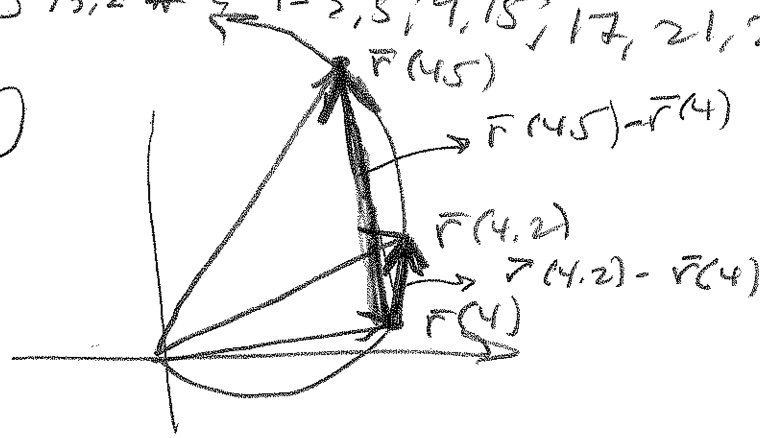
§13.2 # 1-3, 5, 9, 15, 17, 21, 23

(1)



(a) $\bar r(4.5)-\bar r(4)$

$\bar r(4.2)-\bar r(4)$

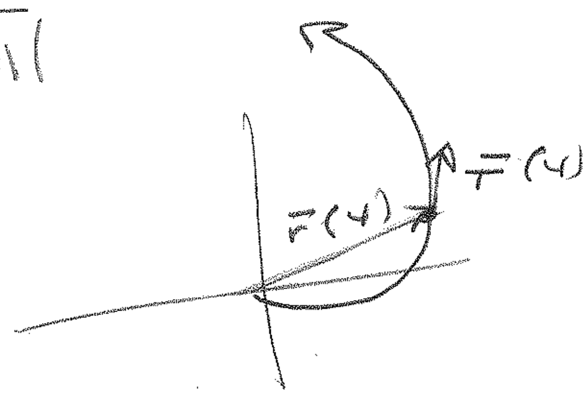
(b) $\dfrac{\bar r(4.5)-\bar r(4)}{.5}$ is in same direction as $\bar r(4.5)-\bar r(4)$, but twice as long.

$\dfrac{\bar r(4.2)-\bar r(4)}{.2}$ is in same direction as $\bar r(4.2)$ but 5 times as long as $\bar r(4.2)-\bar r(4)$

(c) $\bar r'(4)=\lim\limits_{h\to 0}\dfrac{\bar r(4+h)-\bar r(4)}{h}$

$\bar T(4)=\dfrac{\bar r'(4)}{|\bar r'(4)|}$

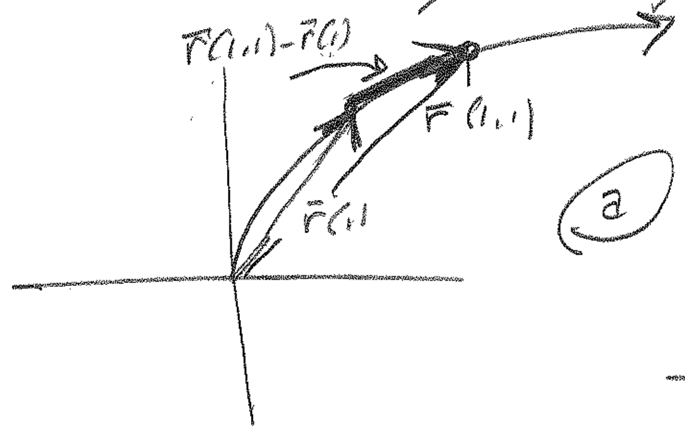
(d) Draw $\bar T(4)$



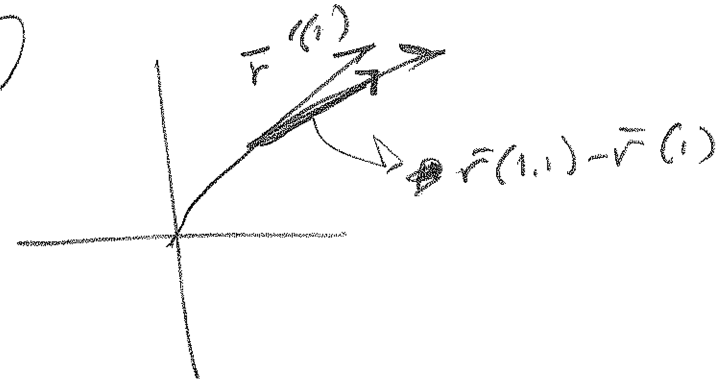
→ §13.2 #s 2, 3, 5, 9, 15, 17, 21, 23

(2) Sketch $\bar{r}(t) = \langle t^2, t \rangle$, $0 \le t \le 2$ &

draw $\bar{r}(1)$, $\bar{r}(1.1)$, $\bar{r}(1.1) - \bar{r}(1)$



(a)



(b) $\bar{r}'(1) \approx \dfrac{\bar{r}(1.1) - \bar{r}(1)}{.1}$ because

$\lim\limits_{h \to 0} \dfrac{\bar{r}(1+h) - \bar{r}(1)}{h}$ exists!

So, h = small $\Rightarrow \bar{r}'(1) \approx \dfrac{\bar{r}(1.1) - \bar{r}(1)}{.1}$

since .1 ≈ small.

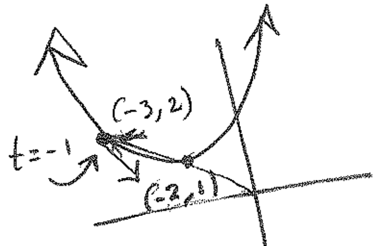
(3) (a) Sketch $\bar{r}(t) = \langle t-2, t^2+1 \rangle$

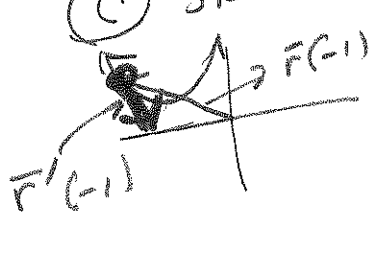
$x = t - 2$

$t = x + 2 \Rightarrow y = (x+2)^2 + 1$

(b) $\bar{r}'(t) = \langle 1, 2t \rangle$

(c) Sketch $\bar{r}(t)$ & $\bar{r}'(t)$ @ $t = -1$





2 S 13.2 #s 5, 9, 15, 17, 21, 23

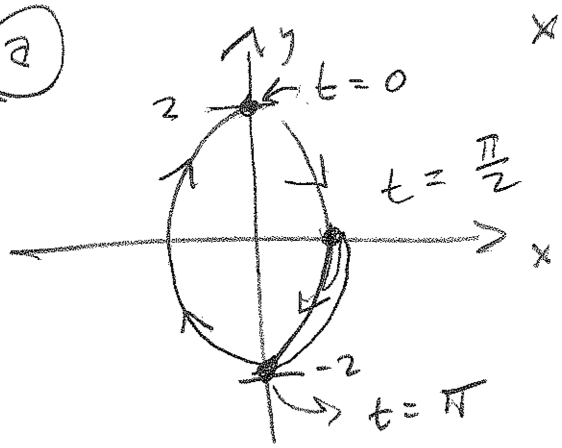
5 (a) Sketch $\bar{r}$

(b) Find $\bar{r}'$ $\qquad \bar{r}(t) = \langle \sin t, 2\cos t \rangle$

(c) sketch $\bar{r}(\frac{\pi}{4})$, $\bar{r}'(\frac{\pi}{4})$

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

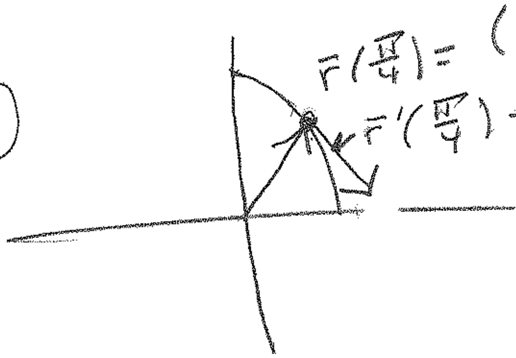
(a)



(b) $\bar{r}'(t) = \langle \cos t, -2\sin t \rangle$

$\bar{r}(\frac{\pi}{4}) = \left(\frac{1}{\sqrt{2}}, \frac{2}{\sqrt{2}}\right) = \langle \frac{1}{\sqrt{2}}, \frac{2}{\sqrt{2}} \rangle$

(c) $\bar{r}'(\frac{\pi}{4}) = \left(\frac{1}{\sqrt{2}}, -\frac{2}{\sqrt{2}}\right)$



9 Find $\bar{r}'$: $\bar{r}(t) = \langle t\sin t, t^2, t\cos(2t) \rangle$

DON'T SAVE TIME PULLING OUT t. $\Longrightarrow \bar{r}'(t) =$

$= t \langle \sin t, t, \cos(2t) \rangle$

$\langle \sin t, t, \cos(2t) \rangle + t \langle \cos t, 1, -2\sin(2t) \rangle$

$= \boxed{\langle \sin t + t\cos t, 2t, \cos(2t) - 2\sin(2t) \rangle}$

§13.2 #s 15, 17, 21, 23

(15) $\bar{r}(t) = c + tb + t^2 c$?

$\Rightarrow$ $\boxed{\bar{r}'(t) = b + 2tc}$

(17) Find $\bar{T}(0)$

$\bar{r}(t) = \langle te^{-t}, 2\arctan t, 2e^{t} \rangle$

$$\boxed{\bar{r}'(t) = \langle e^{-t} - te^{-t}, \frac{2}{t^2+1}, 2e^{t} \rangle}$$

$\bar{r}'(0) = \langle 1, 2, 2 \rangle$

$|\bar{r}'(0)| = \sqrt{1+4+4} = \sqrt{9} = 3 \Rightarrow$

$$\boxed{\bar{T}(0) = \langle \frac{1}{3}, \frac{2}{3}, \frac{2}{3} \rangle}$$

(21) Find $\bar{r}'$, $\bar{T}(1)$, r'', $r' \times r''$

$\bar{r} = \langle t, t^2, t^3 \rangle \Rightarrow$

$\bar{r}' = \langle 1, 2t, 3t^2 \rangle \Rightarrow$

$\bar{r}'' = \langle 0, 2, 6t \rangle$

$\left.\begin{array}{l} \bar{r}'(1) = \langle 1, 2, 3 \rangle \\ |\bar{r}'(1)| = \sqrt{1+4+9} \\ = \sqrt{14} \end{array}\right\} \Rightarrow \boxed{\bar{T}(1) = \frac{1}{\sqrt{14}} \langle 1, 2, 3 \rangle}$

§13.4 #5 ...

(21) cont'd

$\bar{r}'' = \langle 0, 0, 6 \rangle \longrightarrow$

$\bar{r}' \times \bar{r}''$:

$\langle 1, 2t, 3t^2 \rangle$

$\times \langle 0, 2, 6t \rangle$

$\boxed{\bar{r}' \times \bar{r}'' = \langle 6t^2, -6t, 2 \rangle}$

(23) Find parametric eq'ns for tangent line to curve @ $t=1$

$\bar{r} = \langle 1 + 2\sqrt{t}, t^3 - t, t^3 + t \rangle$

$\bar{r}(1) = \langle 3, 0, 2 \rangle$ = initial vector

$\bar{r}'(t) = \langle \frac{1}{\sqrt{t}}, 3t^2 - 1, 3t^2 + 1 \rangle$

$\bar{r}'(1) = \langle 1, 2, 4 \rangle$ = direction vec

$$\boxed{\begin{aligned} x &= 3 + t \\ y &= 2t \\ z &= 2 + 4t \end{aligned}}$$