Math 253 Calculus III Fall 2018 **Quiz # 6, 17 October 2018**

Name: _____

There are 20 points possible on this quiz. This is a closed book quiz and closed note quiz. Calculators are not allowed. If you have any questions, please raise your hand.

1. (4 points) Use the Chain Rule to find $\partial z/\partial t$ if $z = y^2 \arctan(2x)$, $x = e^{st}$, $y = t^2 + s^3$.

2. (6 points) The temperature at a point (x, y) is $T(x, y)$, measured in degrees Celsius. A bug crawls so that its position after t seconds is given by $x = 3\cos(2\pi t)$, $y = 4 + \sqrt{t}$ where x and y are measured in centimeters. The temperature function satisfies $T_x(3, 5) = 8$ and $T_y(3, 5) = -6$.

   (a) In the context of the problem (temperature, crawling bug), explain the meaning of $T_x(3, 5) = 8$ in language your parents could understand.

   (b) How fast is the temperature changing on the bug's path after 1 second? (Give units with your answer.)

3. (4 points) Find the equation of the tangent plane to the surface $x = y^2 + z^2 + 1$ at the point $(14, 2, 3)$.

4. (6 points) Suppose that over a certain region of space the electrical potential V is given by the following equation:

$$V(x, y, z) = xy^2 + yz.$$

(a) Find the rate of change of the potential at the point $P(-1, 2, 4)$ in the direction of the vector $\mathbf{v} = 2\mathbf{i} - 2\mathbf{j} + \mathbf{k}$.

(b) In which direction does V change most rapidly at P?

(c) What is the maximum rate of change of V at P?