

SIR CV RAMAN COACHING CENTRE – IDAPPADI,SALEM –2025

XII- MATHS ,UNIT [7,8,9]- MODEL QUESTION PAPPER – 2025

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SECTION – A (25 X 2 = 50M)

ANSWER ANY 25 QUESTIONS :

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. 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

3. Find the points on the curve $y = x^3 - 3x^2 + x - 2$ at which the tangent is parallel to the line $y = x$.

4. Find the angle of intersection of the curve $y = \sin x$ with the positive x -axis.

5. Find the slope of the tangent to the following curves at the respective given points.

(i) $y = x^4 + 2x^2 - x$ at $x = 1$

6. Find the point on the curve $y = x^2 - 5x + 4$ at which the tangent is parallel to the line $3x + y = 7$.

7. Find the values in the interval $(, 1 2)$ of the mean value theorem satisfied by the function $f(x) = x - x^2$ for $1 \leq x \leq 2$.

8. A truck travels on a toll road with a speed limit of 80 km/hr. The truck completes a 164 km journey in 2 hours. At the end of the toll road the trucker is issued with a speed violation notice. Justify this using the Mean Value Theorem

9. Prove, using mean value theorem, that $|\sin \alpha - \sin \beta| \leq |\alpha - \beta|$, $\alpha, \beta \in \mathbb{R}$.

10. Write the Maclaurin series expansion of the following functions: e^x

11. Evaluate the following limits, if necessary use l'Hôpital Rule :

$$\lim_{x \rightarrow \infty} \frac{x}{\log x}$$

12. An egg of a particular bird is very nearly spherical. If the radius to the inside of the shell is 5mm and radius to the outside of the shell is 5.3 mm, find the volume of the shell approximately

13. A coat of paint of thickness 0.2 cm is applied to the faces of a cube whose edge is 10 cm. Use the differentials to find approximately how many cubic centimetres of paint is used to paint this cube. Also calculate the exact amount of paint used to paint this cube.

14. If $w(x, y, z) = x^2 y + y^2 z + z^2 x, x, y, z \in \mathbb{R}$ find the differential dw .

15. If $v(x, y) = x^2 - xy + \frac{1}{4} y^2 + 7, x, y \in R,$ find the differential dv .

16. Let us assume that the shape of a soap bubble is a sphere. Use linear approximation to approximate the increase in the surface area of a soap bubble as its radius increases from 5 cm to 5.2 cm. Also, calculate the percentage error.

17. Show that the percentage error in the n th root of a number is approximately $1/n$ times the percentage error in the number

18. If the radius of a sphere, with radius 10 cm, has to decrease by 0.1cm, approximately how much will its volume decrease?

19. Let $g(x) = x^2 + \sin x$ Calculate the differential dg .

20. Assume that the cross section of the artery of human is circular. A drug is given to a patient to dilate his arteries. If the radius of an artery is increased from 2 mm to 2.1 mm, how much is cross-sectional area increased approximately?

21. Find the volume of a right-circular cone of base radius r and height h .

22. Find the volume of a sphere of radius a .

23. Evaluate $\int_0^{\infty} e^{-ax} x^n dx$, where $a > 0$.

24. Evaluate $\int_0^1 x^3 (1-x)^4 dx$.

25. Evaluate $\int_0^{\frac{\pi}{2}} (\sin^2 x + \cos^4 x) dx$

$$\int_b^{\infty} \frac{1}{a^2 + x^2} dx, \quad a > 0, b \in \mathbb{R}.$$

26. Evaluate

$$\int_0^{\pi} x^2 \cos nx \, dx, \quad \text{where } n \text{ is a positive integer.}$$

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} x \cos x \, dx.$$

28. Evaluate

$$\int_0^1 [2x] dx \text{ where } [\cdot] \text{ is the greatest integer function.}$$

$$\int_0^1 x dx, \quad \text{as the limit of a sum}$$

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