Name: _____

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1. (10 pts) Consider the curve given by

$$\vec{\mathbf{x}}(t) = \begin{pmatrix} t \\ t^2 \\ t^3 \end{pmatrix}.$$

(a) Compute the velocity, acceleration and jerk (third derivative) vectors. (b) Find the volume of the parallelepiped spanned by these three vectors.

2. (10 pts) Consider the curve given by

$$\vec{\mathbf{x}}(\theta) = \begin{pmatrix} \cos\theta + \sin\theta \\ \cos\theta - \sin\theta \\ \theta \end{pmatrix}.$$

Compute the length of the segment with $0 \leq \theta \leq 2\pi$.

Bonus. (5 pts) Consider the curve given in Problem 1. (a) Compute the curvature at $t = 0$. (b) Find the limit of the curvature as $t \to \infty$.