



RK VISION ACADEMY

NEET | IIT – JEE | FOUNDATIONS

MATRIC PRACTICE PAPER (2024)

(Mathematics)

Grade: XII

Chapter: Applications Of Differential Calculus

Marks: 40 marks

Time: 90 minutes

SECTION A

(10x1=10)

Choose the correct option.

- The maximum value of the function $x^2e^{-2x}, x>0$ is
 (a) $\frac{1}{e^2}$ (b) $\frac{1}{e}$ (c) $\frac{4}{e^4}$ (d) $\frac{1}{2e}$
- The point of inflection of the curve $y=(x-1)^3$ is
 (a) (1,0) (b) (0,0) (c) (1,1) (d) (0,1)
- Angle between the curves $y^2=x$ and $x^2=y$ at the origin is
 (a) $\frac{\pi}{2}$ (b) $\tan^{-1}\left(\frac{3}{4}\right)$ (c) $\frac{\pi}{4}$ (d) $\tan^{-1}\left(\frac{4}{3}\right)$
- A balloon rises straight up at 10m/s. An observer is 40m away from the spot where the balloon left the ground. The rate of change of the balloon's angle of elevation in radian per second when the balloon is 30m above the ground is
 (a) $\frac{3}{25}$ radian/sec (b) $\frac{4}{25}$ radian/sec (c) $\frac{1}{5}$ radian/sec (d) $\frac{1}{3}$ radian/sec
- The function $f(x) = \frac{x}{\log x}$ increases in the interval
 (a) $(1, \infty)$ (b) $(-1, \infty)$ (c) $(0, \infty)$ (d) none of the above
- One of the closest points on the curve $x^2 - y^2 = 4$ to the point (6,0) is
 (a) (2,0) (b) $(\sqrt{5}, 1)$ (c) $(3, \sqrt{5})$ (d) $(\sqrt{13}, -\sqrt{3})$
- A stone is thrown up vertically. The height it reaches at time t seconds is given by $x=80t-16t^2$. The stone reaches the maximum height in time t seconds is given by
 (a) 2 (b) 2.5 (c) 3 (d) 3.5
- The number given by the Rolle's theorem for the function $x^3-3x^2, x \in [0,3]$ is
 (a) 1 (b) $\sqrt{2}$ (c) $\frac{3}{2}$ (d) 2

9. The point on the curve $6y=x^3+2$ at which y-coordinate changes 8 times as fast as x-coordinate is
 (a) (4,11) (b) (4,-11) (c) (-4,11) (d) (-4,-11)
10. The tangent to the curve $y^2-xy+9=0$ is vertical when
 (a) $y=0$ (b) $y=\pm\sqrt{3}$ (c) $y=\frac{1}{2}$ (d) $y=\pm 3$

SECTION B

(3x2=6)

Answer the following.

11. find the value in the interval $(\frac{1}{2}, 2)$ satisfied by the Rolle's theorem for the function $f(x) = x + \frac{1}{x}$, $x \in [\frac{1}{2}, 2]$.
12. Suppose $f(x)$ is a differentiable function for all x with $f'(x) \leq 29$ and $f(2)=17$. What is the maximum value of $f(7)$?
13. Evaluate: $\lim_{x \rightarrow 0} (\frac{\sin mx}{x})$.

SECTION C

(3x3=9)

Answer the following.

14. Find the absolute extrema of the function $f(x) = 6x^{\frac{4}{3}} - 3x^{\frac{1}{3}}$ on the closed interval $[-1, 1]$.
15. Find the asymptotes of the curve $f(x) = \frac{2x^2-8}{x^2-16}$.
16. Write the Maclaurin series expansion of the function $\tan^{-1} x$; $-1 \leq x \leq 1$.

SECTION D

(3x5=15)

Answer the following.

17. If the curves $ax^2+by^2=1$ and $cx^2+dy^2=1$ intersect each other orthogonally, then show that $\frac{1}{a} - \frac{1}{b} = \frac{1}{c} - \frac{1}{d}$.
18. Find intervals of concavity and points of inflexion for the function $f(x) = \frac{1}{2}(e^x - e^{-x})$.

19. A police jeep approaching an orthogonal intersection from the northern direction, is chasing a speeding car that has turned and moving straight east. When the jeep is 0.6km north of the intersection and the car is 0.8km to the east. The police determine with a radar that the distance between them and the car is increasing at 20km/hr. If the jeep is moving at 60km/hr at the instant of measurement, what is the speed of the car?