3.4

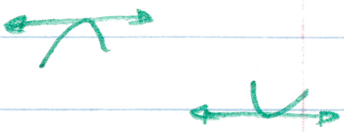
(5) $t = 1.0$ $\quad (1.5, 44)$ $\quad \frac{44-26}{1.5-.5} = \frac{18}{1} = 18 \text{ ft/sec}$

$(.5, 26)$

(13) $s = 24t - .8t^2$ (a)

$v = \frac{ds}{dt} = 24 - 1.6t$

$a = \frac{dv}{dt} = -1.6$



(b) $24 - 1.6t = 0$

$\frac{24}{1.6} = \frac{1.6t}{1.6}$

$\boxed{15s = t}$

(c) $s(15) = 24(15) - .8(15)^2$

$= 180m$

(d) $90 = 24t - .8t^2$

$4.393 \text{ sec.} = t$

(e) $0 = 24t - .8t^2$

$0 = t(24 - .8t)$

$0 = 24 - .8t$

$.8t = 24$

$\boxed{t = 30 \text{ sec}}$

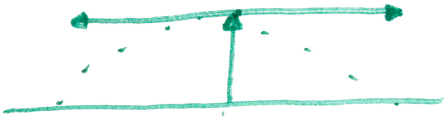
(23) $s = t^3 - 6t^2 + 9t$

$v = \frac{ds}{dt} = 3t^2 - 12t + 9 = 0$ $\quad \cancel{3}(t^2 - 4t + 3) = 0$

$a = \frac{dv}{dt} = 6t - 12$ $\quad (t-3)(t-1) = 0$

$a(3) = 6(3) - 12 = 6 \text{ m/sec}^2, \; t = 3 \text{ sec}$ $\quad t = 3 \quad t = 1$

$a(1) = 6(1) - 12 = -6 \text{ m/sec}^2 \quad t = 1 \text{ sec}$



3.4

(35) $s = v_0 t - 16t^2$

$v = \frac{ds}{dt} = v_0 \overset{+32t}{-32t} = 0^{+32t}$

$t = \boxed{\frac{v_0}{32}} = \frac{32t}{32}$

$s\left(\frac{v_0}{32}\right) = v_0\left(\frac{v_0}{32}\right) - 16\left(\frac{v_0}{32}\right)^2 = 1900$

$\frac{32}{32}\,\frac{v_0^2}{32} - \frac{16 v_0^2}{32^2} = 1900$

$\frac{32 v_0^2}{32^2} - \frac{16 v_0^2}{32^2} = 1900$

$\frac{\cancel{32^2}}{\cancel{16}}\,\sqrt{\frac{\cancel{16} v_0^2}{\cancel{32^2}}} = \sqrt{1900\,\frac{32^2}{16}}$

ONLY WANT POSITIVE ROOT (SHOOTING UP)

$v_0 = 348.712\ \text{ft/sec} \cdot \frac{1\ \text{mi}}{5280\ \text{ft}} \cdot \frac{3600\ \text{sec}}{1\ \text{hr}}$

$237.758\ \text{mi/hr}$

(27) $c(x) = 2000 + 100x - .1x^2$

(a) $c(100) = 2000 + 100(100) - .1(100)^2 = \underline{11000}$

$\frac{c(100)}{100} = \frac{11{,}000}{100} = 110$

(b) $c'(x) = 100 - .2x$

$c'(100) = 100 - .2(100) = \$80$

(c) $c(101) = 2000 + 100(101) - .1(101)^2 = 11{,}079.90$

$c(101) - c(100) = \$79.90$

3.4

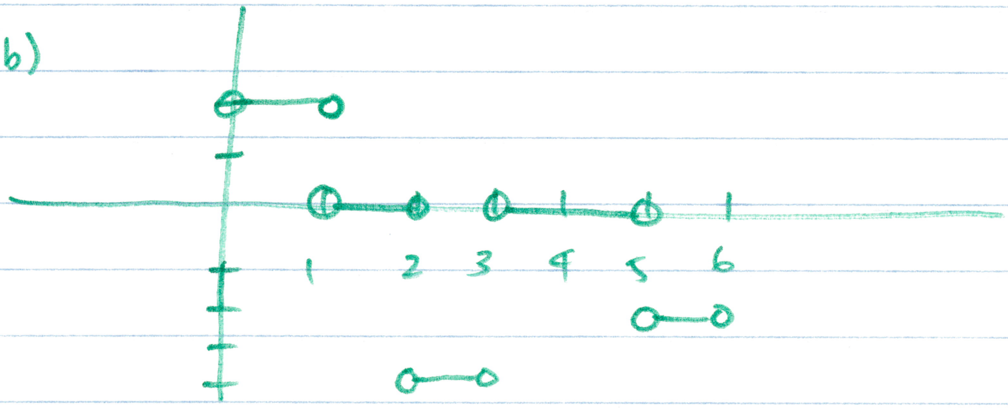
(14) Mars: $s = 1.86t^2$ Jupiter: $s = 11.44t^2$

$v = \frac{ds}{dt} = 3.72t$

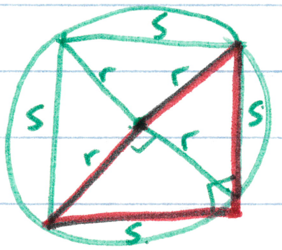
$\frac{16.6}{3.72} = \frac{\cancel{3.72}t}{\cancel{3.72}}$

$4.462 \text{ sec} = t$

(10) (b)



(4)



$s^2 + s^2 = (2r)^2$ $A = s^2$

$2s^2 = 4r^2$

$s^2 = 2r^2$ (a) $A = 2r^2$

(b) $\frac{dA}{dr} = 4r$

(c) $\frac{dA}{dr}(1) = 4(1) = 4$ $\frac{dA}{dr}(8) = 4(8) = 32$

$A'(1)$

(d) in^2/in

3.4

(27) $c(x) = 2000 + 100x - .1x^2$

(a) $\dfrac{2000 + 100(100) - .1(100)^2}{100} = \$110$ $\qquad$ $\dfrac{11{,}000}{100}$

(b) $c'(x) = 100 - .2x$

$c'(100) = 100 - .2(100) = \$80$

(c) $c(101) = 2000 + 100(101) - .1(101)^2 = 11{,}079.9$

$$\begin{array}{r} 11{,}079.9 \\ -\,11{,}000.0 \\ \hline \$79.90 \end{array}$$

(19) $s(t) = t^2 - 3t + 2$

$s(0) = 0^2 - 3(0) + 2 = 2$ $\qquad$ $s(5) = 5^2 - 3(5) + 2 = 12$

(a) DISPLACEMENT: $12 - 2 = \boxed{10 \text{ meters}}$

(b) $\dfrac{f(b) - f(a)}{b - a} = \dfrac{\text{DISPLACEMENT}}{\text{ELAPSED TIME}}$

$\dfrac{10}{5} = \boxed{2\,m/sec}$

(e) $2t - 3 = 0$

$2t = 3$

$t = \frac{3}{2}$

(c) $s'(t) = 2t - 3$

$s'(4) = 2(4) - 3 = \boxed{5\,m/sec}$

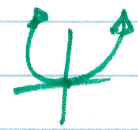
(f)

(d) $s''(t) = 2$ $\quad \boxed{2\,m/sec^2}$

3.4

(47) (a) $g(x) = x^3$ ✓ $\quad h(x) = x^3 - 2$ ✓ $\quad t(x) = x^3 + 3$ ✓

$g'(x) = 3x^2 \quad h'(x) = 3x^2 \quad t'(x) = 3x^2$

(b) 

(c) $f(x) = x^3 + c$

(d) $f'(x) = x^3$

(e) $f(x) = x^3 + 3$

$\cancel{(t-2)^2}$

$\cancel{t^2 - 4}$

(21) $s(t) = (t-2)^2(t-4)$

$= (t-2)(t-2)(t-4)$

$= (t^2 - 4t + 4)(t-4)$

$= t^3 - 4t^2 + 4t - 4t^2 + 16t - 16$

$= t^3 - 8t^2 + 20t - 16$

(a) $s'(t) = 3t^2 - 16t + 20$ velocity

(b) $s''(t) = 6t - 16$ acceleration

(c) $3t^2 - 16t + 20 = 0$ solve $2, \frac{10}{3}$

$6t - 16 = 0$

$\frac{\cancel{6}t}{\cancel{6}} = \frac{16}{6}$

$\frac{8}{3}$

$t = \frac{16}{6}$

$= \frac{8}{3}$

(d)

		2		$\frac{8}{3}$		$\frac{10}{3}$	
f'	+		−		−		+
f''	−		−		+		+

3.4

8 $Q(t) = 200(30-t)^2$

$= 200(30-t)(30-t)$

$= 200(900-30t-30t+t^2)$

$= 200(900-60t+t^2)$

$= 180{,}000 - 12000t + 200t^2$

$Q'(t) = -12000 + 400t$

$Q'(10) = -12000 + 400(10) = -8000$ gal/min

$Q(0) = 200(30-0)^2 = 180{,}000$

$Q(10) = 200(30-10)^2 = 80{,}000$

$$\frac{f(b)-f(a)}{b-a} \qquad \frac{80{,}000 - 180{,}000}{10-0} = \frac{-100{,}000 \text{ gal/min}}{10}$$

$\boxed{-10{,}000 \text{ gal/min}}$

25 $y = 6\left(1-\frac{t}{12}\right)^2 = 6\left(1-\frac{1}{12}t\right)^2$

$= 6\left(1-\frac{1}{12}t\right)\left(1-\frac{1}{12}t\right)$

$= 6\left(1-\frac{1}{12}t-\frac{1}{12}t+\frac{1}{144}t^2\right)$

$= 6\left(1-\frac{1}{6}t+\frac{1}{144}t^2\right)$ $\qquad \frac{\cancel{6}}{\cancel{144}}\ 24$

$= 6 - t + \frac{1}{24}t^2$

(a) $y' = -1 + \frac{1}{12}t$

$y'' = \frac{1}{12} > 0$