"vector calculus" = calculus of spacecurves

vectorvalued function of onevariable:

$\vec{F}(t) = \langle F_1(t), F_2(t), F_3(t) \rangle$ domain = intersection of domains of component functions.

visualize (range) image as a curve in space: $\vec{r} = \vec{F}(t)$

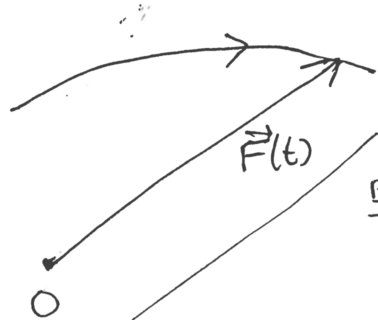
$\langle x, y, z \rangle = \langle F_1(t), F_2(t), F_3(t) \rangle$

$\hookrightarrow x = F_1(t),\ y = F_2(t),\ z = F_3(t)$

$\downarrow$

Sometimes $\vec{r}(t) = \langle x(t), y(t), z(t) \rangle$ no named function

$\vec{r} =$



EX. $\vec{r} = \langle t, t^2, t^3 \rangle$ "twisted cubic"

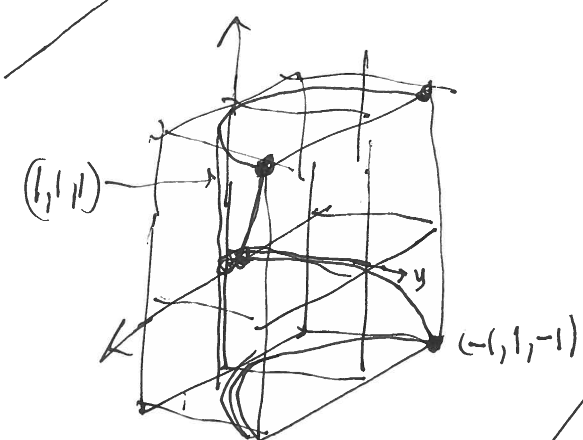
$-1 \le t \le 1$ curve segment.

$\updownarrow$

$x = t,\ y = t^2,\ z = t^3$

≥ 0

$= x^2 \quad = x^3$



curves result from intersection of 2 surfaces

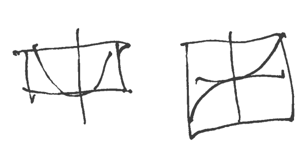
like 2 planes → line

extend up

intersection of $y = x^2$ "generalized" cylinders

$z = x^3$

extend curve in y direction

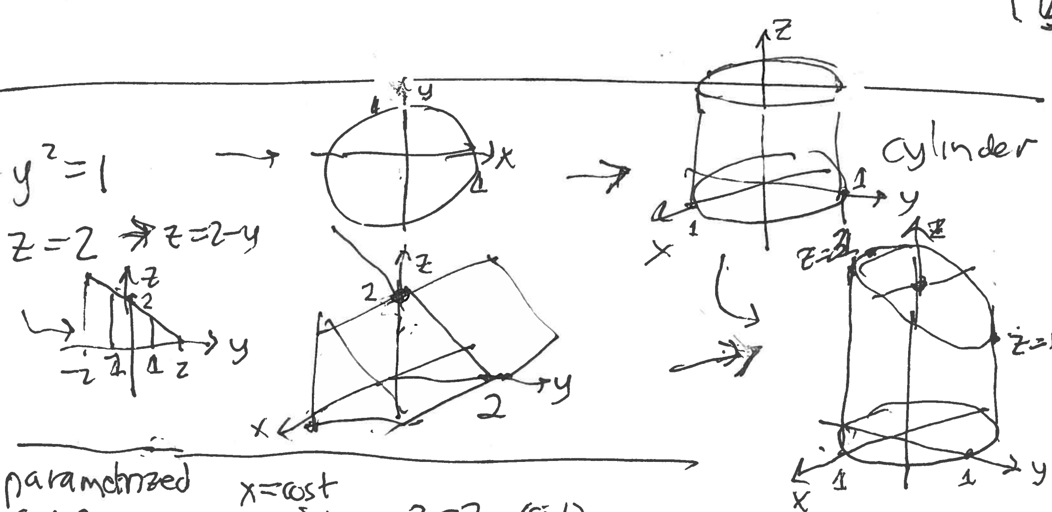


$x = t$

$z = t^3 \rightarrow t = z^{1/3} \rightarrow y = z^{2/3}$ also surface contains curve.

= intersection of any 2 of 3 surfaces $\begin{cases} y = x^2 \\ z = x^3 \\ y = z^{2/3} \end{cases}$

EX. intersection $\begin{cases} x^2 + y^2 = 1 \\ y + z = 2 \rightarrow z = 2 - y \end{cases}$



paramtrized curve $x = \cos t$

$y = \sin t \rightarrow z = 2 - (\sin t)$