

Calculus III Test 2 Review

Sections Covered 12: 3,5,7,8,9,10; 13: 1,3,4,6

1. Find the directional derivative of $f(x, y) = x^2y + e^xy$ at the point $P(1, 3)$ in the direction of $4\mathbf{i} + \mathbf{j}$.
2. Find the tangent plane to the surface $x^2 + y^2/4 + z^2/16 = 3$ at the point $(1, 2, 4)$.
3. Find parametric equations for the line tangent to the curve of intersection of $x^2 + y^2 + z^2 = 12$ and $y = x^2$ at the point $(\sqrt{3}, 3, 0)$.
4. Justifying your answer, find all the critical points of $f(x, y) = x^2 + xy^3 + x$ and indicate whether the critical point(s) are saddle points, local max or mins, or indeterminate.
5. Find the absolute max and min of the function $f(x, y) = x^2y^4 + y^2 - y$ on the rectangular plate $-1 \leq x \leq 1, -1 \leq y \leq 1$.
6. Find the point on the surface $x^2 + y^2/4 + z^2/16 = 3$ closest to the point $(1, 1, 1)$.
7. Find the extreme values of the function $f(x, y) = xy + z$ on the intersection of $x^2 + y^2 + z^2 = 12$ and $y = x^2$.
8. Find the cubic Taylor's approximation to $f(x, y) = x^2e^y$ at the origin and give the coefficient of the xy^{20} term in its Taylor expansion.
9. Evaluate $\int_0^8 \int_{\sqrt[3]{x}}^2 \frac{dy dx}{y^4+1}$
10. Evaluate $\int_{-1}^1 \int_{-\sqrt{1-x^2}}^0 \frac{dy dx}{(x^2+y^2+1)^2}$
11. Find the area inside $r = 1 + \cos(\theta)$ and outside $r = 1$.
12. Evaluate $\int_0^2 \int_0^{4-x^2} \int_0^x \frac{\sin(2z) dy dz dx}{4-z}$
13. Find the volume of the solid inside the sphere $\rho = \sqrt{2}$ and outside the cylinder $r^2 = 1$.