

MISSION NDA MATHEMATICS

COMPLETE TOPICWISE QUESTIONS

APPLICATION OF DIFFERENTIATION

- If a particle is moving such that the velocity acquired is proportional to the square root of the distance covered, then its acceleration is
(a) a constant (b) $\propto s^2$
(c) $\propto \frac{1}{s^2}$ (d) $\propto \frac{1}{s}$
- The curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ touches the straight line $\frac{x}{a} + \frac{y}{b} = 2$ at the point (a, b)
(a) for $x = 3$ (b) for $x = 2$
(c) for any value of n (d) for no value of n
- For the curve $x^{m+n} = a^{m-n}y^{2n}$, (subtangent)^m is proportional to
(a) (subnormal)^m (b) (subnormal)ⁿ
(c) y^{2n} (d) none of these
- If $2a + 3b + 6c = 0$, then $f(x) = ax^2 + bx + c = 0$ has
(a) at least one solution in $[1, 2]$ (b) at least one solution in $[0, 1]$
(c) at least one solution in $[-1, 0]$ (d) two solutions in $[0, 1]$
- The length of the subtangent to the curve $\sqrt{x} + \sqrt{y} = 3$ at the point $(4, 1)$ is
(a) -2 (b) $1/2$
(c) -3 (d) 4
- Tangents are drawn to the curve $x^2y = 1 - y$ at the points where it is met by the curve $xy = 1 - y$. The point of intersection of these tangents is
(a) $(0, -1)$ (b) $(0, 1)$
(c) $(1, 1)$ (d) none of these
- In a $\triangle ABC$, the sides b and c are given. If there is an error ΔA in measuring angle A , then the error Δa in side a is given by
(a) $\frac{S}{2a} \Delta A$ (b) $\frac{2S}{a} \Delta A$
(c) $bcsin A \Delta A$ (d) none of these
- If m is the slope of a tangent to the curve $e^{2y} = 1 + 4x^2$, then
(a) $m < 1$ (b) $|m| \leq 1$
(c) $|m| > 1$ (d) none of these
- If the function $f(x) = ax^3 + bx^2 + 11x - 6$ satisfies the conditions of Rolle's theorem in $[1, 3]$ and $f'\left(2 + \frac{1}{\sqrt{3}}\right) = 0$, then the values of a and b are respectively
(a) 1, -6 (b) -2, 1
(c) -1, $1/2$ (d) -1, 6



10. If $a + b + c = 0$, then the equation $3ax^2 + 2bx + c = 0$ has
 (a) at least one real root in $[0,1]$ (b) one root in $[-1,0]$ and the other in $[1,2]$
 (c) two imaginary roots (d) two coincident roots
11. If the two curves $y = a^x$ and $y = b^x$ intersect at an angle α , then $\tan \alpha$ equals
 (a) $\frac{\log a - \log b}{1 + \log a \log b}$ (b) $\frac{\log a + \log b}{1 - \log a \log b}$
 (c) $\frac{\log a - \log b}{1 - \log a \log b}$ (d) none of these
12. The number of points on the curve $x^{3/2} + y^{3/2} = a^{3/2}$ where the tangents are equally inclined to the axes is
 (a) 1 (b) 2
 (c) 4 (d) none of these
13. Tangents to the curve $y = x^3 + 3x$ at $x = -1$ and $x = 1$ are
 (a) parallel
 (b) intersecting obliquely but not at an angle of 45°
 (c) intersecting at right angles
 (d) intersecting at an angle of 45°
14. The function f defined by $f(x) = 4x^4 - 2x + 1$ is increasing for
 (a) $x < 1$ (b) $x > 0$
 (c) $x < \frac{1}{2}$ (d) $x > \frac{1}{2}$
15. The length of the subnormal of the curve $y^2 = x^3$ at the point $(4,8)$ is
 (a) $3/8$ (b) $8/3$
 (c) 24 (d) 34
16. A particle moves in a straight line so that $s = \sqrt{t}$, then its acceleration is proportional to
 (a) (velocity)³ (b) velocity
 (c) (velocity)² (d) (velocity)^{3/2}
17. A stone is thrown vertically upwards from the top of a tower 64 m high according to the law $s = 48t - 16t^2$. The greatest height above the ground is
 (a) 64 m (b) 36 m
 (c) 100 m (d) none of these
18. If the tangent to the curve $x + y = e^{xy}$ is parallel to the y -axis, then the point of contact is
 (a) $(1,0)$ (b) $(0,1)$
 (c) $(1,1)$ (d) none of these
19. The slope of the tangent to the curves $x = a \sin t, y = a \left(\cos t + \log \tan \frac{t}{2} \right)$ at the point t is
 (a) $\tan t/2$ (b) $\cot t$
 (c) $\tan t$ (d) none of these
20. The area of the triangle formed by the tangent to the curve $y = \frac{8}{(4+x^2)}$ at $x = 2$ and the coordinate axes is
 (a) 2 sq. units (b) 4 sq. units
 (c) 8 sq. units (d) $7/2$ sq. units
21. The equation of the tangent at $(-4,4)$ on the curve $x^2 = -4y$ is
 (a) $2x + y + 4 = 0$ (b) $2x - y - 12 = 0$
 (c) $2x + y - 4 = 0$ (d) $2x - y + 4 = 0$



22. The slope of the tangent to the curves $x = t^2 + 3t - 8$, $y = 2t^2 - 2t - 5$ at the point $(2, -1)$ is
 (a) $22/7$ (b) $6/7$
 (c) 6 (d) none of these
23. Rolle's theorem is not applicable to the function $f(x) = |x|$ in the interval $[-3, 3]$ because
 (a) f is not derivable in $(-3, 3)$ (b) $f(x) \geq 0 \forall x$ in $(-3, 3)$
 (c) $f(3) \neq f(-3)$ (d) f is continuous in $(-3, 3)$
24. The point on the curve $y = x^2$, where the slope of the tangent is equal to the x -coordinate of the point is
 (a) $(2, 0)$ (b) $(0, 2)$
 (c) $(0, 0)$ (d) $(-\frac{1}{2}, \frac{1}{2})$
25. If the function $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = \tan x - x$, then $f(x)$
 (a) increases (b) decreases
 (c) remains constant (d) becomes zero
26. The distance travelled s (in metres) by a particle in t second is given by $s = t^3 + 2t^2 + t$. The speed of the particle after 18 will be
 (a) 8 cm/s (b) 6 cm/s
 (c) 2 cm/s (d) none of these
27. The curve $y - e^{xy} + x = 0$ has a vertical tangent at the point
 (a) $(1, 1)$ (b) at no point
 (c) $(0, 1)$ (d) $(1, 0)$
28. For the curve $xy = c^2$, the subnormal at any point varies as
 (a) x^2 (b) x^3
 (c) y^2 (d) y^3
29. Rolle's theorem is applicable in case of $\phi(x) = a^{\sin x}$ in
 (a) any interval (b) the interval $[0, \pi]$
 (c) the interval $(0, \pi/2)$ (d) none of these
30. If Rolle's theorem holds for the function $f(x) = x^3 + bx^2 + cx$, $1 \leq x \leq 2$ at the point $4/3$, the values of b and c are
 (a) $b = 8, c = -5$ (b) $b = -5, c = 8$
 (c) $b = 5, c = -8$ (d) $b = -5, c = -8$
31. The normals to the curves $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$ at the point $\theta = (2n + 1)\pi$, $n \in I$ are all
 (a) parallel to the x -axis (b) parallel to the y -axis
 (c) parallel to the line $y = x$ (d) none of these
32. If the tangent to the curves $x = at^2$, $y = 2at$ is perpendicular to the x -axis, then its point of contact is
 (a) (a, a) (b) $(0, a)$
 (c) $(0, 0)$ (d) $(a, 0)$
33. If $a + b + c = 0$, then the quadratic equation $3ax^2 + 2bx + c = 0$ has
 (a) imaginary roots (b) at least one real root in $[0, 1]$
 (c) one root in $[2, 3]$ and the other in $[3, 6]$ (d) none of these



34. Let $f(x) = x^3 + \frac{3}{2}x^2 + 3x + 3$, then $f(x)$ is
 (a) a decreasing function (b) an increasing function
 (c) an odd function (d) an even function
35. An object is moving in the clockwise direction around the unit circle $x^2 + y^2 = 1$. As it passes through the point $(\frac{1}{2}, \frac{\sqrt{3}}{2})$, its y -coordinate is decreasing at the rate of 3 unit per second. The rate at which the x -coordinate changes at this point is (in unit per second)
 (a) 2 (b) $3\sqrt{3}$
 (c) $\sqrt{3}$ (d) $2\sqrt{3}$
36. Let $f(x) = x^3 - 6x^2 + 9x + 8$, then $f(x)$ is strictly decreasing in
 (a) $(-\infty, 1)$ (b) $(1, 3)$
 (c) $(3, \infty)$ (d) $(-\infty, 1) \cup (3, \infty)$
37. The function $y = a(1 - \cos x)$ is maximum when x is equal to
 (a) π (b) $\pi/2$
 (c) $-\pi/2$ (d) $-\pi/6$
38. If the curve $y = ax^3 + bx^2 + cx$ is inclined at 45° to the x -axis at $(0,0)$ but it touches the x -axis at $(1,0)$, then the values of a, b and c are given by
 (a) $a = -1, b = 2, c = 1$ (b) $a = 1, b = -2, c = 1$
 (c) $a = 1, b = 1, c = -2$ (d) $a = -2, b = 1, c = 1$
39. The function $f(x) = x^2 - 2x$ is increasing in the interval
 (a) $(-2, -1)$ (b) $(-1, 0)$
 (c) $(0, 1)$ (d) $(1, 2)$
40. The position of a point in time t is given by $x = a + bt - ct^2, y = at + bt^2$. Its acceleration at time t is
 (a) $b - c$ (b) $b + c$
 (c) $2b - 2c$ (d) $2\sqrt{b^2 + c^2}$
41. The point on the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ at which the normal is parallel to the x -axis is
 (a) $(0,0)$ (b) $(0, a)$
 (c) $(a, 0)$ (d) (a, a)
42. If $f'(x) = g(x)(x - a)^2$, where $g(a) \neq 0$ and is continuous at $x = a$, then
 (a) f is increasing near a if $g(a) > 0$ (b) f is increasing near a if $g(a) < 0$
 (c) f is increasing near a if $g(a) = 0$ (d) none of these
43. The function $f(x) = \frac{x}{1+|x|}$ is
 (a) non-differentiable at $x = 0$ (b) strictly increasing
 (c) strictly decreasing (d) neither increasing nor decreasing
44. The coordinates of a point on the curve $y = x \log x$ at which the normal is parallel to the line $2x - 2y = 3$ are
 (a) $(0,0)$ (b) (e, e)
 (c) $(e^2, 2e^2)$ (d) $(e^{-2}, -2e^{-2})$
45. Two towns A and B are 60 km apart. A school is to be built to serve 150 students in town A and 50 students in town B . If the total distance to be travelled by all the 200 students is to be as small as possible, then the school should be built at



- (a) town B
(c) town A
- (b) 45 km from town A
(d) 45 km from town B
46. The curves $ax^2 + by^2 = 1$ and $a'x^2 + b'y^2 = 1$ intersect orthogonally if
 (a) $\frac{1}{a} + \frac{1}{a'} = \frac{1}{b} + \frac{1}{b'}$
 (b) $\frac{1}{a} - \frac{1}{b} = \frac{1}{a'} - \frac{1}{b'}$
 (c) $\frac{1}{a} + \frac{1}{b} = \frac{1}{a'} + \frac{1}{b'}$
 (d) none of these
47. The critical points of the function $f(x) = (x - 2)^{2/3}(2x + 1)$ are
 (a) 1 and 2
 (b) 1 and $-1/2$
 (c) -1 and 2
 (d) 1
48. A ladder 10 – m long rests against a vertical wall with the lower end on the horizontal ground. The lower end of the ladder is pulled along the ground away from the wall at the rate of 3 cm/s. The height of the upper end while it is descending at the rate of 4 cm/s is
 (a) $4\sqrt{3}$ m
 (b) $5\sqrt{3}$ m
 (c) 6 m
 (d) 8 m
49. If the tangent to the curve $y = 2x^2 - x + 1$ at a point p is parallel to $y = 3x + 4$, the coordinates of p are
 (a) (2,1)
 (b) (1,2)
 (c) (-1,2)
 (d) (2, -1)
50. Let $f(x) = (x^2 - 4)^{1/3}$, then f has a
 (a) local maxima at $x = 0$
 (b) local minima at $x = 0$
 (c) point of inflexion at $x = 0$
 (d) none of these

ANSWER KEY

1. (a)	2. (c)	3. (b)	4. (b)	5. (a)	6. (b)	7. (b)	8. (b)	9. (a)	10. (a)
11. (a)	12. (a)	13. (a)	14. (d)	15. (c)	16. (a)	17. (c)	18. (a)	19. (b)	20. (b)
21. (d)	22. (b)	23. (a)	24. (c)	25. (a)	26. (a)	27. (d)	28. (d)	29. (b)	30. (b)
31. (a)	32. (c)	33. (b)	34. (b)	35. (b)	36. (b)	37. (a)	38. (b)	39. (d)	40. (d)
41. (b)	42. (a)	43. (b)	44. (d)	45. (c)	46. (b)	47. (a)	48. (c)	49. (b)	50. (b)

