

Name:

1. Find the derivative of $\mathbf{r}(t) = \frac{1}{1+t}\mathbf{i} + \frac{t}{1+t}\mathbf{j} + \frac{t^2}{1+t}\mathbf{k}$.

2. Find the parametric equation for the tangent line to the curve with the given parametric equation at the specified point:

$$x = e^t, \quad y = te^t, \quad z = te^{t^2} \quad (1, 0, 0).$$

3. Find the length of the curve $\mathbf{r}(t) = 12t\mathbf{i} + 8t^{3/2}\mathbf{j} + 3t^2\mathbf{k}$ for $0 \leq t \leq 1$.

4. Let C be the curve of intersection of the parabolic cylinder $x^2 = 2y$ and the surface $3z = xy$. Find the exact length of C from the origin to the point $(6, 18, 36)$.
(Hint: Let $x = t$ to find the equation of the curve.)