Math 173 - Quiz 6
March 30, 2017

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (3 points) Find the directional derivative of $g(x,y) = \sqrt{x^2+y^2}$ at the point $(3,4)$ in the direction of $3\hat{\imath} - 4\hat{\jmath}$.

$\vec{\nabla} g(x,y) = \frac{1}{2}(x^2+y^2)^{-1/2}(2x\hat{\imath} + 2y\hat{\jmath})$

$\vec{\nabla} g(3,4) = \frac{3\hat{\imath}+4\hat{\jmath}}{5}$

$\vec{v} = 3\hat{\imath} - 4\hat{\jmath}$

$\|\vec{v}\| = 5$

$\frac{\vec{\nabla} g(3,4)\cdot\vec{v}}{\|\vec{v}\|} = \frac{9-16}{25} = \boxed{-\frac{7}{25}}$

2. (3 points) Let $f(x,y,z) = x\tan(y+z)$. Compute the gradient of f at the point $(4,3,-1)$.

$\vec{\nabla} f(x,y,z) = \tan(y+z)\hat{\imath} + x\sec^2(y+z)\hat{\jmath} + x\sec^2(y+z)\hat{k}$

$\boxed{\vec{\nabla} f(4,3,-1) = \tan(2)\hat{\imath} + 4\sec^2(2)\hat{\jmath} + 4\sec^2(2)\hat{k}}$

3. (4 points) Let $f(x,y) = x^2y + 2xy^3$. Find a unit vector that is normal to the level curve through the point $(3,2)$.

$\vec{\nabla} f(x,y) = (2xy + 2y^3)\hat{\imath} + (x^2 + 6xy^2)\hat{\jmath}$

$\vec{\nabla} f(3,2) = 28\hat{\imath} + 81\hat{\jmath}$

$\|\vec{\nabla} f(3,2)\| = \sqrt{28^2+81^2} = \sqrt{7345}$

$\boxed{\frac{28\hat{\imath}+81\hat{\jmath}}{\sqrt{7345}}}$