Name:_________________________________________________________________________

Write all of your responses on this paper. If you need extra space for your work please use the back. Make sure that you show all of your work.

1. Let \( r(t) = \langle t^2, \sin(e^{4\sqrt{t}}), \cos(\sqrt[3]{t^3 + 7t^2}) \rangle \) and let \( s = \int_1^t |r'(u)| \, du \). If we denote \( f(s) \) as the solution to the previous equation (solving for \( t \) in terms of \( s \), that is, \( t = f(s) \)) find,
\[
\int_1^{25} |r'(f(s))| \, ds
\]

**Solution:** 24

2. Find a formula for the curvature of \( r(t) = \langle 3t, 2t^2 - 5, 5t \rangle \). From this formula discuss how much the curve will be changing direction as \( t \) approaches infinity.

**Solution:** First note that \( r'(t) = \langle 3, 4t, 5 \rangle \) and \( r''(t) = \langle 0, 4, 0 \rangle \). So
\[
\kappa(t) = \frac{|r'(t) \times r''(t)|}{|r'(t)|^3} = \frac{|\langle -20, 0, 12 \rangle|}{(\sqrt{24 + 16t^2})^3} = \frac{\sqrt{544}}{(\sqrt{24 + 16t^2})^3}
\]