



CAMBRIDGE INSTITUTE OF TECHNOLOGY

K.R. PURAM, BENGALURU-560036

Department of Basic Sciences

Question bank - BMATS101 (AI/CS/IS/IOT)



1. Find the expression for angle between radius vector and tangent $\tan \phi = r \frac{d\theta}{dr}$.
2. Determine the angle between the curves $r = a(1 + \cos\theta)$ and $r = b(1 - \cos\theta)$.
3. Find the angle between the radius vector and the tangent of the curve $\frac{2a}{r} = 1 + \cos\theta$.
4. Determine the angle of intersection between the curves $r = a \log\theta$ and $r = \frac{a}{\log\theta}$.
5. Find the pedal equation of the curve $r^m = a^m \cos m\theta + b^m \sin m\theta$.
6. Determine the radius of curvature for the curves $x = a \cos^3\theta$ and $y = b \sin^3\theta$ at $\theta = \frac{\pi}{4}$.
7. Show that for the equiangular spiral $r = ae^{\theta \cot \alpha}$, $\frac{\rho}{r}$ is constant.
8. Derive the formula for radius of curvature of the curve in Cartesian form $\rho = \frac{(1+y_1^2)^{3/2}}{y_2}$.
9. Find the radius of curvature of the curve $x^3 + y^3 = 3axy$ at $(\frac{3a}{2}, \frac{3a}{2})$.
10. Find the radius of curvature of the curve $x = a(\cos t + t \sin t)$ and $y = a(\sin t - t \cos t)$.
11. Show that the radius of curvature for the curve $r^n = a^n \cos n\theta$ varies inversely as r^{n-1} .
12. Derive the formula for radius of curvature of the curve in polar form as $\rho = \frac{(r^2 + r_1^2)^{3/2}}{r^2 + 2r_1^2 - rr_2}$.
13. Expand $\log(1+e^x)$ in Maclurin's series upto third degree term.
14. Determine the Maclaurin's series expansion of $\log(\sec x + \tan x)$ up to the terms containing fourth degree.
15. Express $\log(1+x)$ as Maclaurin's series up to fifth degree terms and hence prove that
$$\log \sqrt{\frac{1+x}{1-x}} = x + \frac{x^3}{3} + \frac{x^5}{5} + \dots$$
16. Find the value of the indeterminate form $\lim_{x \rightarrow a} \left(2 - \frac{x}{a}\right)^{\tan\left(\frac{\pi x}{2a}\right)}$.
17. Find the value of the given indeterminate form $\lim_{x \rightarrow 0} (\cos x)^{\frac{1}{x^2}}$.
18. Find the value of the given indeterminate form $\lim_{x \rightarrow 0} \left(\frac{a^x + b^x + c^x}{3}\right)^{\frac{1}{x}}$.
19. Find the value of the indeterminate form $\lim_{x \rightarrow 0} (a^x + x)^{\frac{1}{x}}$.

20. Determine the radius of curvature of $r(1 - \cos \theta) = 2a$ hence show that ρ^2 varies as r^3 .

21. Determine the radius of curvature of the curve $r = a(1 + \cos \theta)$, S.T $\frac{\rho^2}{r} = \text{constant}$.