

Calc 3 - Assignment #01

① Find the length of the curves:

a) $r(t) = \langle 2 \sin(t), 5t, 2 \cos(t) \rangle, -10 \leq t \leq 10$

b) $r(t) = \langle 2t, t^2, \frac{1}{3}t^3 \rangle, 0 \leq t \leq 1$

c) $r(t) = \langle 12t, 8t^{3/2}, 3t^2 \rangle, 0 \leq t \leq 1$

② Suppose you start at the point $(0, 0, 3)$

and move 5 units along the curve

$\vec{r}(t) = \langle 3 \sin(t), 4t, 3 \cos(t) \rangle$ in the positive

direction. Where are you now?

③ Find the unit tangent vector $\vec{T}(t)$:

a) $\vec{r}(t) = \langle 2 \sin(t), 5t, 2 \cos(t) \rangle$

b) $\vec{r}(t) = \langle t^2, \sin(t) - t \cos(t), \cos(t) + t \sin(t) \rangle, t > 0$

c) $\vec{r}(t) = \langle \sqrt{2}t, e^t, e^{-t} \rangle$

④ Find the curvature:

a) $\vec{r}(t) = \langle t^2, t \rangle$

b) $\vec{r}(t) = \langle 3t, 4 \sin(t), 4 \cos(t) \rangle$

⑤ Show that the circular helix

$\vec{r}(t) = \langle a \cos(t), a \sin(t), bt \rangle, a > 0, b > 0$, has constant curvature.