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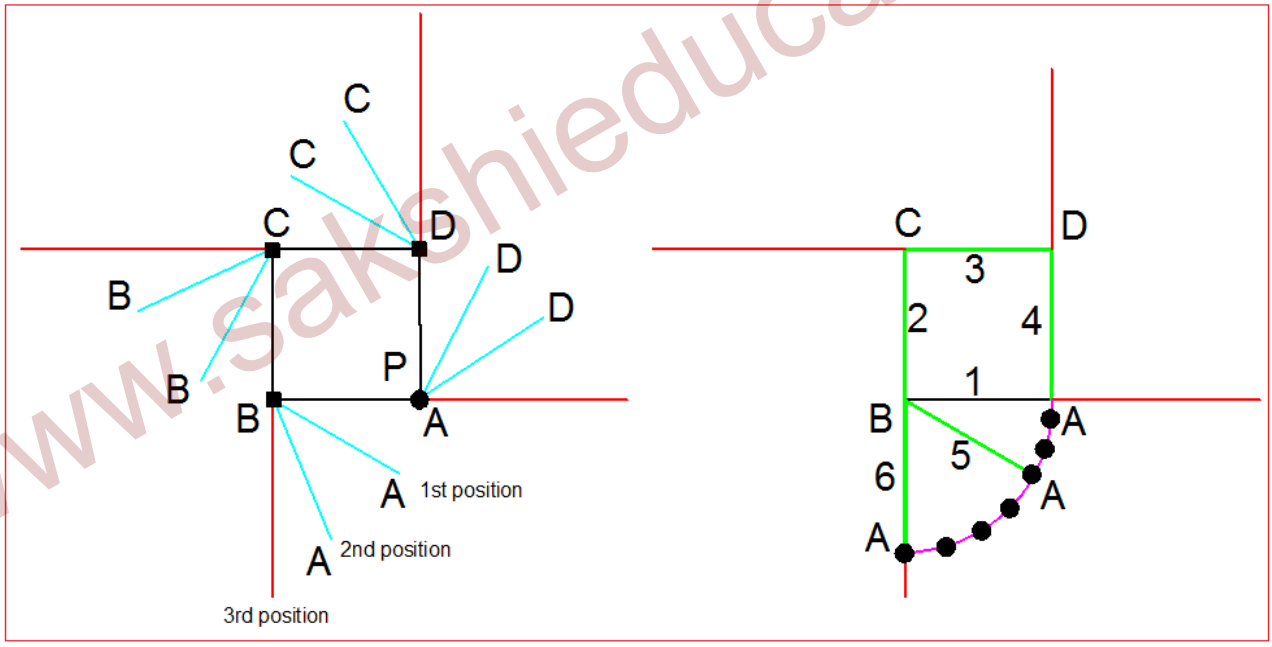
INVOLUTES

Definition: It is a single – curved line traced out by an end of a string when unwound itself from a straight line or a circle or a polygon, the string being kept tight.

E.g.: Coir is unwinding from a drum.



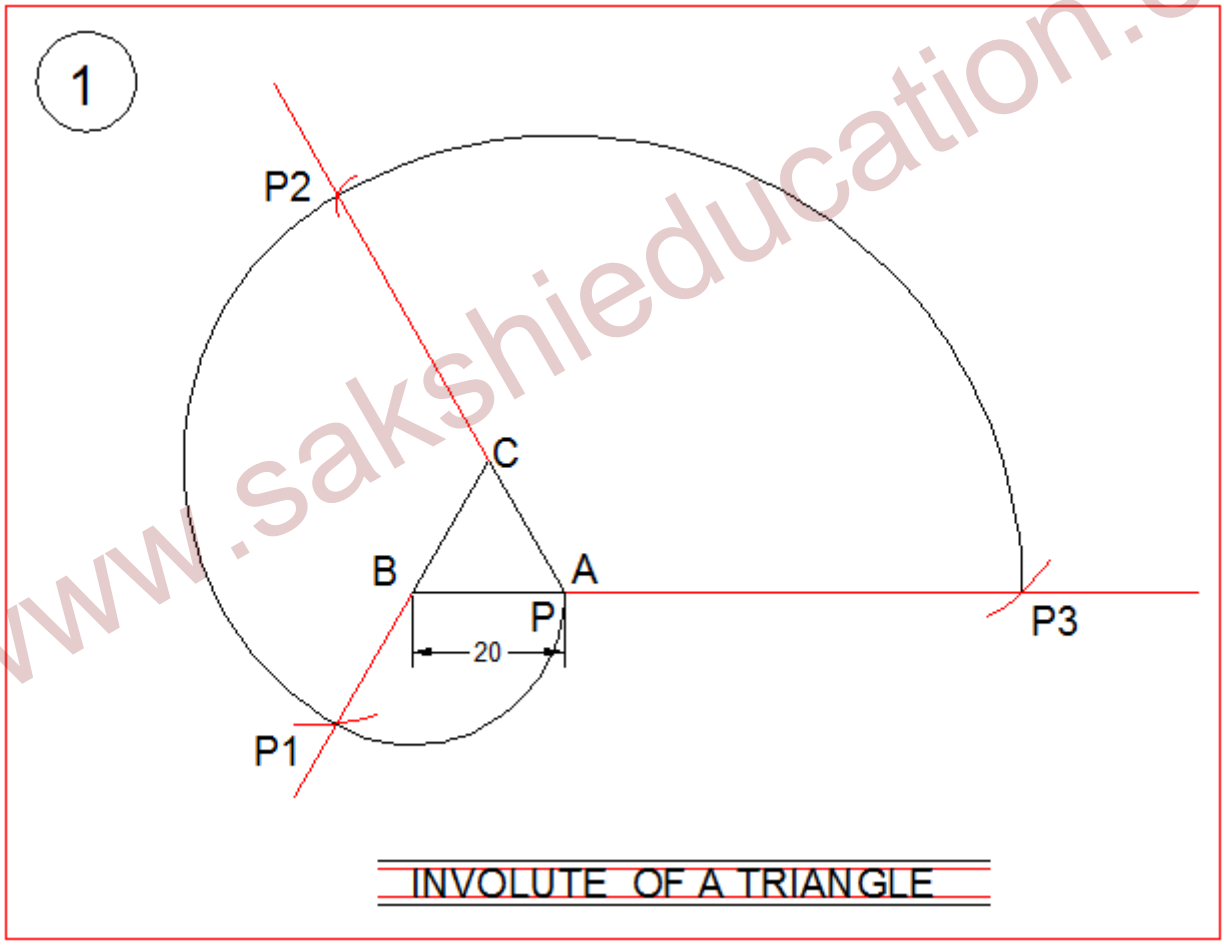
Note: How to draw the red lines for any polygon:

1. The Point 'P' is the end of a string.
2. Unwound in the clockwise direction.
3. Unwind the AB line till it is collinear (in-line) with the BC line.
4. In the 1st position the line AB is not collinear (in-line) with the BC line.

5. In the 2nd position the line AB is not collinear (in-line) with the BC line.
6. In the 3rd position the line AB is collinear (in-line) with the BC line.
7. So the 3rd position is the correct place to draw the construction line (red line) for AB. Similarly draw for all sides.
8. Follow the same procedure for all Polygons.

QUESTIONS

1. Draw involutes for the following polygons of side 20mm
   a. **Equilateral Triangle**



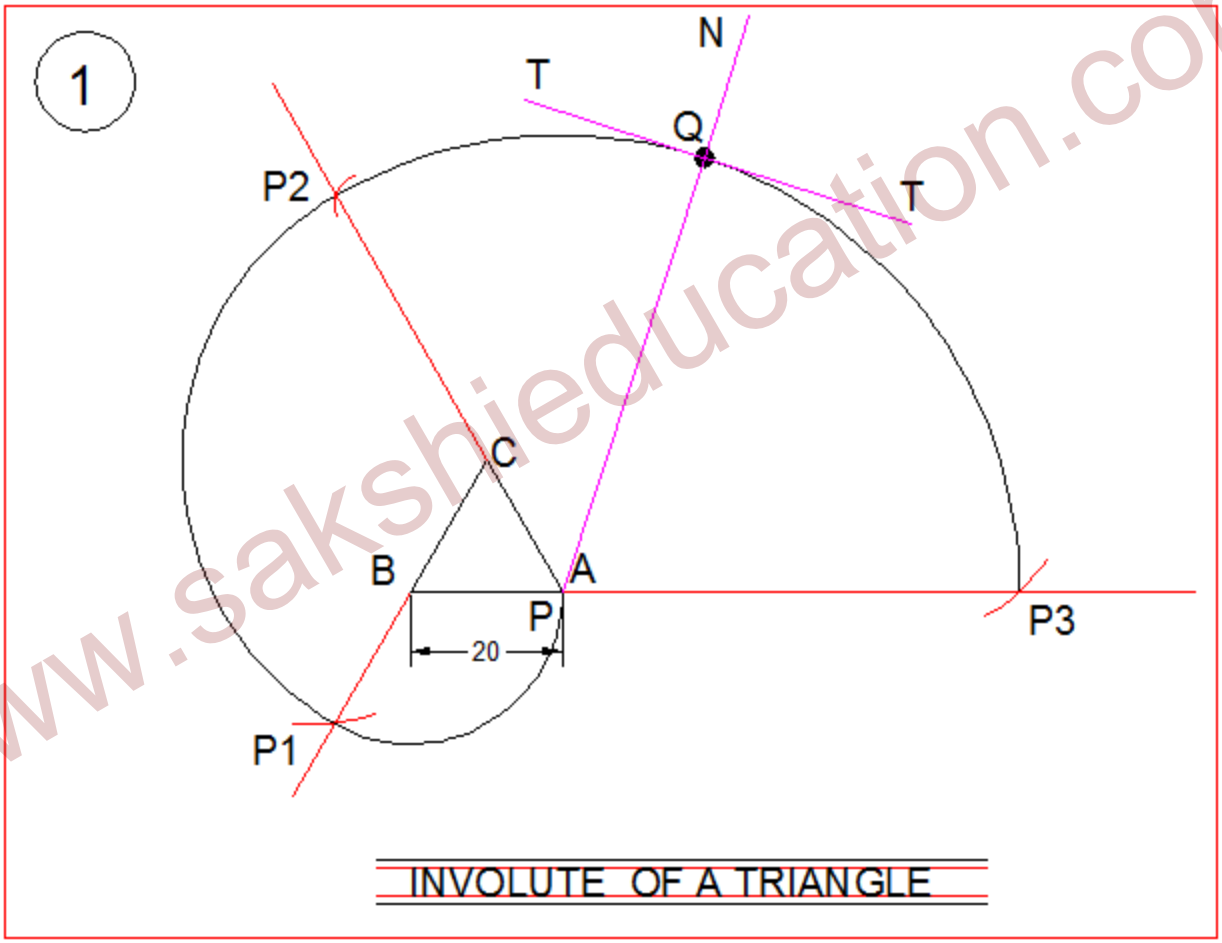
Note:

1. The Point 'P' is the one end of a string/thread.
2. Unwind in the clockwise direction.

Drawing Procedure:

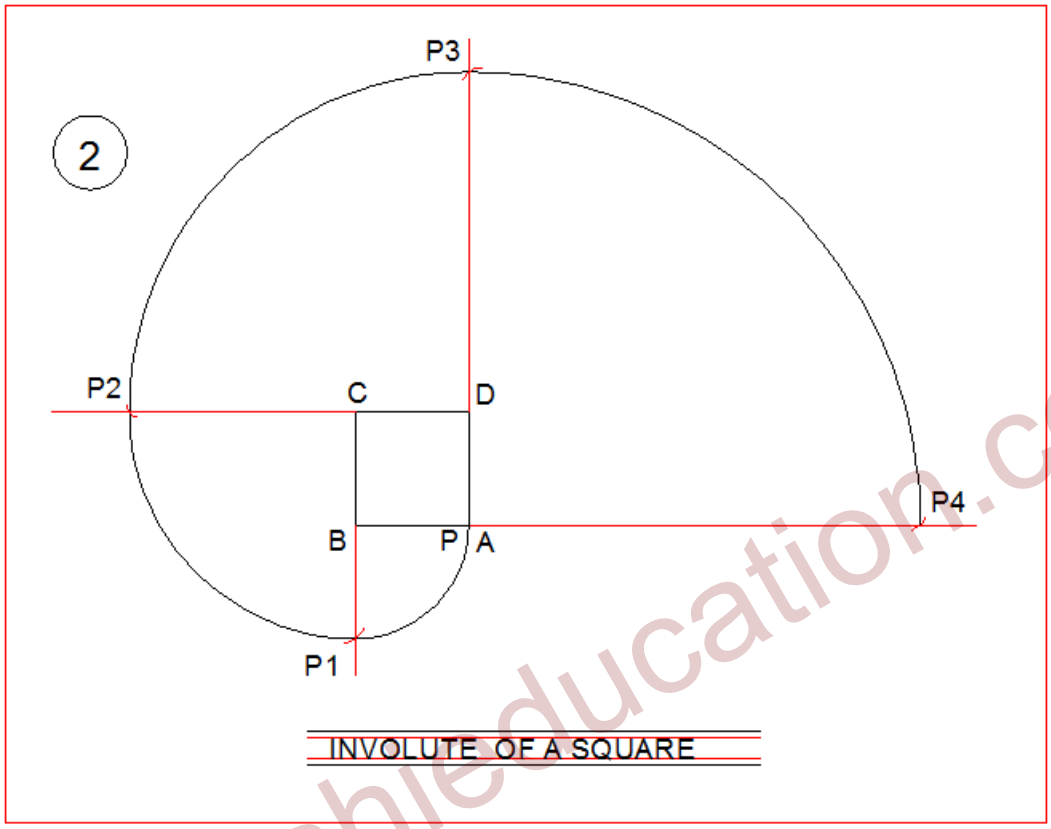
1. First draw the equilateral triangle ABC of side 20 mm.
2. With B as centre and BA as radius, draw an arc to cut BC produced at P1.
3. With C as centre and CP1 as radius, draw an arc to cut CA produced at P2.
4. Similarly with A as centre and AP2 as radius, draw an arc to cut AB produced at P3.

How to draw a Tangent and Normal for an Involute of Polygons:

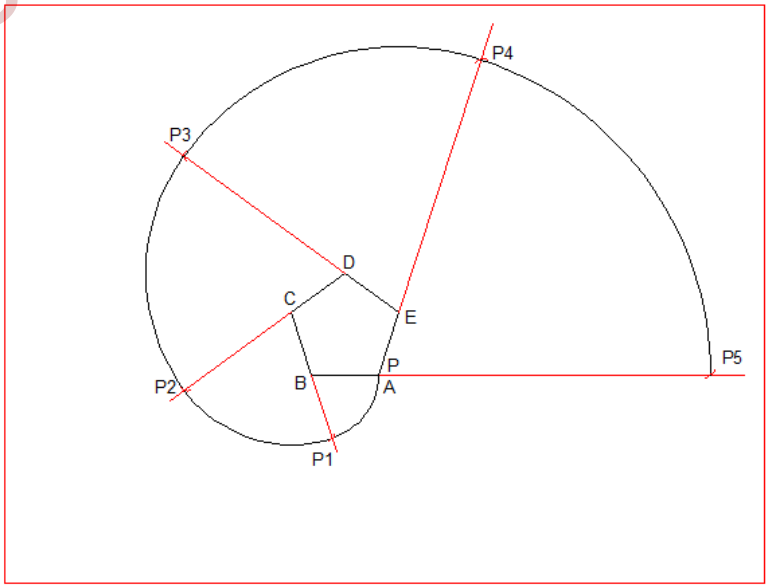


1. Locate Q as per the data given in the problem.
2. The point Q lies in the arc P2 P3.The corresponding centre for the arc P2P3 is point A.
3. Join A and Q and extend, which is the required Normal.
4. Draw a line perpendicular to normal at the point Q , which is the required Tangent.
5. Use HB to draw tangent and Normal lines.

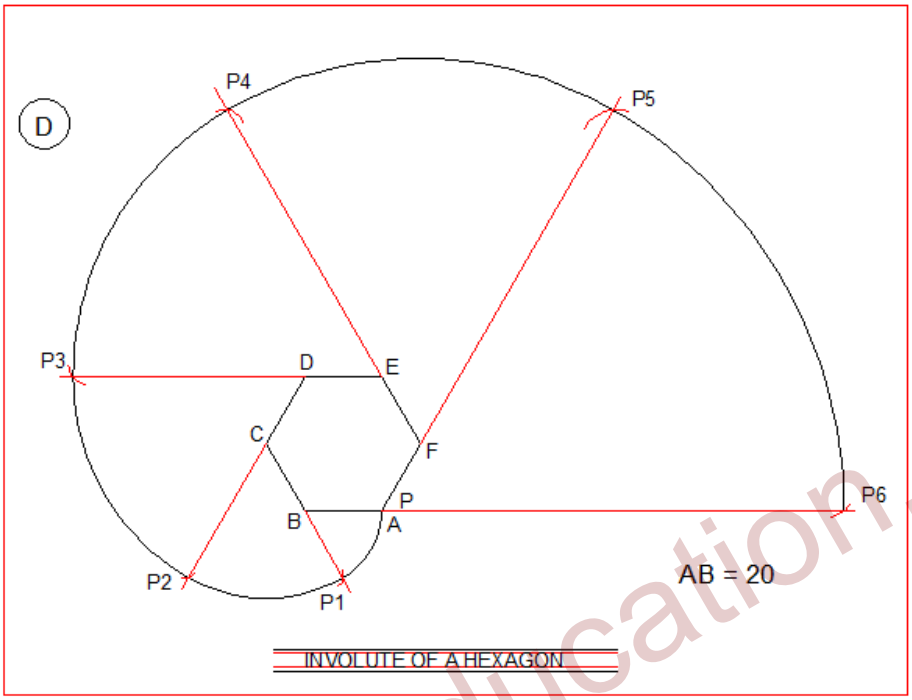
b. Square



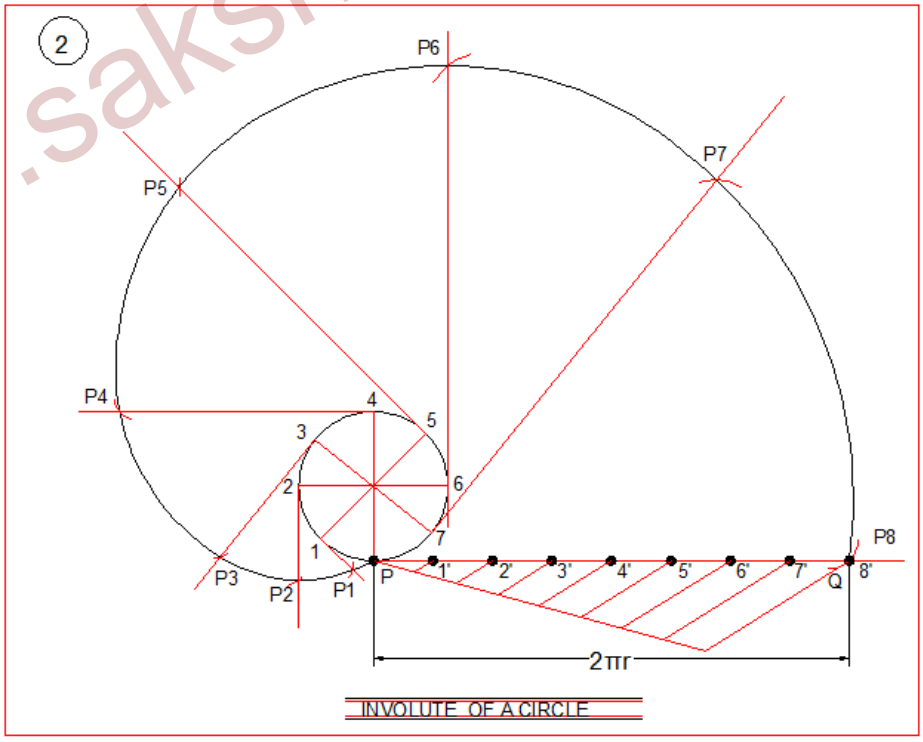
c. Pentagon



d. Hexagon

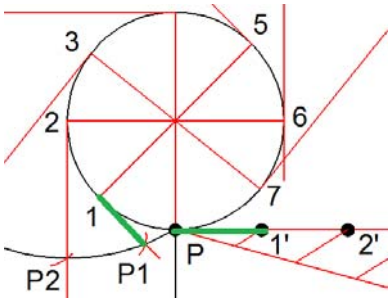


2. Draw an Involute of a circle of radius 20mm. Draw tangent and normal at a point on it.



Drawing Procedure:

1. Draw a circle of radius r = 20mm.
2. Calculate 2πr value, draw a horizontal line PQ, the length of PQ is equal to 2πr.
3. Divide the circle into 8 parts (or 12 parts) as 1, 2, 3 . . . 8.
4. Draw tangents at 1, 2, 3. . 8. And mark P1, P2 . . . P8. Such that P1' = 1 P1 ,P2' = 2 P2 , etc.,



5. Draw a smooth curve with free hand through P1, P2 . . P8.
6. The smooth curve is Involute of a circle.

Note:

1. The curve should start from the Point P.
2. Don't use compass for joining the point's p1, p2 . . . p8. Join the points with the free hand.

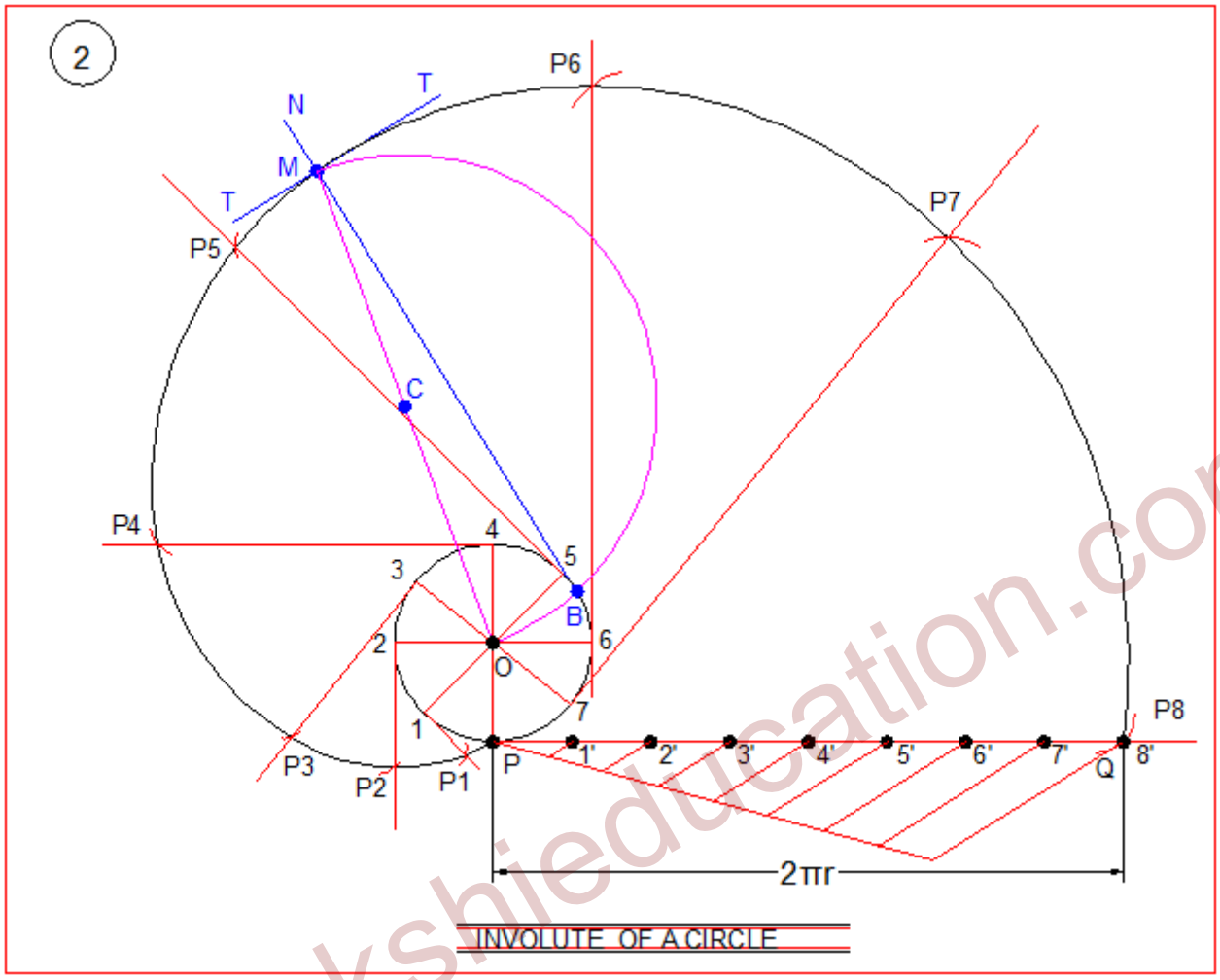
Tangent and Normal:

Case1: Draw an Involute of a circle of radius 20mm. Draw tangent and normal at a point on it.

For this case locate M at point any on the curve.

Case2: Draw an Involute of a circle of radius 20mm. Draw tangent and normal at a ____ mm distance from centre of a circle.

For this case, take given radius with compass and O as centre go along the curve and see where the curve is cutting, that point is M.



Drawing Procedure:

1. Locate M.
2. Draw a line from O to M (use 2H pencil), C is midpoint of line OM. Mark C.
3. With C as centre and CM / CO as radius draw a semi circle.(use 2H pencil)
4. The semi circle cuts the circle at a point B.
5. Join M and B, and extend, which is the required Normal.
6. Draw a line perpendicular to normal, which is Tangent.