MATH 253 Name: _____

Quiz 6 February 18, 2022

**Instructions:** Ten points total. Show all work for credit.

1. (5 pts.)

   (a) (4 pts.) Find (i) the best linear approximation to the function

   $$f(x, y, z) = \sqrt{x^2 + y^2 + z^2} \quad \text{at the point } (3, 2, 6)$$

   and (ii) use it to approximate the value of $\sqrt{(3.01)^2 + (1.98)^2 + (6.01)^2}$, using a calculator to give your answer to four decimal places.

*Answers:* (i) Linear approximation: (ii) $\sqrt{(3.01)^2 + (1.98)^2 + (6.01)^2} \approx$

(continued from LAST page)

(b) (1 pt.) **(Visualization practice)** Describe carefully in words the level surface

$$f(x, y, z) = 12$$

2. (a) (5 pts)

i. (2 pts.) Use the Chain Rule to find $\dfrac{\partial z}{\partial t}$ when $z = \arctan\left(x^2 + y^2\right)$, for $x = s\ln(t)$ and $y = te^s$. (You **must** use the chain rule to earn credit for this part. No chain rule, no credit.) You may give your answer in terms of $x$, $y$, $s$, and $t$.

ii. (2 pts.) Now compute the value $\left.\dfrac{\partial z}{\partial t}\right|_{(0,1)}$.
That is, compute the value of the partial derivative at the point $(s, t) = (0, 1)$.

iii. (1 pt.) Is the function $z$ increasing, decreasing, or stable in the $t$-direction at the point $(s, t) = (0, 1)$? Justify briefly.