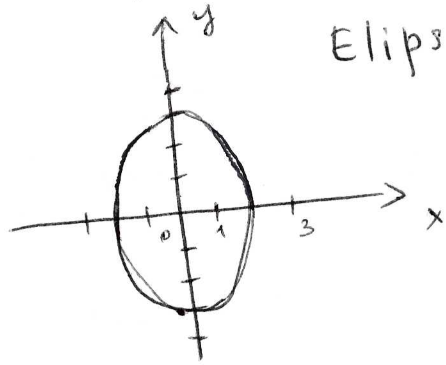
Section 12.2 #86

Solution keys
Hw √ 4

(a) Elipse



(b) $r'(t) = -2\sin t\, i + 3\cos t\, j$

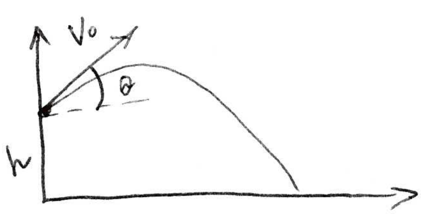
$r''(t) = -2\cos t\, i - 3\sin t\, j$

$\|r'(t)\| = \sqrt{4\sin^2(t) + 9\cos^2(t)}$

Min of $\|r'(t)\|$ is 2 $(t = \pi/2)$

Max of $\|r'(t)\|$ is 3, $(t = 0)$

Section 12.3 #56



$r(t) = (V_0 \cos\theta)t\, i + [h + (V_0 \sin\theta)t - 16t^2]j$

$y(t) = h + V_0 \sin\theta\, t - 16t^2$

$0 = 6 + 45\sin\theta\, t - 16t^2$

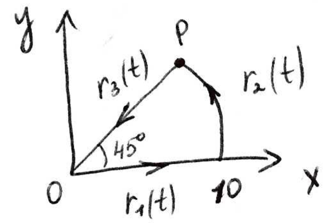
$\boxed{t \approx 2.08 \text{ sec}}$ – total time

$x(t) = (V_0 \cos\theta)t$

$\boxed{x(2.08) = 69.02 \text{ ft}}$ – horizontal distance travel

2

Section 12.1 # 58



Let's consider

$r_1(t)$ is a straight line without j comp.

$r_2(t)$ - part of the circle $[0, \pi/4]$

$r_3(t)$ - line from point P to (0,0)

$x^2+y^2=100$, then $x = 10\cos 45° = 5\sqrt{2}$

$y = 10 \sin 45° = 5\sqrt{2}$

Then: $r_1(t) = ti$, $0 \le t \le 10$ $(r_1(0)=0,\ r_1(10)=10i)$

$r_2(t) = 10(\cos t\, i + \sin t\, j)$,

$0 \le t \le \frac{\pi}{4}$ $\left(r_2(0)=10i,\ r_2\left(\frac{\pi}{4}\right)=5\sqrt{2}i+5\sqrt{2}j\right)$

$r_3(t) = 5\sqrt{2}(1-t)i + 5\sqrt{2}(1-t)j$

$0 \le t \le 1$ $(r_3(0) = 5\sqrt{2}i + 5\sqrt{2}j,\ r_3(1)=0)$

Section 12.1 # 90

$r(t) = ti + t^2 j + t^3 k$

$u(s) = (-2s+3)i + 8s\,j + (12s+2)k$

Equating components:

$\left.\begin{aligned} t &= -2s+3 \\ t^2 &= 8s \\ t^3 &= 12s+2 \end{aligned}\right\}$ $s = \frac{1}{2}$, $s = \frac{9}{2}$

$\boxed{\text{for } s=\frac{1}{2},\ t=-2\left(\frac{1}{2}\right)+3=2}$

for $s=\frac{9}{2}$, $t=-2\left(\frac{9}{2}\right)+3=-6$

$t^2 = 8\left(\frac{9}{2}\right)=36$

$t^3 = 12\left(\frac{9}{2}\right)=54$

So a collision is impossible, because the path intersect at (2, 4, 8) but at different time: $t=2$ and $s=\frac{1}{2}$.

Section 12.1 #91

No, not necessary. See # 90

Section 12.1 # 92

yes