexagon**. Reproduce the drawing of this symbol showing all construction lines.

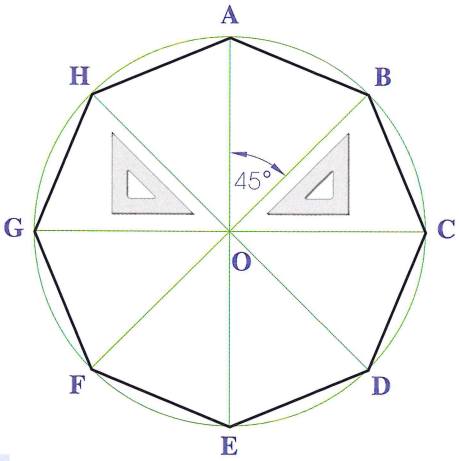


3. The **IDA** logo contains three equally spaced **regular hexagons**. Each hexagon is inscribed in a circle of radius 50 mm. Draw the logo showing all construction lines.



Example 3

Inscribe a **regular octagon** in a given circle.

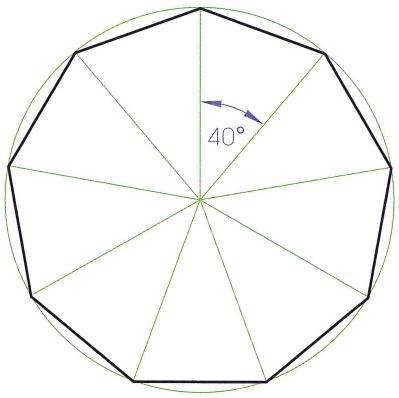


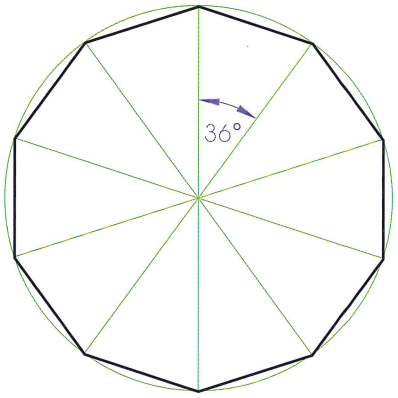
1. Draw any radius OA of the circle. The **central angle** equals 360° ÷ 8 = 45°. Draw radius OB at 45° to the radius OA. Join AB. This is one side of the required octagon.

2. Draw lines using the 45° set square as shown to locate the remaining vertices of the octagon around the circumference of the circle. Draw the required octagon ABCDEFGH.

Example 4

Inscribe a **regular nonagon** and a **regular decagon** in a given circle.





1. The central angle for the regular nonagon is 360° ÷ 9 = 40°. The solution is based on drawing nine equal sectors (see page 94) in the circle as shown in the figure (above, left).

2. The central angle for the regular decagon is 360° ÷ 10 = 36°. The solution is based on drawing ten equal sectors (see page 94) in the circle as shown in the figure (above, right).

Answer Worksheet 6B

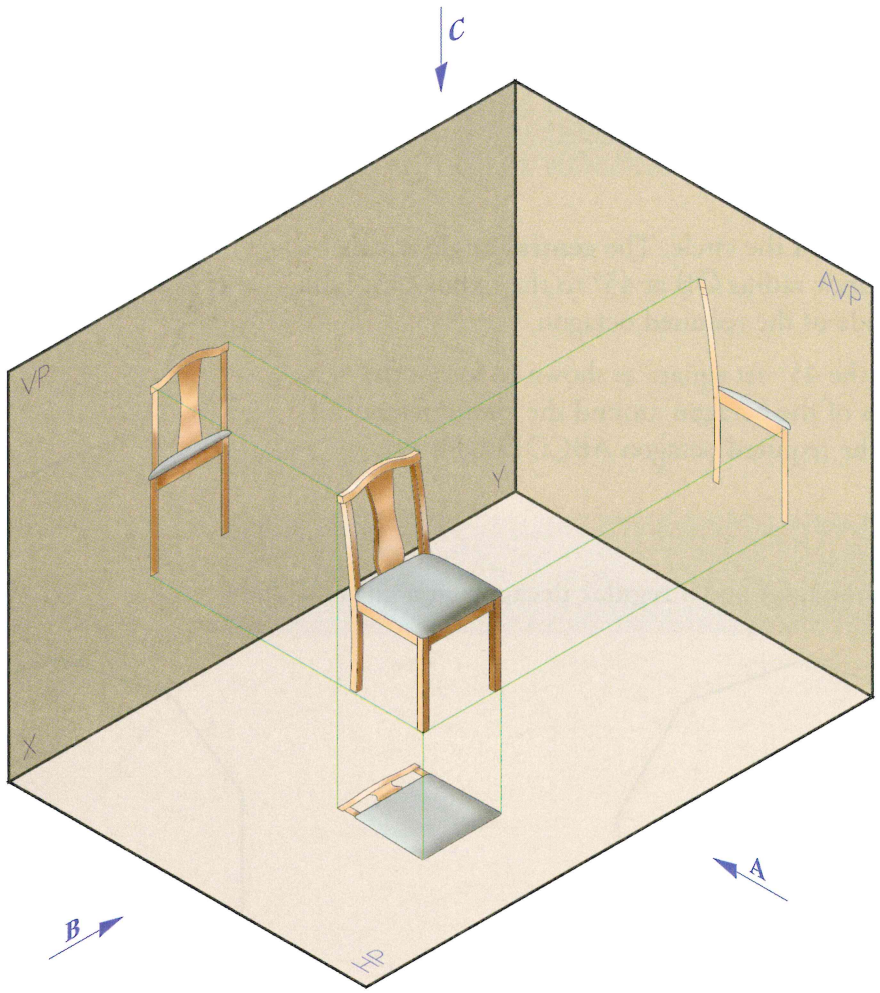
Chapter 7

Orthographic Projection 1

Orthographic projection is a method of representing a three-dimensional object on a plane surface.

It is based on projecting points on the object perpendicularly onto planes of projection and joining them in order, as shown below. Three different views are obtained:

(i) The view looking in the direction of arrow **A** is called a **front elevation**.
(ii) The view looking in the direction of arrow **B** is called an **end elevation**.
(iii) The view looking in the direction of arrow **C** is called a **plan**.



The front elevation is projected onto the **vertical plane** (VP). The end elevation is projected onto an **auxiliary vertical plane** (AVP). The plan is projected onto the **horizontal plane** (HP).

The line of intersection between the vertical plane and the horizontal plane is called the XY line.

The three views shown above are still three-dimensional.