·3 § 13.1 #s 1–4, 7, 8, 11, 12, 15–17, 21–26

#s 1, 2 Find the domain

$\vec{r}(t) = \langle \sqrt{9-t^2},\ e^{-3t},\ \ln(t+1) \rangle$

Need $9 - t^2 \geq 0$

$-t^2 \geq -9$

$t^2 \leq 9$

$t^2 - 9 \leq 0$

$(t-3)(t+3) \leq 0$

+ − +

N Y N

-3 3

$=0$ $=0$

Y Y

$[-3, 3]$

$t + 1 > 0$

$t > -1$

$(-1, \infty)$

$[-3, 3] \cap (-1, \infty)$ AND

AND

N N Y

-3 -1 3

N N Y

$= \boxed{(-1, 3] = \mathcal{D}}$

→ §13.1 #s 2-4, 7, 8, 11, 12, 15-17, 21-26

(2) $\vec{r}(t) = \left\langle \frac{t-2}{t+2}, \sin t, \ln(9-t^2) \right\rangle$

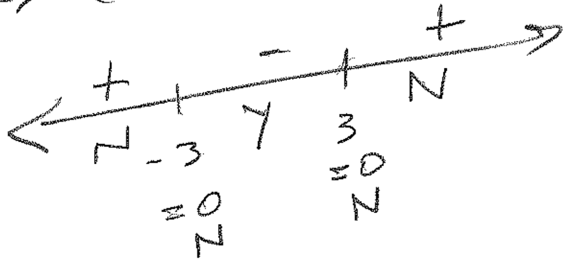
Need

$t+2 \neq 0$ and $9-t^2 > 0$

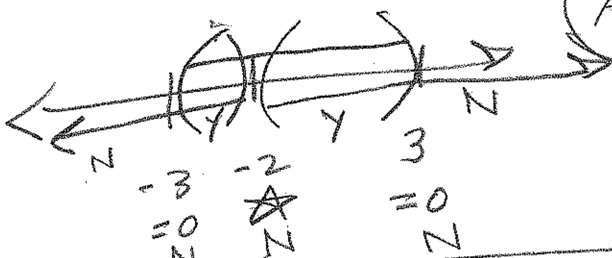
$\Rightarrow t^2 - 9 < 0$

$t \neq -2$

$\Rightarrow (t-3)(t+3) < 0$



AND



$\left((-\infty,-2)\cup(-2,\infty)\right)\cap(-3,3)$

$\boxed{(-3,-2)\cup(2,3) = D}$

(3) $\lim_{t\to 0} \left\langle e^{-3t}, \frac{t^2}{\sin^2 t}, \cos(2t) \right\rangle$

$= \left\langle \lim_{t\to 0} e^{-3t}, \left(\lim_{t\to 0} \frac{t}{\sin t}\right)^2, \lim_{t\to 0} \cos(2t) \right\rangle$

$= \langle e^{-0}, 1^2, 1 \rangle = \boxed{\langle 1, 1, 1 \rangle}$

.03 §13.1 #s 4, 7, 8, 11, 12, 15–17, 21–26

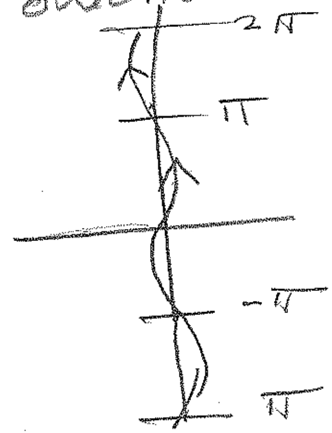
(4) $\lim_{t\to 1} \left\langle \frac{t^2-t}{t-1}, \sqrt{t+8}, \frac{\sin(\pi t)}{\ln t} \right\rangle \longrightarrow \frac{0}{0}$ L'H

$$= \left\langle \lim_{t\to 1} \frac{t(t-1)}{t-1}, \sqrt{1+8}, \lim_{t\to 1} \frac{\pi \cos(\pi t)}{\frac{1}{t}} \right\rangle$$

$$= \left\langle \lim_{t\to 1} t, \sqrt{9}, \frac{\pi}{1} \right\rangle = \boxed{\langle 1, 3, \pi \rangle}$$

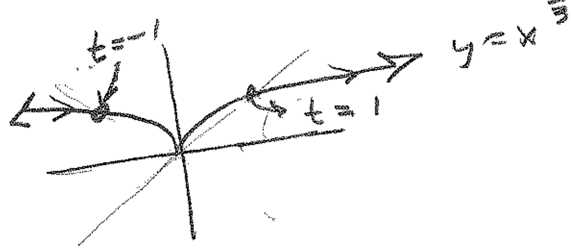
#s 7–14 Sketch the curve w/ given vector eq'n. Indicate direction of increasing t.

(7) $\vec{r}(t) = \langle \sin t, t \rangle$



(8) $\vec{r}(t) = \langle t^3, t^2 \rangle$

$x = t^3 \Rightarrow t = \sqrt[3]{x} \rightarrow y = t^2 = x^{\frac{2}{3}}$



203 §13.1 #s 11, 12, 15-17, 21-26

(11) $\bar{r}(t) = \langle 1, \cos t, 2\sin t \rangle$

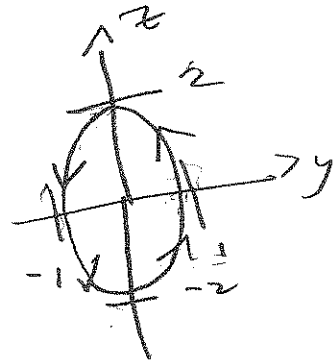
In plane $x=1$, we have

$$\cos^2 t + \frac{4\sin^2 t}{4} = 1$$

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

$$y^2 + \frac{z^2}{4} = 1$$

ellipse



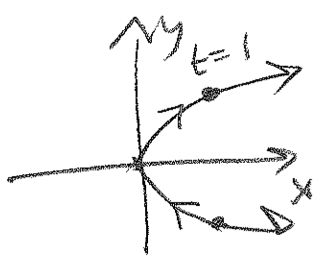
(12) $\bar{r}(t) = \langle t^2, t, 2 \rangle$

In the plane $z=2$

$y = t$

$y^2 = t^2 = x$

$x = y^2$

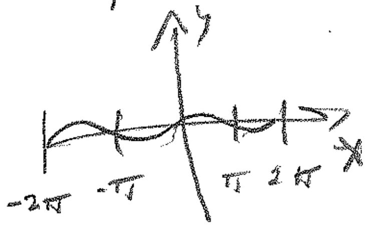


#s 15, 16 Draw projections of the curve on the coordinate planes. Use 'em to help sketch the curve

3 §13.1 #s 15–17, 21–26

15 $\bar{r}(t) = \langle t, \sin t, 2\cos t \rangle$

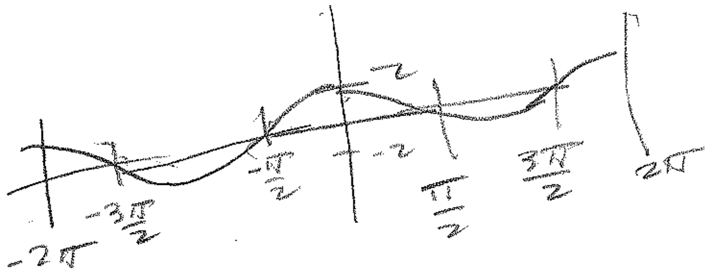
xy-plane, $z=0$



$y = \sin x$

xz-plane

$z = 2\cos x$



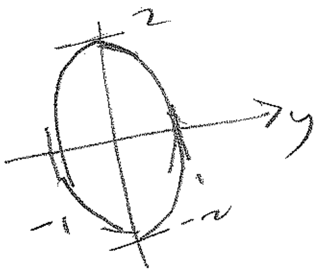
yz-plane

$y = \sin t \quad z = 2\cos t$

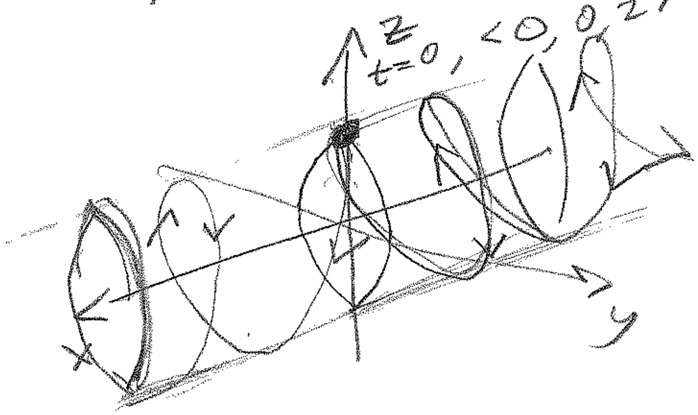
$\frac{z}{2} = \cos t$

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

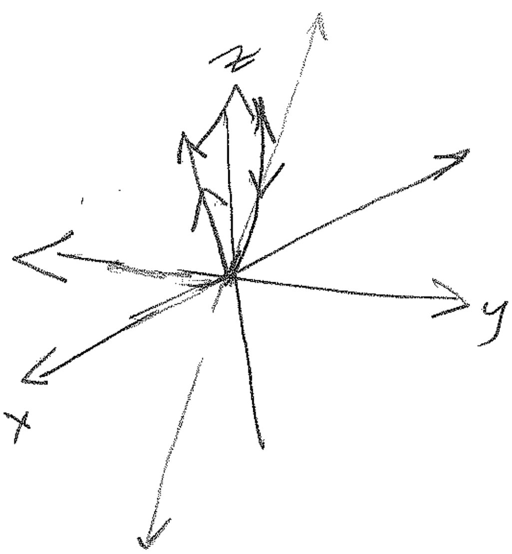
$y^2 + \frac{z^2}{4} = 1$



So, it lives on the cylinder $y^2 + \frac{z^2}{4} = 1$



16 $\langle t, t, t^2 \rangle$



parabola living over $y = x$

3 §13.1 #s: 17, 21-26

17 Find vector eq'n & parametric eq'ns for line segment from P to Q

P(2,0,0), Q(6,2,-2)

$\vec{r}(0) = P$

$\vec{r}(1) = Q$

$\vec{r}(t) = (1-t)\langle 2,0,0\rangle + t\langle 6,2,-2\rangle$

OR $\langle 2,0,0\rangle - \langle 2t,0,0\rangle + \langle 6t,2t,-2t\rangle$

$= \langle 2-2t+6t, 2t, -2t\rangle$ +4t

$$\boxed{= \langle 2+4t, 2t, -2t\rangle = \vec{r}(t) \quad x = 4t+2,\ y = 2t,\ z = -2t}$$

#s 21-26 Matching