Quiz 2 25 points Math 200 Name: ______________________________

1. Let $\vec{\alpha}(t) = \langle t, \cosh(t), \sinh(t) \rangle$ for all parts of this problem. You do not need to repeat work. Recall that $\cosh^2(t) - \sinh^2(t) = 1$.

   (a) (5 points) Find the arc length of the trace of $\vec{\alpha}(t)$ from $t = 0$ to $t = \ln(2)$.

   (b) (4 points) Find the equation of the osculating plane for the trace of $\vec{\alpha}(t)$ at $t = 0$.

   (c) (4 points) Find the curvature for the trace of $\vec{\alpha}(t)$ at $t = 0$.

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

3. (4 points) Find $f\,'(0)$ if $f(t) = \vec{p}(t) \cdot \left\langle e^t, \sin(t), \arctan(t)\right\rangle$, $\vec{p}(0) = \langle -2, 1, 3\rangle$, and $\left.\dfrac{d\vec{p}}{dt}\right|_{t=0} = \langle 2, 0, 4\rangle$.

4. (a) (2 points) Convert $P = (-1, 1, -3)$ to cylindrical coordinates.

   (b) (2 points) Convert $P = (-1, 1, -3)$ to spherical coordinates.