SRM UNIVERSITY

MA1001- CALCULUS AND SOLID GEOMETRY

Unit-IV Geometrical Applications of Differential Calculus

Multiple Choice Questions

1. If the radius of curvature and curvature of a curve at any point are ρ and κ respectively, then
   (a) $\rho = \frac{-1}{\kappa}$ (b) $\rho = \kappa$ (c) $\rho = -\kappa$ (d) $\rho = \frac{1}{\kappa}$
2. The locus of center of curvature is called
   (a) Involute (b) Evolute (c) Radius of curvature (d) Envelope
3. The envelope of the family of curves $A\alpha^2 + B\alpha + C = 0$ (α is parameter) is
   (a) $B^2 + 4AC = 0$ (b) $B^2 - AC = 0$ (c) $B^2 + AC = 0$ (d) $B^2 - 4AC = 0$
4. The curvature of the straight line is
   (a) 1 (b) 2 (c) -1 (d) 0
5. The radius of curvature of the curve $y = 4\sin x$ at $x = \frac{\pi}{2}$ is
   (a) $\frac{1}{2}$ (b) $\frac{-1}{2}$ (c) $\frac{1}{4}$ (d) $\frac{-1}{4}$
6. The envelope of $ty - x = at^2$, t is the parameter is
   (a) $x^2 = 4ay$ (b) $y^2 = 4ax$ (c) $x^2 + y^2 = 1$ (d) $x^2 - y^2 = 1$
7. The curvature at any point of the circle is equal to $---$ of its raduis
   (a) Square (b) Same (c) Reciprocal (d) constant
8. What is the radius of curvature at (4, 3) on the curve $x^2 + y^2 = 25$
   (a) 5 (b) -5 (c) 25 (d) -25
9. What is the curvature of a circle of radius 3
   (a) 3 (b) -3 (c) $\frac{1}{3}$ (d) $\frac{-1}{3}$
10. Find the envelope of the curve $y = mx + \frac{a}{m}$ where m is a parameter
    (a) $y^2 - 4ax = 0$ (b) $y^2 + 4ax = 0$ (c) $x^2 + y^2 = 1$ (d) $xy = c^2$
11. The radius of curvature of $y = e^x$ at $x = 0$ is
    (a) $2\sqrt{2}$ (b) $\frac{2}{\sqrt{2}}$ (c) $\sqrt{2}$ (d) $\frac{1}{\sqrt{2}}$
12. The radius of curvature of the curve $y = log\sec x$ at any point of it is
    (a) $\sec x$ (b) $\tan x$ (c) $\cot x$ (d) $cosecx$
13. In an ellipse the radius of curvature at the end of which axis is equal to the semi latus rectum of the ellipse
    (a) Minor (b) Major (c) Vertical (d) Horizontal
14. The radius of curvature of the curve $x = t^2$, $y = t$ at $t = 1$ is
    (a) $5\frac{\sqrt{5}}{2}$ (b) $\frac{\sqrt{5}}{2}$ (c) $\frac{5}{2}$ (d) $\sqrt{5}$

15. Evolute of a curve is the envelope of $----$ of that curve
    (a) Tangent (b) Normal (c) Parallel (d) Locus

16. The evolute of the cycloid $x = a(\theta - \sin\theta),\ y = a(1 - \cos\theta)$ is
    (a) Astroid (b) Parabola (c) Cycloid (d) Circle

17. A curve which touches each member of a family of the curves is called $---$ of that family
    (a) Evolute (b) Envelope (c) Circle of curvature (d) Radius of curvature

18. The envelope of family of lines $y = mx + am^2$ $(where\,\mathrm{m}\,istheparameter)$ is
    (a) $x^2 + 2ay = 0$ (b) $x^2 + 4ay = 0$ (c) $y^2 + 2ax = 0$ (d) $y^2 + 4ax = 0$

19. The envelope of the family of lines $\frac{x}{t} + yt = 2c,\ t$ being the parameter is
    (a) $x^2 + y^2 = c^2$ (b) $xy = c^2$ (c) $x^2y^2 = c^2$ (d) $x^2 - y^2 = c^2$

20. The radius of curvature at any point on the curve $r = e^\theta$ is
    (a) $\frac{\sqrt{2}}{r}$ (b) $\frac{r}{\sqrt{2}}$ (c) r (d) $\sqrt{2}r$

21. The radius of curvature in Cartesian coordinates is
    (a) $\rho = \dfrac{\left(1 + y_1^2\right)^{3/2}}{y_2}$ (b) $\rho = \dfrac{\left(1 - y_1^2\right)^{3/2}}{y_2}$ (c) $\rho = \dfrac{\left(1 + y_1^2\right)^{2/3}}{y_2}$ (d) $\rho = \dfrac{\left(1 + y_2^2\right)^{3/2}}{y_1}$

22. The radius of curvature in polar coordinates is
    (a) $\rho = \dfrac{\left(r^2 + (r')^2\right)^{3/2}}{r^2 - rr' + 2(r')^2}$ (b) $\rho = \dfrac{\left(r^2 - (r')^2\right)^{3/2}}{r^2 - rr' + 2(r')^2}$ (c) $\rho = \dfrac{\left(r^2 - (r'')^2\right)^{3/2}}{r^2 - rr' + 2(r')^2}$
    (d) $\rho = \dfrac{\left(r^2 + (r')^2\right)^{3/2}}{r^2 - rr'' + 2(r')^2}$

23. The radius of curvature in parametric coordinates is
    (a) $\rho = \dfrac{\left((x')^2 + (y')^2\right)^{3/2}}{x'y'' - y'x''}$ (b) $\rho = \dfrac{\left((x')^2 + (y')^2\right)^{3/2}}{x'y'' + y'x''}$ (c) $\rho = \dfrac{\left((x')^2 - (y')^2\right)^{3/2}}{x'y'' - y'x''}$
    (d) $\rho = \dfrac{\left((x')^2 - (y')^2\right)^{3/2}}{x'y'' + y'x''}$

24. The equation of circle of curvature at any point (x, y) with center of curvature $\overline{x}, \overline{y}$ and with radius of curvature ρ is
    (a) $(x + \overline{x})^2 + (y + \overline{y})^2 = \rho^2$ (b) $(x - \overline{x})^2 + (y - \overline{y})^2 = \rho^2$ (c) $(x - \overline{x})^2 - (y + \overline{y})^2 = \rho^2$
    (d) $(x + \overline{x})^2 + (y + \overline{y})^2 = \rho$

****

Answers:

1. *d* **2.** *b* **3.** *d* **4.** *d* **5.** *c* **6.** *b* **7.** *c* **8.** *a* **9.** *c* **10.** *b* **11.** *a* **12.** *a* **13.** *b* **14.** *a* **15.** *b* **16.** *c* **17.** *b* **18.** *b* **19.** *b* **20.** *d* **21.** *a* **22.** *d* **23.** *a* **24.** *b*