

EXAM 2
Math 232
June 30, 2005

Name _____

1. Find each of the following. (5 pts each)

(a) f_x if $f(x, y) = 3x^4y + 8x^{0.5}y^2 - 3x^2$

(b) $\frac{\partial}{\partial h} \left(\frac{13}{2a}(2a + b)h \right)$

(c) $\frac{\partial z}{\partial y} \Big|_{(5,0)}$ if $z = e^{x+2y} \sin y$.

(d) $f_x(\pi/3, 1)$ if $f(x, y) = x \ln(y \cos(x))$

2. A drug is injected into a patient's blood vessel. The function $c = f(x, t)$ represents the concentration of the drug at a distance x mm in the direction of the blood flow measured from the point of injection and at time t seconds since the injection. What are the units of the partial derivative $\frac{\partial c}{\partial x}$? Do you expect it to be positive or negative? (5 pts)

3. Find the local linearization of $z = x^2y$ at the point $(3, 1)$. (8 pts)

4. Find the differential of $F(m, r) = Gm/r^2$ at $(100, 10)$. (6 pts)

5. Find the gradient of $f(x, y) = \sin(x^2) + \cos(y)$ at $(\frac{\sqrt{\pi}}{2}, 0)$. (8 pts)

6. Show that the point $(3, 2, 1)$ lies on the surface $x^2 - xyz = 3$ then find a vector normal to this surface at the given point. (8 pts)

7. Find both $\frac{\partial f}{\partial u}$ and $\frac{\partial f}{\partial v}$ for the following function $z = \tan^{-1}\left(\frac{x}{y}\right)$ with $x = u^2 + v^2$ and $y = u^2 - v^2$. (12 pts)

8. For the function $f(x, y) = e^{-2x^2 - y^2}$ find f_{xx} , f_{yy} and f_{xy} . (9 pts)

9. Let $z = f(w) + x^2L(v)$. Can you find z_{xx} ? If not explain why not, if so find it. (4 pts)
10. For the equation, $f(x, y) = (x + y)(xy + 1)$, find all critical points and classify them as local maxima, local minima, saddle points, or none of these. (6 pts)
11. Find the global maximum and minimum (if they exist) for $f(x, y) = y\sqrt{x} - y^2 - x + 6y$ on the domain D , where D is the rectangle $0 \leq x \leq 9$ and $0 \leq y \leq 5$. (8 pts)
12. Find the quadratic Taylor polynomial about $(0, 0)$ for $\cos(x + 3y)$ and use it to estimate the function at $(1, 1)$. (This should give you an estimate for $\cos 4$.) (6 pts)