section 3.7 pg 171 # 1, 15, 41, 43, 51, 59, 73, 75, 77

① $f(x) = 3\sin^2 x = 3(\sin x)^2$

$f'(x) = 6\sin x \cos x$

⑮ $f(x) = \cos 2x \sin 2x$

$f'(x) = -\sin 2x \sin 2x\,(2) + \cos 2x \cos 2x\,(2)$

$= -2\sin^2 2x + 2\cos^2 2x$

(41) $x = \tan(t^7)$

$\frac{dx}{dt} = [\sec^2(t^7)\,](7t^6)$

(43) $x = (\tan t)^7$

$\frac{dx}{dt} = 7(\tan t)^6 \sec^2 t$

(51) $x = \frac{\sec 5t}{\tan 3t} = \frac{1}{\cos 5t \tan 3t}$

$\frac{dx}{dt} = \frac{-1}{(\cos 5t \tan 3t)^2} \cdot [-5\sin 5t \tan 3t + \cos 5t \sec^2 3t\,]$

(59) $x = \sqrt{1+\cos 5t}$

$\frac{dx}{dt} = \frac{1}{2} \cdot \frac{1}{\sqrt{1+\cos 5t}} \cdot (-5\sin 5t) = \frac{-5\sin 5t}{2\sqrt{1+\cos 5t}}$

(73) $R = \frac{1}{16} V_0^2 \sin\alpha \cos\alpha$ maximize R $\quad 0 \le \alpha \le 2\pi$

$R' = \frac{1}{16} V_0^2 [\cos\alpha \cos\alpha + \sin\alpha(-\sin\alpha)]$

$\frac{1}{16} V_0^2 (\cos^2\alpha - \sin^2\alpha) = 0$

$\cos^2\alpha - \sin^2\alpha = 0$

$1 - \sin^2\alpha - \sin^2\alpha = 0$

$1 = 2\sin^2\alpha$

$\sin\alpha = \frac{\sqrt{2}}{2}$

so $\alpha = \pi/4$ or $3\pi/4$

$R(0) = \frac{1}{16} V_0^2 \sin 0 \cos 0 = 0$

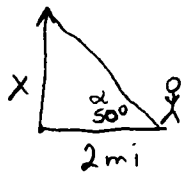
$R(2\pi) = \frac{1}{16} V_0^2 \sin 2\pi \cos 2\pi = 0$

$R(\pi/4) = \frac{1}{16} V_0^2 \sin\pi/4 \cos\pi/4 = \frac{1}{16} V_0^2 \left(\frac{\sqrt{2}}{2}\right)^2$ ← maximum

$= \frac{1}{16} V_0^2 \left(\frac{2}{4}\right) = \frac{V_0^2}{32}$

$R(3\pi/4) = -\frac{V_0^2}{32}$

(75)



increasing $5°/\text{sec} = d\alpha/dt$

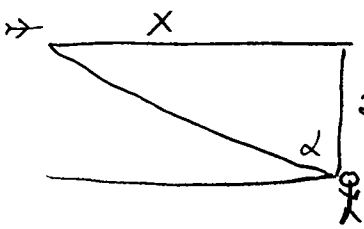
$\sin\alpha = \frac{x}{2}$ $\quad t = \#\text{ secs}$

$$\frac{dx}{dt} = \frac{dx}{d\alpha} \cdot \frac{d\alpha}{dt} = (2\cos\alpha)(5) = 10\cos\alpha$$

when $\alpha = 50°$,

$$\frac{dx}{dt} = 10\cos 50$$

(77)



$\frac{d\alpha}{dt} = .5°/\text{sec}$

$\tan\alpha = \frac{x}{20000}$ $\quad x = 20000\tan\alpha.$

$\frac{dx}{dt}$ is speed of plane

$$\frac{dx}{dt} = \frac{dx}{d\alpha}\frac{d\alpha}{dt} = (20000\sec^2\alpha)(.5)$$

$$= 10000\sec^2\alpha$$

when $\alpha = 60°$,

$$\frac{dx}{dt} = 10000\sec^2 60° \text{ ft/sec}$$