12 January 2024 16:59

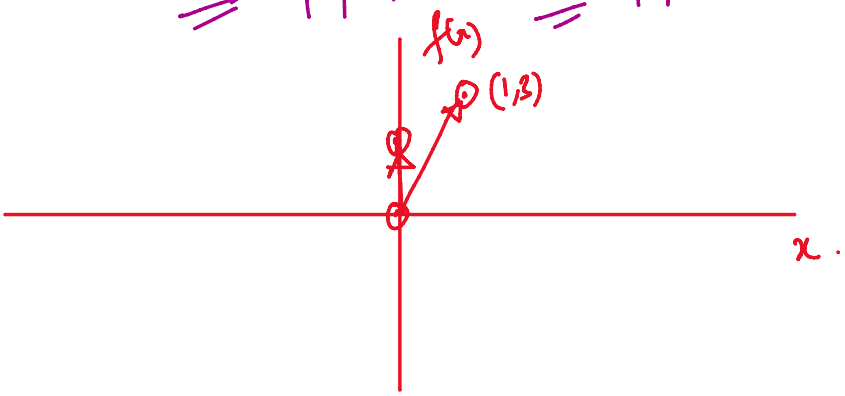
functions: $f(x) = x^2 + x + 1$ — independent variable

$f(x,y) = x^2 + xy + y^2$

vector function: $\vec{r} = \langle [f(x)]^2 + [f(x)] + 1 \rangle$ — function

$\vec{r} = \langle x^2 + x + 1 \rangle$ $\quad f(x) = x$

$x=0$ $|\vec{r}| = 1$ $\quad x=1$ $|\vec{r}| = 3$ $\quad x=2$ $|\vec{r}| = 7$



$f(x) = x$

Example 1 Determine the domain of the following function.

$$\vec{r}(t) = \langle \cos t, \ln(4-t), \sqrt{t+1} \rangle$$

$\sqrt{x}$ ↓ $x \geq 0$.

$\log x$ ↓ $x \in (0, \infty)$

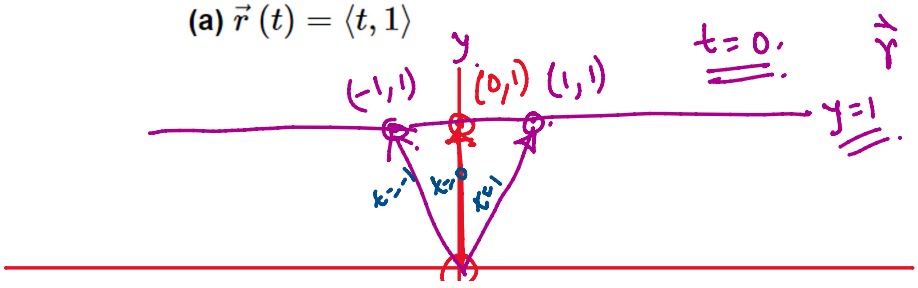
$4 - t > 0$; $t < 4$

$\cos t$ ↓ $(-\infty, \infty)$ $\quad \ln(4-t)$ ↓ $t < 4$ $\quad \sqrt{t+1}$ ↓ $t \geq -1$

$-1 \leq t < 4$

Example 2 Sketch the graph of each of the following vector functions.

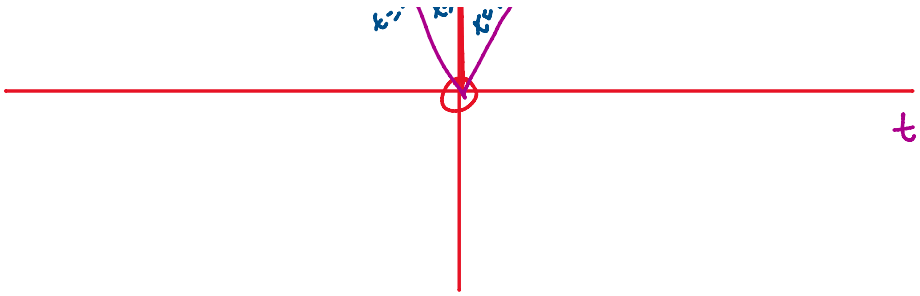
(a) $\vec{r}(t) = \langle t, 1 \rangle$



$t = 0$. $\quad \vec{r} = \langle 0, 1 \rangle$

$t = 1$ $\quad \vec{r} = \langle 1, 1 \rangle$

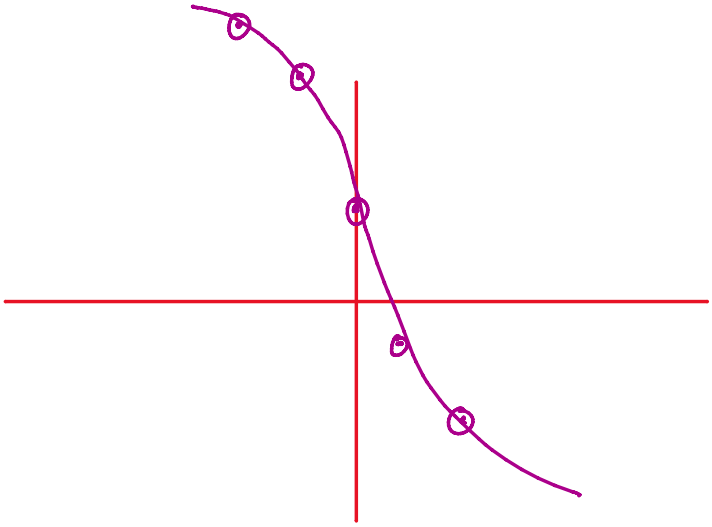
$t = -1$ $\quad \vec{r} = \langle -1, 1 \rangle$



$t=-1 \quad \vec{r} = \langle -1, 1 \rangle$

(b) $\vec{r}\,(t) = \langle t, t^3 - 10t + 7 \rangle$

$-8 + 20 + 7$

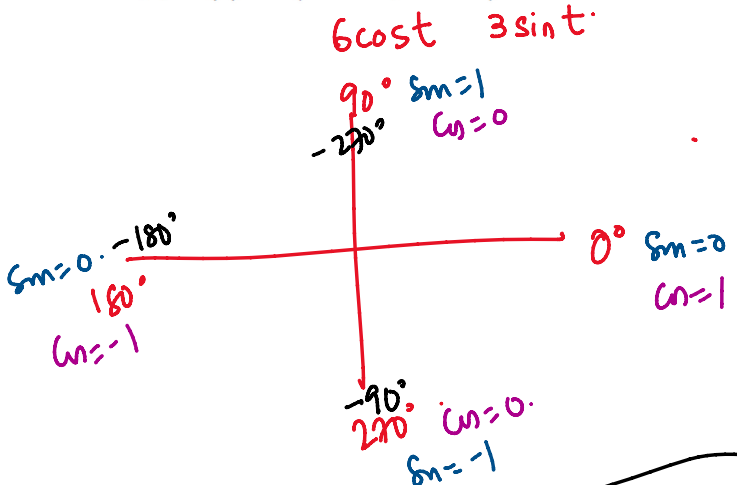


t	$\vec{r}$
-2	$\langle -2, 19 \rangle$
-1	$\langle -1, 16 \rangle$
0	$\langle 0, 7 \rangle$
1	$\langle 1, -2 \rangle$
2	$\langle 2, -5 \rangle$

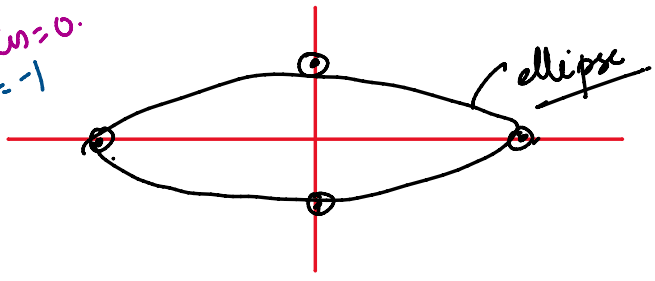
$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \quad x = a\cos\theta \quad y = b\sin\theta$

(a) $\vec{r}\,(t) = \langle 6\cos t, 3\sin t \rangle$

$6\cos t \quad 3\sin t$

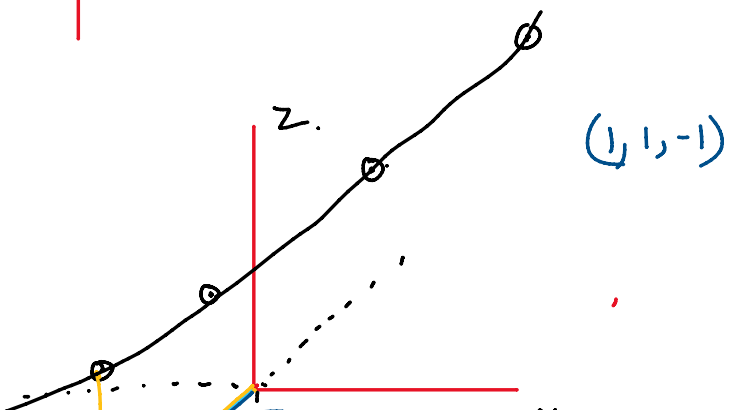


t	$\vec{r}$
$-\pi$	$\langle -6, 0 \rangle$
$-\pi/2$	$\langle 0, -3 \rangle$
0	$\langle 6, 0 \rangle$
$\pi/2$	$\langle 0, 3 \rangle$
π	$\langle -6, 0 \rangle$



$\vec{r}\,(t) = \langle 2 - 4t, -1 + 5t, 3 + t \rangle$

t	$\vec{r}$ (x, y, z)
-2	$\langle 10, -11, 1 \rangle$
-1	$\langle 6, -6, 2 \rangle$
0	$\langle 2, -1, 3 \rangle$

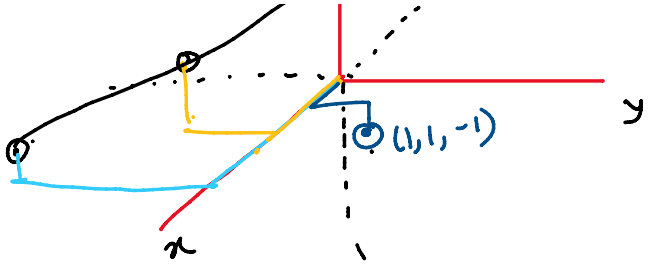


-1

0 $\langle 2, -1, 3 \cdot \rangle$

1 $\langle -2, 4, 4 \rangle$

2 $\langle -6, 9, 5 \cdot \rangle$



Standard 2D shapes.

circle, triangle, quadrilaterals, Polygons, ellipse, parabola, hyperbola.

$\cos^2\theta + \sin^2\theta = 1$

$\left(\frac{x}{r}\right)^2 + \left(\frac{y}{r}\right)^2 = 1$

$\frac{x^2}{r^2} + \frac{y^2}{r^2} = 1$

$x^2 + y^2 = r^2$

$x^2 + y^2 = r^2$ circle with center $(0,0)$ and radius $= r$.

$r\cos\theta, r\sin\theta$.

x, y.

$x = r\cos\theta \quad y = r\sin\theta$

$\frac{x}{r} = \cos\theta \quad \frac{y}{r} = \sin\theta$.

$a\cos\theta, b\sin\theta$.

x, y.

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ ellipse

$at^2, 2at$

$x \quad y$.

$x = at^2 \quad y = 2at$.

$\frac{x}{a} = \left(\frac{y}{2a}\right)^2$

$y^2 = 4ax \rightarrow$ parabola