

Activity 7: Chain Rule and Gradient

Names: _____ Date: November 5, 2009 Score: _____

Show your work or explain your answer for each of the following. You should submit one copy for your group. Feel free to ask your instructor for advice if you need it.

1. (5 pts) Consider the function $f(x, y, z) = x^2y + 3e^z$ near the point $(-3, 2, 0)$.
 - (a) Evaluate $f(5, 6, 7)$ as exactly as possible.
 - (b) Calculate $Jf(x, y, z)$

 - (c) Calculate $Jf(5, 6, 7)$

 - (d) Calculate $Df(5, 6, 7)$

 - (e) Calculate $\nabla f(x, y, z)$

 - (f) Calculate $\nabla f(5, 6, 7)$

 - (g) In which direction does the function f change the fastest as a point moves away from $(5, 6, 7)$?

 - (h) Using only your answers in parts (a) - (g), approximate $f(5.01, 6.02, 6.97)$.

2. Let $a(x, y) = x^2 + 2y^2$ and let $b(t) = (3 \cos(t), 4 \sin(t))$.

(a) Calculate $J(a \circ b)(t)$

(b) Calculate $J(a \circ b)(-1)$

(c) Calculate $J(b \circ a)(x, y)$

(d) Calculate $J(b \circ a)(2, -4)$

(e) If $x(t) = 3 \cos(t)$ and $y(t) = 4 \sin(t)$, calculate $\frac{da}{dt}$.

(f) If $t(x, y) = x^2 + 2y^2$, calculate $\frac{\partial b}{\partial x}$ and $\frac{\partial b}{\partial y}$.