



N K MATHS ACADEMY

TIRUPUR-9843434491

MATHEMATICS

Ln-7, 8

MARKS: 50

TIME: 1.30 HRS

I. ANSWER ANY 10 QUESTIONS:**10X2=20**

1. The temperature T in Celsius in a long rod of length 10 m, insulated at both ends, is a function of length x given by $T = x(10 - x)$. Prove that the rate of change of temperature at the midpoint of the rod is zero
2. A particle moves so that the distance moved is according to the law $s(t) = \frac{t^3}{3} - t^2 + 3$. At what time the velocity and acceleration are zero respectively?
3. For what value of x the tangent of the curve $y = x^3 - 3x^2 + x - 2$ is parallel to the line $y = x$
4. Find the slope of the tangent to the curves $x = a \cos^3 t$, $y = b \sin^3 t$ at $t = \frac{\pi}{2}$
5. Evaluate: $\lim_{x \rightarrow 1} \frac{x^2 - 3x + 2}{x^2 - 4x + 3}$
6. Evaluate $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$
7. Prove that the function $f(x) = x^2 - 2x - 3$ is strictly increasing in $(2, \infty)$
8. Use linear approximation to find an approximate value of $\sqrt{9.2}$ without using a calculator
9. Find a linear approximation for $h(x) = \frac{x}{x+1}$ at $x_0 = 1$
10. Find differential dy for $y = (3 + \sin(2x))^{\frac{2}{3}}$
11. Find df for $f(x) = x^2 + 3x$ and evaluate it for $x = 3$ and $dx = 0.02$
12. If the volume of a cube of side length x is $v = x^3$. Find the rate of change of the volume with respect to x when $x = 5$ units.

II. ANSWER ANY 5 QUESTIONS:**5X3=15**

13. Find the angle of intersection of the curve $y = \sin x$ with the positive x -axis
14. Show that the two curves $x^2 - y^2 = r^2$ and $xy = c^2$ where c, r are constants, cut orthogonally
15. Evaluate $\lim_{x \rightarrow 1^+} \left(\frac{2}{x^2 - 1} - \frac{x}{x - 1} \right)$

16. A right circular cylinder has radius $r = 10$ cm. and height $h = 20$ cm. Suppose that the radius of the cylinder is increased from 10 cm to 10.1 cm and the height do not change. Estimate the change in the volume of the cylinder. Also, calculate the relative error and percentage error.
17. The time T , taken for a complete oscillation of a single pendulum with length l , is given by the equation $T = 2\pi\sqrt{\frac{l}{g}}$, where g is a constant. Find the approximate percentage error in the calculated value of T corresponding to an error of 2 percent in the value of l .
18. The relation between the number of words y a person learns in x hours is given by $y = 52\sqrt{x}$, $0 \leq x \leq 9$ What is the approximate number of words learned when x changes from (i) 1 to 1.1 hour? (ii) 4 to 4.1 hour?

IV. ANSWER THE FOLLOWING**3X5=15**

19. Salt is poured from a conveyer belt at a rate of 30 cubic metre per minute forming a conical pile with a circular base whose height and diameter of base are always equal. How fast is the height of the pile increasing when the pile is 10 metre high?

(OR)

A camera is accidentally knocked off an edge of a cliff 400 ft high. The camera falls a distance of $s = 16t^2$ in t seconds.

- (i) How long does the camera fall before it hits the ground?
- (ii) What is the average velocity with which the camera falls during the last 2 seconds?
- (iii) What is the instantaneous velocity of the camera when it hits the ground?
20. If the curves $ax^2 + by^2 = 1$ and $cx^2 + dy^2 = 1$ intersect each other orthogonally then,

$$\frac{1}{a} - \frac{1}{b} = \frac{1}{c} - \frac{1}{d}$$

(OR)

For the function $f(x) = 4x^3 + 3x^2 - 6x + 1$ find the intervals of monotonicity, local extrema, intervals of concavity and points of inflection

21. We have a 12 square unit piece of thin material and want to make an open box by cutting small Squares from the corners of our material and folding the sides up. The question is, which cut produces the box of maximum volume?

(OR)

Prove that among all the rectangles of the given area square has the least perimeter

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