Section 13.3: Additional Problems

1. Let $\mathbf{r}(t) = \langle 5 - t, 4 - 3t, 3t \rangle$ and $P(4, 1, 3)$
   (a) Find the arc length function for the curve measured from the point P in the direction of increasing t.
   (b) Reparameterize the curve with respect to the arc length starting from P.
   (c) Find the point 4 units along the curve (in the direction of increasing t) from P.
2. 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 $(6, 18, 36)$
3. Find the arc length function for $\mathbf{r}(t) = \langle e^t, e^t \sin(t), e^t \cos(t) \rangle$ from the point $(1, 0, 1)$ in the direction of increasing t.
4. Find the curvature of $\mathbf{r}(t) = \langle t^3, t^2, t \rangle$ at a general point and then at $(8, 4, 2)$.