AP Physics Hwk Chap 2 Conceptual Questions (4, 5, 7, 11, 12, 13, 14)

(4) a) $v_A > v_B$
As slope is greater
b) No. Never same slope so
never same speed

(5) at $t = 1s$ $v_A > v_B$
a) greater slope
b) yes same speed at
about 3s, where
slopes are equal

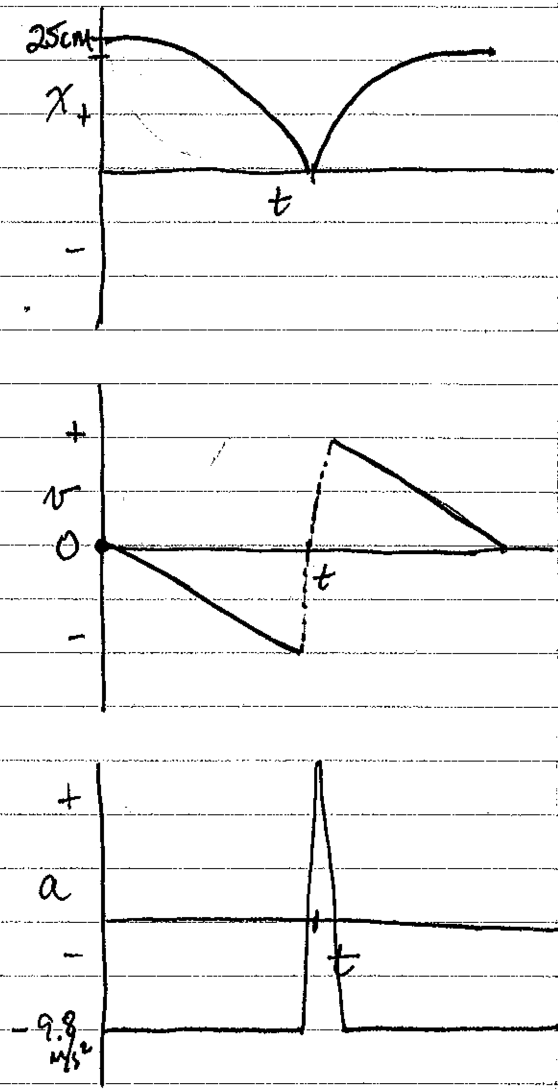
(7) a) fastest at D
b) left at C, D, & E
c) B to C
d) B

(11) a) thrown ball as it is
moving up $\uparrow +v$, $\downarrow a-$
b) ball falling down
$(-)v \downarrow$ $\downarrow(-)a$

(12) a) $= \vec{g}$
b) $= \vec{g}$
c) $= \vec{g}$
$\vec{a}$ always $\vec{g}$

(13) a) $= \vec{g}$
b) $= \vec{g}$
$\vec{a}$ always $\vec{g}$

(14)
See next column
for falling & bouncing
tennis ball



Starts
at $x_0 = +25cm$
$v_0 = 0 m/s$
$a = -9.8 m/s^2$

ends at
$x_f = < 25cm$
$v_f = 0$
$a = -9.8 m/s^2$

AP Physics Chap 2 Hwk E&P (21-23, 25^2, 26-27)

(21) $x = (2t^2 - t + 1)$ m

at $t = 2$s find x_2, v_2, a_2

a) $x_2 = [2(2^2) - 2 + 1] = 7$m

b) $\frac{dx}{dt} = v = 4t - 1$

$v_2 = 4(2) - 1 = 7$m/s

c) $\frac{dv}{dt} = a = 4$ $\quad$ 4m/s^2

(22) $v_x = (2t^2)$ m/s

$x_0 = 1$m $\quad$ at $t = 1$s

$t_0 = 0$ $\quad$ find x_1, v_1, a_1

a) $x = \int v\,dt = \int 2t^2\,dt$

$= \frac{2}{3}t^3 + C$

$= \frac{2}{3}t^3 + x_0$

$x_1 = \frac{2}{3}(1)^3 + 1$

$= 1.67$m

b) $v_x = 2t^2$

$v_1 = 2(1)^2 = 2$m/s

c) $a = \frac{dv}{dt} = 4t$

$a_1 = 4(1) = 4$m/s^2

(23) $v_0 = 8.0$m/s

area yields $(a)(t) = \Delta v$

triangle $\quad \frac{1}{2}(4\text{m/s}^2)(4\text{s}) = \Delta v$

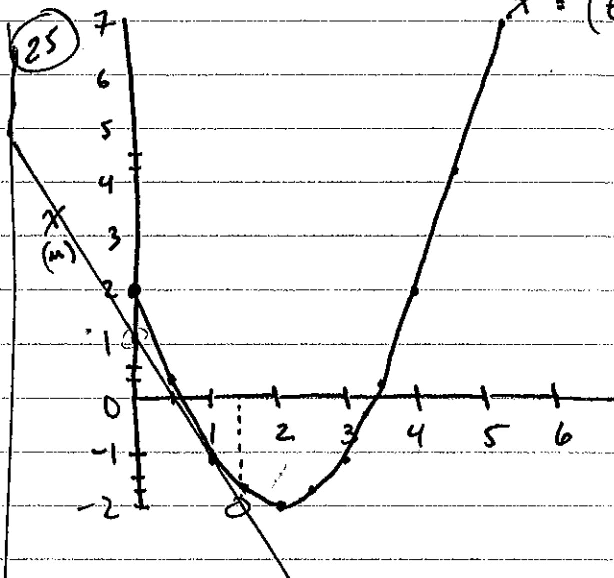
$\Delta v = +8.0$m/s

$v_f = v_0 + \Delta v$

$= 8.0$m/s $+ 8.0$m/s

$v_4 = 16$m/s

(25)



b) $\frac{\Delta y}{\Delta x}$ ~~θ~~ $= \frac{y_f - y_0}{x_f - x_0}$ $\quad \frac{-2-1}{1.5-0} = -2$ so $v_{1s} \approx -2$m/s

c) $\frac{dx}{dt} = 2t - 4 = v$

$v_1 = 2(1) - 4 = -2$m/s

the same!

d) yes, turning point at $t = 2$s

e) $v = 2t - 4$ if $v = 4$ $t = ?$

$4 = 2t - 4$

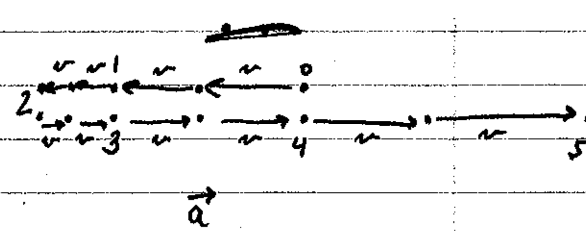
$8 = 2t$

$t = 4$s

$x = t^2 - 4t + 2$

$x_4 = +2$m

f)



(26) $v_0 = 10\,m/s$ at $t = 7.0\,s$ find v_7

Particle A $\vec{x}$ vs. t slope... at 7s

$\frac{-30 - 30\,m}{8-2\,s}$ $\frac{-60}{6}$ = $-10\,m/s = v_7$

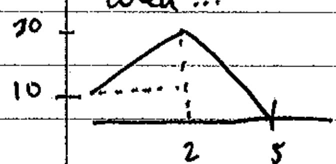
Particle B $\vec{v}$ vs t read graph

$v_7 = -20\,m/s$

Particle C $\vec{a}$ vs. t

find total Δv from t=0 to t=7s

area...

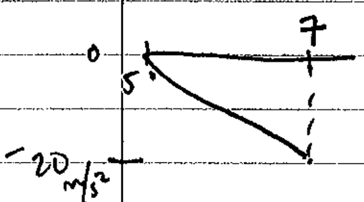


upper left Δ is $\frac{1}{2}(2s)(20\,m/s^2) = {}^{+}20\,m/s$

lower left $\square$ is $2s(10\,m/s^2) = {}^{+}20\,m/s$

right Δ is $\frac{1}{2}(3s)(30\,m/s^2) = {}^{+}45\,m/s$

$+85\,m/s$



$\frac{1}{2}(2s)(-20\,m/s^2) = {}^{-}20\,m/s$

so total $\Delta v_{0\,to\,7}$ is ${}^{+}85\,m/s + {}^{-}20\,m/s = +65\,m/s$

$v_0 = 10\,m/s\ (+65\,m/s) = v_f$

$75\,m/s$

(27) $x_0 = 0$, $t_0 = 0$

on $\vec{v}$ vs. t. graph each "box" is

$(2s)(5m) = 10m$

so to be at 35m - need 3.5 boxes

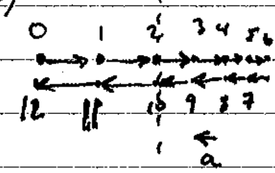
a) this occurs at $t = 4s$

also total of

4 + boxes (40m), need -.5 box to get back to 35m so this happens at

8s

b)



← turning point

AP Physics Chap 2 Hwk E&P (33-36, 42, 65) 78^B, 83^B

(33) $v_x = kt^2$

$t_0 = 0$, $x_0 = -9.0\,m$

$t_3 = 3.0\,s$, $x_3 = 9.0\,m$

$\int v\,dt = x(t)$

$\int kt^2\,dt = \frac{1}{3}kt^3 + x_0 = x(t)$

$x(t) = \frac{1}{3}kt^3 + x_0$

$x(0) = -9.0\,m$ so $x_0 = -9.0\,m$

$x(t) = \frac{1}{3}kt^3 + -9.0\,m$

$x(3) = 9.0\,m = \frac{1}{3}k(3)^3 + -9.0\,m$

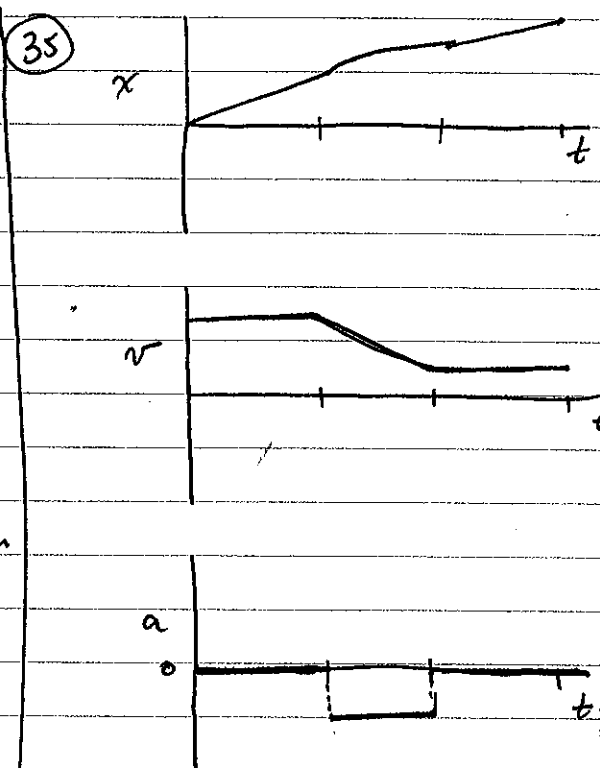
$18 = \frac{1}{3}k(27)$

$18 = 9k$

$m/s = \frac{m}{s^3}\,s^2$

$k = 2\ m/s^3$

(35)



(34) $a_x = (10 - t)\ m/s^2$

$x_0 = 0$, $v_0 = 0$, $t_0 = 0$

$v(t) = \int a\,dt$

$v(t) = \int (10 - t)\,dt$

$v(t) = 10t - \frac{1}{2}t^2 + v_0$

based on inital conditions

v_0 must be zero

$v(t) = -\frac{1}{2}t^2 + 10t$

$v(t) = (-\frac{1}{2}t + 10)t$

a) $v = 0\,m/s$ at $t = 0\,s$ & $t = 20\,s$

b) $x(t) = \int v(t)\,dt$

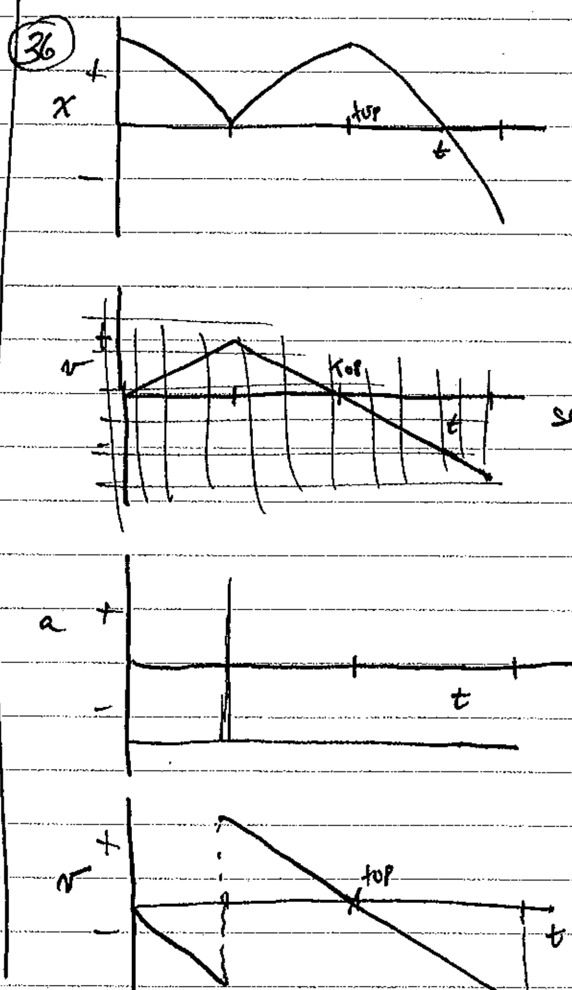
$x(t) = \int (-\frac{1}{2}t^2 + 10t)\,dt$

$x(t) = -\frac{1}{6}t^3 + 5t^2 + \cancel{x_0} \rightarrow 0$

$x(20) = -\frac{1}{6}(20)^3 + 5(20)^2$

$= 667\,m$

(36)



assumes $x_0 = 0$ at center of track

see below

	Data Set	
	Time (s)	Velocity (m/s)
1	0	0
2	2	28
3	4	46
4	6	60
5	8	70
6	10	78
7		
8		
9		
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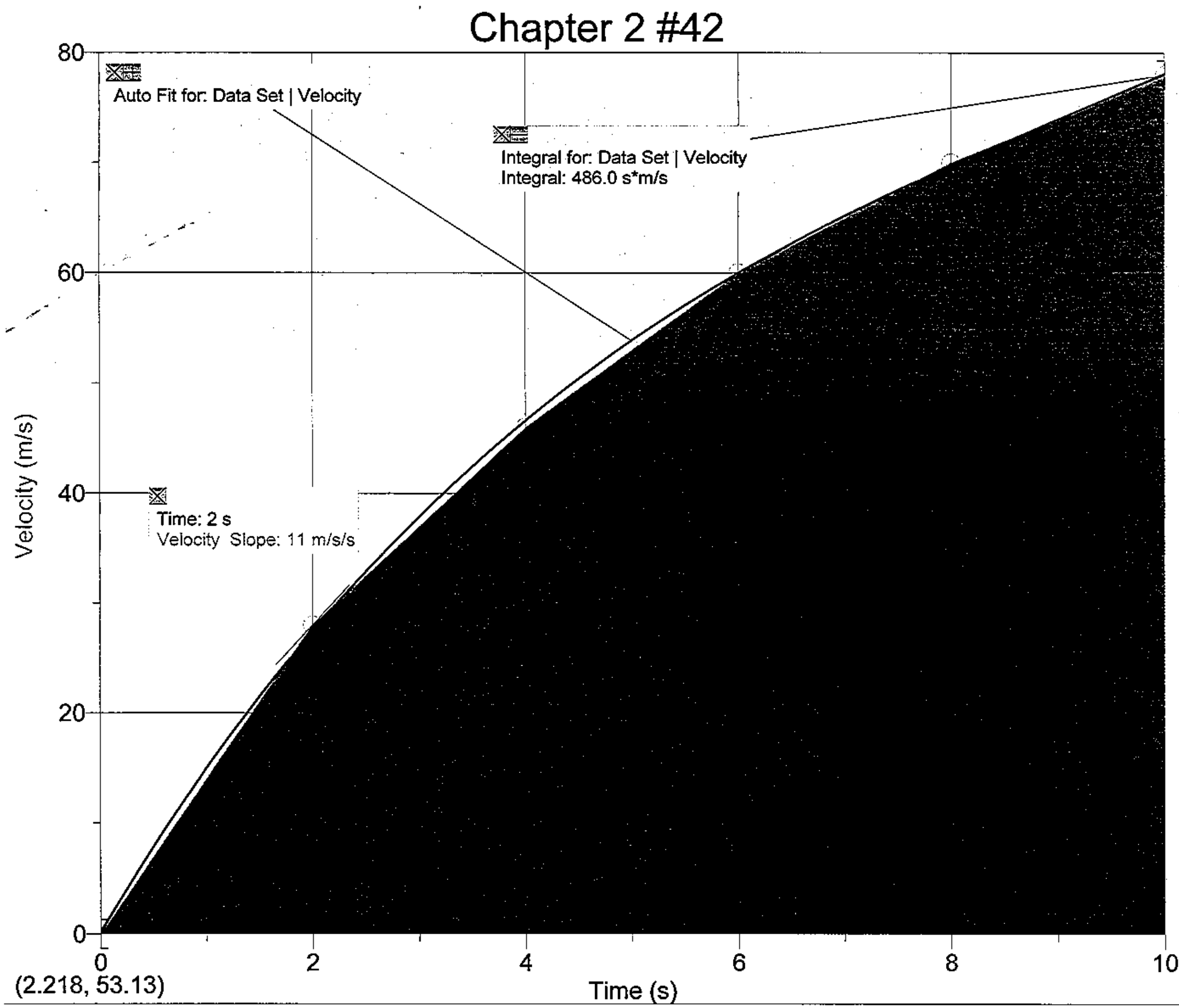

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#42

a) acceleration not constant – slope changing

b) used LoggerPro Tangent tool at 2s a = 11 m/s², at 8s a = 5 m/s²

c) used LoggerPro Integral tool distance = 486m

[redacted]

(65) $v_x^2 = \frac{2P}{m} t$

$P = 3.6 \times 10^4 \, W$

$m = 1200 kg$

$v_{10}^2 = \frac{2(3.6E4)}{1200}(10)$

a) $v_{10} = 24.5 m/s$

$v_{20} = 34.6 m/s$

$v(t) = \sqrt{\frac{2P}{m}} \, t^{1/2}$

$a = \frac{dv}{dt} = \frac{1}{2}\sqrt{\frac{2P}{m}} \, t^{-1/2}$

b) $a(t) = \frac{\sqrt{2P/M}}{2\sqrt{t}}$

c) $a_1 = 3.87 m/s^2$

$a_{10} = 1.22 m/s^2$

d) for very small values of t, accel. becomes enormously large!

e) $x(t) = \int v \, dt$

$x(t) = \int \sqrt{2P/M} \, t^{1/2} \, dt$

$x(t) = \sqrt{\frac{2P}{M}} \cdot \frac{2}{3} t^{3/2}$

$402 = \frac{2}{3}\sqrt{\frac{2P}{M}} \, t^{3/2}$

$603 = \sqrt{\frac{2P}{M}} \, t^{3/2}$

$(77.847)^2 = (t^{3/2})^2$

$\sqrt[3]{6060.15} = \sqrt[3]{t^3}$ $t = 18.2 sec$