1) Find the length of the curve.

   a) $\mathbf{r}(t) = \langle 2\sin t, 5t, 2\cos t \rangle, \quad -10 \le t \le 10$

   b) $\mathbf{r}(t) = \sqrt{2}t\,\mathbf{i} + e^{t}\,\mathbf{j} + e^{-t}\,\mathbf{k}, \quad 0 \le t \le 1$

2) Reparametrize the curve with respect to arc length measured form the point where $t = 0$ in the direction of increasing t.

   a) $\mathbf{r}(t) = \langle 2t, 1-3t, 5+4t \rangle,$

   b) $\mathbf{r}(t) = 3\sin t\,\mathbf{i} + 4t\,\mathbf{j} + 3\cos t\,\mathbf{k}$

3) Find the curvature of $\mathbf{r}(t) = \langle t, t^2, t^3 \rangle$ at the point $(1,1,1)$.

4) Find the curvature of the following functions:

a) $y = x^3$

b) $y = \cos x$

5) Given $\mathbf{r}(t) = \left\langle t^2, \frac{2}{3}t^3, t \right\rangle$ find the vectors $\mathbf{T}$, $\mathbf{N}$, and $\mathbf{B}$ at the point $\left(1, \frac{2}{3}, 1\right)$

6) Find the circle of curvature to the graph $y = e^x$ at $x = 0$.