



KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS TREATED AS EXAM MALPRACTICE

Answer any TEN Questions

(10 X 10 = 100 Marks)

- ✓ 1. Find the volume of the solid generated by revolving the region $R = \{(x, y) | 0 \leq x \leq 2, (x - 1)^2 \leq y \leq 1\}$ around the line $x = -1$.
- ✓ 2. Find the critical points and local maxima and minima of the function $y = \frac{3}{4}(x^2 - 1)^{2/3}$. Identify the intervals on which the function is concave up and concave down. Also identify the inflection points.
- ✓ 3. The pressure, volume and temperature of an ideal gas are related by the equation $PV = 8.31T$. Find the rate at which the pressure is changing when the temperature is 300 K and increasing at a rate of 0.1 K/sec and the volume is 100 l and increasing at a rate of 0.2 l/sec .
- ✓ 4. Determine the extreme values of $f(x, y) = x + 2y$ on the circle $x^2 + y^2 = 1$ using Lagrange's multiplier method.
- ✓ 5. Find the second degree Taylor polynomial of the function $f(x, y) = \log(1 + x + 2y)$ at $(2, 1)$.
- ✓ 6. Evaluate $\int_0^1 \int_{-\sqrt{y}}^{\sqrt{y}} (6x - y) dx dy$ by changing the order of integration.
7. Evaluate $\iiint \sqrt{1 - x^2 - y^2 - z^2} dx dy dz$ taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$, by transforming in to spherical polar coordinates.
8. Find $\int_0^{\pi/2} \sqrt{\sin \theta} d\theta \times \int_0^{\pi/2} \frac{1}{\sqrt{\sin \theta}} d\theta$
- ✓ 9. Find the directional derivative of the function $\phi = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of the normal to the surface $x \log z - y^2 + 4 = 0$ at $(-1, 2, 1)$
- ✓ 10. Prove that if \vec{r} is the position vector of any point in space, then $r^n \vec{r}$ is irrotational.
- ✓ 11. Find the work done in moving a particle in the force field $\vec{F} = 3x^2 \vec{i} + (2xz - y) \vec{j} + z \vec{k}$ along the straight line from $(0, 0, 0)$ to $(2, 1, 3)$
- ✓ 12. Apply Greens theorem to evaluate $\oint_c (2x^2 - y^2) dx + (x^2 + y^2) dy$, where c is the boundary of the area enclosed by the x -axis and upper half of the circle $x^2 + y^2 = a^2$