

Math 2313, Final

Name _____

1. Find a vector parallel to both of the planes $x + 2y - z = 0$ and $y + z = 3$.

answer: $(3, -1, 1)$

2. Find the equation of the tangent plane to the surface $2x^2 + y^2 + z^2 = 15$ at $(1, 3, 2)$.

answer: $4x + 6y + 4z = 30$

3. Find $\frac{\partial U}{\partial p}$ if
 $U = x^3 + \ln(xy) + e^{3yz}$
 $x = pq$
 $y = q/p$
 $z = p^2 + q^2$

answer: $(3x^2 + \frac{1}{x})q + (\frac{1}{y} + 3ze^{3yz})(-\frac{q}{p^2}) + (3ye^{3yz})(2p)$

4. Evaluate $\int_0^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} e^{x^2+y^2} dy dx$

answer: $\frac{\pi}{2}(e^4 - 1)$

5. Find the directional derivative of $f(x, y, z) = x^3 + \ln(xy) + e^{3yz}$ at the point $(1, 1, 0)$ in the direction of the vector $(1, 1, -1)$.

answer: $\frac{2}{\sqrt{3}}$

6. Find the point on the surface $z = \sqrt{x^2 + 2y^2}$ closest to the point $(1, 1, 0)$.

answer: $(\frac{1}{2}, \frac{1}{3}, \sqrt{\frac{17}{36}})$

7. Write an integral which, if evaluated (but don't evaluate), would give the mass of the tetrahedron in the first octant under the plane $6x + 3y + z = 12$, if the density is given by $\rho(x, y, z) = x^2 + z^2$.

answer: $\int_0^2 \int_0^{4-2x} \int_0^{12-6x-3y} (x^2 + z^2) dz dy dx$