

Name of College - S.S. College, T. Bad

Dept - Mathematics

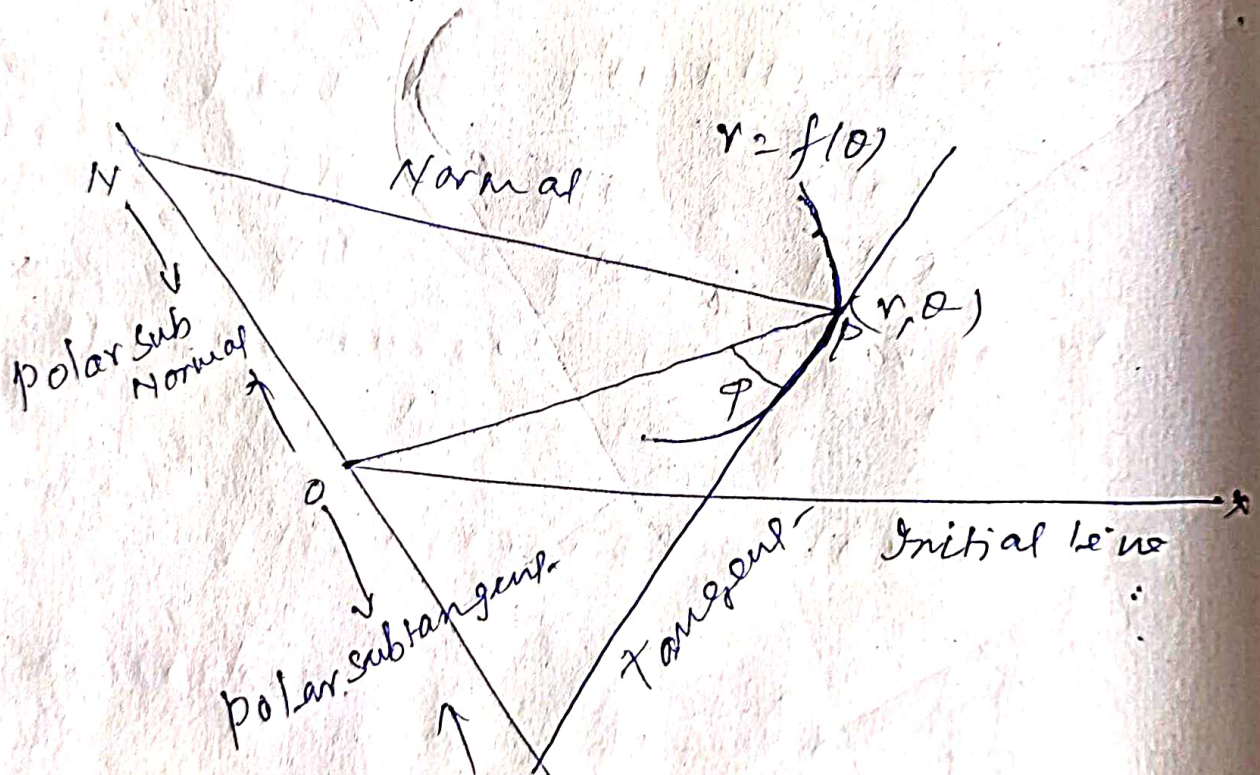
Topic - Polar Subtangent - and
Polar Subnormal.

Class - B.Sc I (Hons)

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Study Material.

Polar Sub-Tangent and Polar Sub-Normal



Let O be the pole and Ox be the initial line. Let $P(r, \theta)$ be any point on the curve $r = f(\theta)$.

Here PT has been drawn from P and Normal PN drawn at the point P .

Again From O, a line NOT has been drawn which is perpendicular to OT. let us suppose that this line meets the tangent at T and the Normal at the point N.

then OT is called the polar Subtangent and ON is called the polar SubNormal

Let $\angle OPT = \phi$ (angle between radius vector and tangent drawn at $P(r, \theta)$)

$$\text{lang} = \frac{OT}{OP}$$

$$\Rightarrow OT = OP \text{ lang} = r \text{ lang}$$

$$= r \cdot r \frac{d\theta}{dr} \quad \left(\text{lang} = r \frac{d\theta}{dr} \right)$$

$$= r^2 \frac{d\theta}{dr}$$

$$\therefore \text{Polar Subtangent} = r^2 \frac{d\theta}{dr}$$

Again $\angle OPT = \phi$

$$\therefore \angle OPN = 90 - \phi$$

$$\therefore \angle ONP = \phi$$

Now, From $\triangle OPT$

$$\text{lang} = \frac{OP}{ON}$$

$$ON = \frac{OP}{\text{lang}} = \frac{r}{r \cdot \frac{d\theta}{dr}} = \frac{1}{\frac{d\theta}{dr}} = \frac{dr}{d\theta}$$

$$\therefore \text{Polar Sub Normal} = \frac{dr}{d\theta}$$

Angle of intersection of two curves

$$r = f(\theta)$$

$$\text{and } r = F(\theta)$$

If α be the angle between them

$$\text{then } \tan \alpha = \frac{f(\theta) F'(\theta) - f'(\theta) F(\theta)}{f'(\theta) F'(\theta) + f(\theta) F(\theta)}$$

If two curves touch each other
then $\alpha = 0$.

$$\therefore f(\theta) F'(\theta) - f'(\theta) F(\theta) = 0$$

$$\Rightarrow \frac{f(\theta)}{f'(\theta)} = \frac{F(\theta)}{F'(\theta)} = \frac{F(\theta)}{F'(\theta)}$$

If two curves are orthogonal.

$$\text{then } \tan \alpha = \tan \pi/2 = \frac{1}{0}$$

$$f'(\theta) F'(\theta) + f(\theta) \cdot F(\theta) = 0$$

Remarks - $\alpha = \varphi_1 - \varphi_2$

Evaluate $\tan \varphi_1$ and $\tan \varphi_2$