$\boxed{1}$ Consider the curve $\mathbf{r}(t) = \langle t^2, \sin(t) - t\cos(t), \cos(t) + t\sin(t) \rangle$ for $t \geq 0$ from Problem 12 of Section 10.3.

(a) Suppose we start at the point $(x, y, z) = (0, 0, 1)$ at $t = 0$ and move along the curve until $t = 5$. How far have we traveled along the curve? (Note: this does *not* ask how far the ending point is from the starting point.)

(b) Suppose we again start at the point $(x, y, z) = (0, 0, 1)$, but now move along the curve in the positive t direction a distance of 3 units. What point have we reached?

(c) Suppose we once more start at the point $(x, y, z) = (0, 0, 1)$, and again move in the positive t direction. Is there a time $t > 0$ when we have traveled a distance of precisely t units? If so, find this time. If not, explain why not.