Name: _____ Sort #: _____

Worksheet 9

Directional Derivatives & Gradients MATH 2210, Fall 2018

1. Decide if each statement is true or false. If the statement is true, explain why. If the statement is false, provide a counter example. Solutions without appropriate justification will receive no credit.

   (a) If $\hat{\mathbf{u}}$ is tangent to the level curve of f that passes through $(1, 2)$ then $D_{\hat{\mathbf{u}}} f(1, 2) = 0$.

   (b) If $f_x(1, 2) = -3$ and $f_y(1, 2) = 4$ then $-3 \leq D_{\hat{\mathbf{u}}} f(1, 2) \leq 4$.

2. Calculate the directional derivative of $f(x, y) = \sqrt{\sin(x) + y^2}$ at the point $P(0, 2)$ in the direction of the origin.

3. Find the points on the surface $xy+z^2 = 1$ where the tangent plane is parallel to the plane $3x + y + 2z = 5$. Hint: the surface $xy + z^2 = 1$ is a level surface for $f(x, y, z) = xy + z^2$.

4. Find parametric equations for the line that is normal to the hyperboloid

$$x^2 + y^2 - z^2 = -4$$

at the point $P_0(1, 2, 3)$ Hint: the hyperboloid is a level surface for $f(x, y, z) = x^2+y^2-z^2$.