Lecture 6: Vector Valued Functions

Vector Valued Functions take a scalar as an input and output a vector.

$$\bar{F}(t) = f_1(t)\hat{\imath} + f_2(t)\hat{\jmath} + f_3(t)\hat{k}$$

$$\bar{F}(t) = \langle f_1(t), f_2(t), f_3(t) \rangle$$

$f_1, f_2, + f_3$ are the "component functions" of $\bar{F}$

Ex. 1 Identify the component functions and domain of $\bar{F}$

$$\bar{F}(t) = t^3\hat{\imath} + \ln(3-t)\hat{\jmath} + \sqrt{t}\,\hat{k}$$

$f_1(t) = t^3 \quad f_2(t) = \ln(3-t) \quad f_3(t) = \sqrt{t}$

domain of:

$f_1(t)$ defined $\forall t \in \mathbb{R}$

$f_2(t)$ defined $\forall t \in (-\infty, 3)$

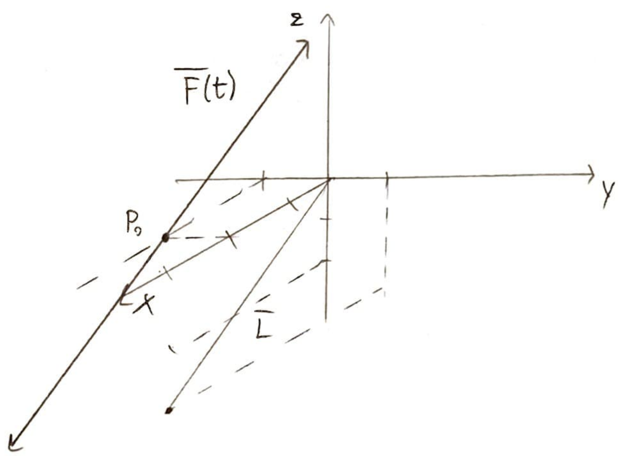
$f_3(t)$ defined $\forall t \in [0, \infty)$

$\therefore \bar{F}(t)$ defined $\forall t \in [\emptyset, 3)$

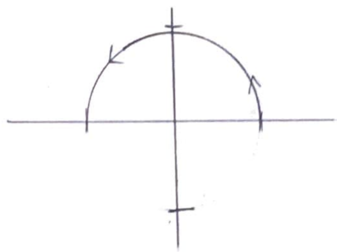
Ex. 2 Sketch the curve of $\bar{F}(t) = \langle 2+3t, -1+t, -2t \rangle$

$x(t) = 2+3t \qquad y(t) = -1+t \qquad z(t) = -2t$

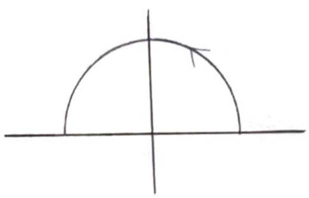
This is the equation of a line with $P_0 = (2, -1, \emptyset)$ + $\bar{L} = \langle 3, 1, -2 \rangle$



Ex. 3 $\bar{r}(t) = \langle \cos(t), \sin(t), 0 \rangle \quad t \in [0, \pi]$

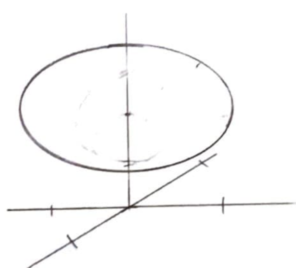


Ex. 4 $\bar{r}(t) = \langle \cos(2t), \sin(2t) \rangle \quad t \in [0, \pi/2]$

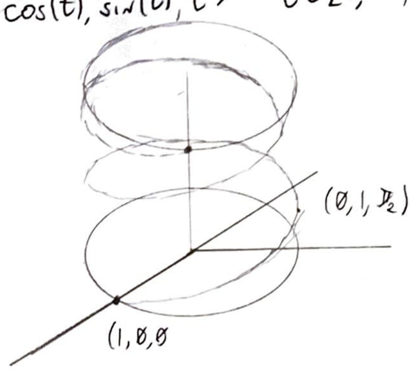


same curve different $\bar{r}(t)$

Ex. 5 $\bar{r}(t) = \langle \cos(t), \sin(t), 2 \rangle \quad t \in [0, 2\pi]$



Ex. 6 $\bar{r}(t) = \langle \cos(t), \sin(t), t \rangle \quad t \in [0, \infty)$



Ex. 7 $\bar{r}(t) = \langle (4 + \sin(20t)) \cos(t), (4 + \sin(20t)) \sin(t), \cos(20t) \rangle$

Yeah idk fam.

Sometimes we need computers. This is a toroidal spiral. Hella neat!