Quiz 2 25 points Math 200 Name: ______________________

1. Let $\vec{\alpha}(t) = \left\langle t, \frac{4t^{3/2}}{3}, t^2 \right\rangle$ for all parts of this problem. You do not need to repeat work.

   (a) (5 points) Find the arc length of the trace of $\vec{\alpha}(t)$ from $t = 0$ to $t = 4$.

   (b) (4 points) Find the equation of the osculating plane for the trace of $\vec{\alpha}(t)$ at $t = 1$.

   (c) (4 points) Find the curvature for the trace of $\vec{\alpha}(t)$ at $t = 1$.

2. (4 points) Find and simplify $I = \int_{-2}^{2} \left\langle (t^3 - t)\sin^2(t), \cos^2(\pi t), \sin(2\pi t)\sin(3\pi t) \right\rangle \, dt$. Show work to defend your answer.

3. (4 points) Find $f'(1)$ if $f(t) = \vec{p}(t) \cdot \left\langle e^t, \ln(t), \arctan(t) \right\rangle$, $\vec{p}(1) = \langle -e, -1, 3 \rangle$, and $\left.\dfrac{d\vec{p}}{dt}\right|_{t=1} = \langle 1, 3, 4 \rangle$. Show work to defend your answer.

4. (a) (2 points) Convert $P = \left(-3, 4, \sqrt{11}\right)$ to cylindrical coordinates.

   (b) (2 points) Convert $P = \left(-3, 4, \sqrt{11}\right)$ to spherical coordinates.