CHAPTER THREE

3.1 __Ex. 3.1__ $\rightarrow E^+$

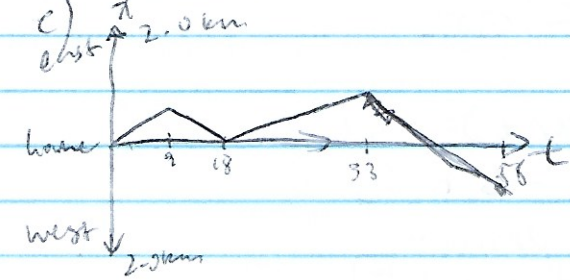
a) $\sum \Delta x = 0.5\,km - 0.5\,km + 1.0\,km - 1.75\,km$
$= \boxed{-0.75\,km}$

b) $|\Delta x| = \boxed{0.75\,km}$

c) $\bar{v} = \frac{\Delta x}{t} = \frac{-0.75\,km}{(9+9+15+25)\,min} = \boxed{-0.013\,km/min}$

d) $d_{total} = (0.5 + 0.5 + 1.0 + 1.75)\,km = \boxed{3.75\,km}$

e)



__CYU 3.1__ $\rightarrow E^+$

a) $\Delta x = -3\,km + 2\,km = \boxed{-1\,km}$

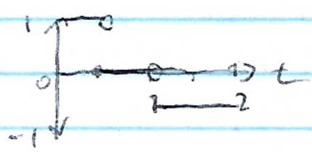
b) $d = 3\,km + 2\,km = \boxed{5\,km}$

c) $|\Delta x| = \boxed{1\,km}$

3.2 __Ex. 3.2__

$\bar{v}_1 = \frac{\Delta x}{t} = \frac{0.5\,m}{0.5\,s} = 1\,m/s \qquad \bar{v}_2 = 0\,m/s$

$\bar{v}_3 = \frac{\Delta x}{t} = \frac{-0.5\,m}{1\,s} = -\frac{1}{2}\,m/s$



__Ex. 3.3__ $\qquad x(t) = 3.0t + 0.5t^3\,m$

a) $v(t) = x'(t) = (3.0 + 1.5t^2)\,m/s$
$v(2.0\,s) = (3.0 + 1.5(2^2))\,m/s = 9.0\,m/s$

b) $x(1.0) = 3.0(1.0) + (0.5)(1^3)\,m = 3.5\,m$
$x(3.0) = 3.0(3.0) + (0.5)(3.0^3)\,m = 22.5\,m$

$\bar{v}_{3,1} = \frac{\Delta x}{t} = \frac{(22.5\,m - 3.5\,m)}{2.0\,s} = \boxed{9.5\,m/s}$

EX. 3.4 $x(t) = 3.0t - 3t^2$ m $v(t) = x'(t) = 3.0 - 6t$ m/s

a) $v(0.25) = 3.0 - 6(.25)$ m/s $= \boxed{1.5 \text{ m/s}}$

$v(0.5) = 3.0 - 6(.5)$ m/s $= \boxed{0 \text{ m/s}}$

$v(1) = 3.0 - (6)(1.0)$ m/s $= \boxed{-3.0 \text{ m/s}}$

b) $s(0.25) = |v(0.25)| = \boxed{1.5 \text{ m/s}}$

$s(0.5) = |v(0.5)| = \boxed{0 \text{ m/s}}$

$s(1) = |v(1)| = \boxed{3.0 \text{ m/s}}$

CYU 3.2 $x(t) = -3t^2$ m

a) $v(t) = x'(t) = -6t$ m/s

b) velocity is never positive

c) $v(1.0) = -6(1.0)$ m/s $= \boxed{-6 \text{ m/s}}$

$s(1.0) = |v(1.0)| = \boxed{6 \text{ m/s}}$

3.3 EX. 3.5 $\to E^+$

$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{-15.0 \text{ m/s}}{1.80 \text{ s}} = -8.33$ m/s²

CYU 3.3

$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{2.0 \times 10^7 \text{ m/s}}{10^{-4} \text{ s}} = \boxed{2.0 \times 10^{11} \text{ m/s}^2}$

EX. 3.6 $v(t) = 20t - 5t^2$ m/s

a) $a(t) = v'(t) = 20 - 10t$ m/s²

b) $v(1, 2, 3, 5) = 20t - 5t^2 = 15$ m/s, 20 m/s, 15 m/s, -25 m/s

c) $a(1, 2, 3, 5) = 20 - 10t$ m/s² $= 10$ m/s², 0 m/s², -10 m/s², -30 m/s²

d) t = 1: obj. speeding up t = 2: obj. not accelerating but still in motion t = 3, ~~5~~: obj. slows down
t = 5: obj. speeding up in other direction.

CYU 3.4

acft. lands on rwy 9.
the ~~aircraft~~ aircraft has a negative acceleration the whole time that is greater when thrust reversers & brakes are applied.

3.4 Ex. 3.7

$v_f = v_0 + at = (70.0\,\text{m/s}) + (-1.50\,\text{m/s}^2)(40.0\,\text{s})$

$= \boxed{10\,\text{m/s}}$

Ex. 3.8

$\Delta x = \cancel{v_0 t}^{0} + \frac{1}{2}at^2 = \frac{1}{2}(26.0\,\text{m/s}^2)(5.56\,\text{s})^2 = \boxed{402\,\text{m}}$

Ex. 3.9 Ref. Ex. 2.8

$v_f^2 = \cancel{v_0^2}^{0} + 2a\Delta x$

$v_f = \sqrt{2a\Delta x} = \sqrt{2(26.0\,\text{m/s}^2)(402\,\text{m})} = \boxed{145\,\text{m/s}}$

Ex. 3.10

a) ~~Δx~~ $\cancel{v_f^2}^{0} = v_0^2 + 2a\Delta x$

$\Delta x_{dry} = \dfrac{-v_0^2}{2a} = \dfrac{-(30.0\,\text{m/s})^2}{2(-7.00\,\text{m/s}^2)} = \boxed{64.3\,\text{m}}$

b) $\Delta x_{wet} = \dfrac{-v_0^2}{2a} = \dfrac{-(30.0\,\text{m/s})^2}{2(-5.00\,\text{m/s}^2)} = \boxed{90.0\,\text{m}}$

c) $\Delta x_{delay} = \bar{v}t = (30.0\,\text{m/s})(0.500\,\text{s}) = 15\,\text{m}$

$\Delta x_{dry} = 64.3\,\text{m} + 15\,\text{m} = \boxed{79.3\,\text{m}}$

$\Delta x_{wet} = 90.0\,\text{m} + 15\,\text{m} = \boxed{105\,\text{m}}$

Ex. 3.11

$\cancel{v_f = v_0 + at}$ $\quad \Delta x = v_0 t + \frac{1}{2}at^2 \quad$ $\cancel{v_f^2 = v_0^2 + 2a\Delta x}$

$200\,\text{m} = (10.0\,\text{m/s})t + (0.5)(2.00\,\text{m/s}^2)t^2$

$1.00\,\text{m/s}^2\, t^2 + 10.0\,\text{m/s}\, t - 200\,\text{m} = 0$

$t = \dfrac{-10 \pm \sqrt{100 + 800}}{2} = \dfrac{-10 \pm 30}{2} = \boxed{10.0\,\text{s}}$

Ex. 3.12

$v_0 = \dfrac{\Delta x - \frac{1}{2}at^2}{t} = \dfrac{(1000\,\text{km}) - \frac{1}{2}(20\,\text{m/s}^2)(120\,\text{s})^2}{120\,\text{s}}$ 2

$= \boxed{8323\,\text{m/s}}$

$v_f = v_i + at = 8323\,\text{m/s} + (20\,\text{m/s}^2)(120\,\text{s}) = \boxed{10720\,\text{m/s}}$

Ex. 3.13

a) $v_g = 10\,m/s$ $a_g = 0\,m/s^2$ $v_{0c} = 0\,m/s$, $a_c = 4\,m/s^2$

$\Delta x = v_0 t + \frac{1}{2}at^2$ $\Delta x = \bar{v}t$

$\overset{0}{v_{0c}t} + \frac{1}{2}a_c t^2 = v_g t$

$\frac{1}{2}(4\,m/s^2)t^2 - (10\,m/s)t = 0$

$t(2\,m/s^2\,t - 10\,m/s) = 0$

$t = \boxed{5.0\,s}$

b) $\Delta x = v_g t = (10\,m/s)(5.0\,s) = \boxed{50\,m}$

CYU 3.6

$\frac{1}{2}a_p t^2 = v_b t$

$a_p = \frac{2v_b t}{t^2} = \frac{2v_b}{t} = \frac{2(10\,m/s)}{30\,s} = \boxed{0.67\,m/s^2}$

3.5 Ex. 3.14

a) $\Delta x = v_0 t + \frac{1}{2}at^2$

$98\,m = (-4.9\,m/s)t + (.5 \times 9.8\,m/s^2)t^2$

$+4.9t^2 + 4.9t - 98 = 0$

$t = \frac{4.9 \pm \sqrt{4.9^2 + 4 \times 4.9 \times 98}}{2 \times 4.9} = \boxed{4.0\,s}$

b) $v_f = v_0 + at = (-4.9\,m/s) + (-9.8\,m/s^2)(4.0\,s) = \boxed{-44.1\,m/s}$

Ex. 3.15

a) $\overset{0}{v_f} = v_0 + at$

$v_0 = -at = -(-9.8\,m/s^2)(2.5\,s) = \boxed{25\,m/s}$

b) $\Delta x = v_0 t + \frac{1}{2}at^2 = (25\,m/s)(2.5\,s) + \frac{1}{2}(9.8\,m/s^2)(2.5\,s)^2 = \boxed{93\,m/s}$

c) $t = \boxed{2.5\,s}$, $(5\,s/2)$

d) $a_{top} = -9.8\,m/s^2$

e) Velocity $v_f = -v_0 = \boxed{-25\,m/s}$

CYU 3.7

$\Delta x = \overset{0}{v_0 t} + \frac{1}{2}at^2$

$t = \sqrt{\frac{2\Delta x}{a}} = \sqrt{\frac{2(30.0\,m)}{9.8\,m/s^2}} = \boxed{2.47\,s}$

Δx increases faster than v

Ex. 3.16

$v_f = v_0 + at$

a) $t = \frac{-v_0}{a} = \frac{-(200.0\,m/s)}{-9.8\,m/s^2} = 20.4\,s$

$x_f = x_0 + v_0 t + \frac{1}{2}at^2 = 5.0\,km + (200.0\,m/s)(20.4\,s) + \frac{1}{2}(-9.8\,m/s^2)(20.4\,s)^2$
$= \boxed{7.04\,km}$

b) $v_f^2 = v_0^2 + 2a\Delta x$
$v_f = \sqrt{v_0^2 + 2a\Delta x} = \sqrt{(200.0\,m/s)^2 + 2(-9.8\,m/s^2)(1.0\,km)}$
$= \boxed{143\,m/s}$

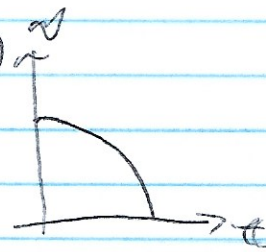
3.6 Ex. 3.17

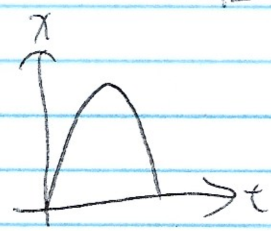
a) $a(t) = -\frac{1}{4}t\ m/s^3$
$v(t) = \int a\,dt = -\frac{1}{8}t^2\ m/s^3 + C_1$
$v(0) = \cancel{-\frac{1}{8}(0^2)\,m/s^3} + C_1 = 5.0\,m/s$ $v(t) = -\frac{1}{8}t^2 + 5.0$

b) $-\frac{1}{8}t^2\,m/s^3 + 5.0\,m/s = 0$
$t = \sqrt{8 \cdot 5.0} = \boxed{6.32\,s}$

c) $x(t) = \int v\,dt = -\frac{1}{24}t^3\,m/s^3 + 5.0t\,m/s + C_2$
$x(0) = 0;\ C_2 = 0$
$x(t) = -\frac{1}{24}t^3\,m/s^3 + 5.0t\,m/s$

d) $\Delta x = x_f - \cancel{x_0}^{\,0} = x(6.32\,s) = (-\frac{1}{24})(6.32\,s)^3\,m/s^3 + 5.0(6.32\,s)\,m/s$
$= \boxed{21.1\,m}$

e)




CYU 3.8 $a(t) = (5 - 10t)\,m/s^2$

a) $v(t) = \int a\,dt = 5t - 5t^2 + C_1$
$v(0) = 0;\ C_1 = 0$ $v(t) = 5t - 5t^2$

b) $x(t) = \int v\,dt = \frac{5}{2}t^2 - \frac{5}{3}t^3 + C_2$; $x(0) = 0 \Rightarrow x(t) = \frac{5}{2}t^2 - \frac{5}{3}t^3$

c) $5t - 5t^2 = 0$; $5t(-t+1) = 0$; $v = 0$ @ $t = 0$, $t = 1\,s$

Ex. 3.12

$\Delta x = v_0 t + \frac{1}{2} a t^2$

$v_0 = \frac{\Delta x - \frac{1}{2} a t^2}{t} = \frac{(1000\,km - \frac{1}{2}(20\,m/s^2)(120\,s)^2)}{120\,s}$

$= \boxed{7133\,m/s}$

$v_f = v_0 + at = 7133\,m/s + (20\,m/s^2)(120\,s) = \boxed{9533\,m/s}$

Ex. 3.14

b) $\cancel{v_f^2} = v_0^2 + 2a\Delta x$

$\Delta x = \frac{-v_0^2}{2a} = \frac{-(25\,m/s)^2}{2(-9.8\,m/s^2)} = \boxed{31.9\,m}$

(correct b/c using 2 sig figs)

CH. 3 E20

1) Man goes 4 km west, 10 km east, then 20 km west.
$\Delta x = -6$ km $|\Delta x| = 6$ km $d = 34$ km

5) measures distance

9) average speed; is the same if distance = magnitude of displacement

13) Car is coming to rest at a stoplight; velocity $= 0$ & acceleration is negative at the instant it stops

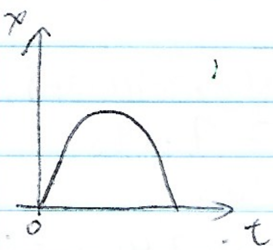
17) Know initial, final position & acceleration, need time & velocities
Know initial velocity, time and distance, need to find acceleration & final velocity

21) 6 times (sum growth = 6 g mm)

25) a) $x_0 = -2.0$ km , $x_f = +5.0$ km
b) $\Delta x = x_f - x_0 = \boxed{7.0 \text{ km}}$

29) a) $v = \frac{\Delta x}{t} = \frac{(23.5 \text{ km})}{2.5 \text{ min}} = \boxed{9.4 \text{ km/min}} = \boxed{157 \text{ m/s}}$
b) 157 m/s / 343 m/s $= \boxed{0.46\ v_{sound}}$

33)

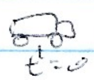


37) $a = \frac{\Delta v}{\Delta t} = \frac{30.0 \text{ m/s}}{7.00 \text{ s}} = \boxed{4.29 \text{ m/s}^2}$

41) $a = \frac{\Delta v}{\Delta t} = \frac{6{,}500 \text{ m/s}}{60.0 \text{ s}} = \boxed{108 \text{ m/s}^2}$
$108 \text{ m/s}^2 / 9.8 \text{ m/s}^2 = \boxed{11 g}$

45) a) $\Delta x = v_0 t + \frac{1}{2} a t^2 = (30 \text{ m/s})(5 \text{ s}) + \frac{1}{2}(30 \text{ m/s}^2)(5 \text{ s})^2 = \boxed{525 \text{ m}}$
b) $v_f = v_0 + at = (30 \text{ m/s}) + (30 \text{ m/s}^2)(5 \text{ s}) = \boxed{180 \text{ m/s}}$

49) a) $a = \frac{\Delta v}{\Delta t} = (-5 \text{ m/s} + 8 \text{ m/s}) / 10 \text{ s} = \boxed{-1.3 \text{ m/s}^2}$
b) $v_0 = \boxed{+5.0 \text{ m/s}}$
c) $\cancel{v_f}^{0} = v_0 + at$ $t = \frac{-v_0}{a} = \frac{-(5.0 \text{ m/s})}{-1.3 \text{ m/s}^2} = \boxed{3.85 \text{ s}}$

53) a)  $\xrightarrow{a = 2.4 \text{ m/s}^2}$ $t = 0$ $t = 12$
b) $a = 2.40 \text{ m/s}^2$ $\Delta t = 12.0$ s
c) $\Delta x = \cancel{v_0 t}^{0} + \frac{1}{2} a t^2 = \frac{1}{2}(2.40 \text{ m/s}^2)(12.0 \text{ s})^2 = \boxed{173 \text{ m}}$ reasonable
d) $v_f = \cancel{v_0}^{0} + at = (2.40 \text{ m/s}^2)(12.0 \text{ s}) = \boxed{28.8 \text{ m/s}}$

57) a) $\bar{a} = \frac{\Delta v}{\Delta t} = (26.8 \text{ m/s})/(3.90 \text{ s}) = \boxed{6.87 \text{ m/s}^2}$
b) $\Delta x = \cancel{v_0 t}^{0} + \frac{1}{2} a t^2 = \frac{1}{2}(6.87 \text{ m/s}^2)(3.90 \text{ s})^2 = \boxed{52.2 \text{ m}}$

61) a) $\cancel{v_f^2}^{0} = v_0^2 + 2a\Delta x$ $a = \frac{-v_0^2}{2\Delta x} = \frac{-(0.600 \frac{m}{s})^2}{2(2.00 mm)} = \boxed{-90.0 \frac{m}{s^2}}$

$-90.0 \frac{m}{s^2} / 9.8 \frac{m}{s^2} = \boxed{-9.18 g}$

b) $\cancel{v_f} = v_0 + at$ $t = \frac{-v_0}{a} = -(0.600 \frac{m}{s}) / -90.0 \frac{m}{s^2} = \boxed{6.67 \times 10^{-3} s}$

c) $\cancel{v_f^2} = v_0^2 + 2a\Delta x$ $a = \frac{-v_0^2}{2\Delta x} = \frac{-(0.600 \frac{m}{s})^2}{2(4.50 mm)} = -40.0 \frac{m}{s^2} = \boxed{-4.08 g}$

65) a) $\bar{a} = \frac{\Delta v}{\Delta t} = 145.0 \frac{m}{s} / 4.45 s = \boxed{32.6 \frac{m}{s^2}}$

b) $v_f^2 = \cancel{v_0^2} + 2a\Delta x$ $v_f = \sqrt{2a\Delta x} = \sqrt{2(32.6 \frac{m}{s^2})(402.0 m)} = \boxed{162 \frac{m}{s}}$

c) found avg. acceleration; a dragster wouldn't have a constant acceleration b/c its speed would continue to increase until infinity. The acceleration would probably decrease over time.

69) a) ~~[illegible]~~ $a = 9.8 \frac{m}{s^2}$ $v_0 = 1.40 \frac{m}{s}$ $t = 1.8 s$

b) $\Delta x = v_0 t + \frac{1}{2} a t^2 = (1.40 \frac{m}{s})(1.8 s) + \frac{1}{2}(9.8 \frac{m}{s^2})(1.8 s)^2 = \boxed{18.4 m}$

73) ~~[illegible]~~ $x_f - x_0 = v_0 t + \frac{1}{2} a t^2$

$-0.40 m = (11.0 \frac{m}{s}) t - \frac{1}{2}(9.8 \frac{m}{s^2}) t^2$

$-4.9 \frac{m}{s^2} t^2 + 11.0 \frac{m}{s} t + 0.40 m = 0$

$t = \frac{-11 \pm \sqrt{11^2 + 4(4.9)(0.4)}}{-9.8} = \boxed{2.28 s}$

77) a) ~~[illegible]~~

$v_f^2 = \cancel{v_0^2}^{0} + 2a\Delta x$ $v_f = \sqrt{2a\Delta x} = \sqrt{2(9.8 \frac{m}{s^2})(250 m)} = \boxed{70.0 \frac{m}{s}}$

b) $v_f = \cancel{v_0} + at$ $t = \frac{v_f}{a} = \frac{70.0 \frac{m}{s}}{9.8 \frac{m}{s^2}} = 7.14 s$

$t_{sound} = \frac{\Delta x}{v} = 250 m / 335 \frac{m}{s} = 0.746 s$

$t_{tourist} = t - t_{sound} - t_{react} = 7.14 s - 0.746 s - 0.300 s$
$= \boxed{6.04 s}$

81) 0–5.0 s $v(t) = 3.2t \frac{m}{s}$

5.0 s–11.0 s $v(t) = (16.0 - 1.5(t - 5.0)) \frac{m}{s}$

after 11.0 s $v(t) = 7.0 \frac{m}{s}$

$16.0 - 1.5t + 7.5$

$-1.5t + 23.5$

a) 0–5.0 s: $a(t) = 3.2 \frac{m}{s^2}$

5.0 s–11.0 s: $a(t) = -1.5 \frac{m}{s^2}$

after 11.0 s: $a(t) = 0$

b) $x(t) = \int v\,dt$ 0–5 s: $x(t) = 1.6t^2 \frac{m}{s^2} + \cancel{C_1}^{0}$

5.0 s–11.0 s: $= -0.75t^2 + 23.5t$ m $+ C_2 = -0.75t^2 + 23.5t + 40$ m

after 11: $x(t) = 7.0t$ m $+ C = 7.0t + 208$ m

$x(2) = \boxed{6.4 m}$ $x(7) = \boxed{168 m}$ $x(12) = \boxed{292 m}$

85) $\cancel{v(t)} = \cancel{2.22\,\frac{cm}{s}}$ $a = 1.2\,\frac{cm}{s^2}$
$v(4) = -3.4\,\frac{cm}{s}$
$v(t) = \int a\,dt = 1.2t\,\frac{cm}{s^2} + C_1$
$1.2(4)\frac{cm}{s} + C_1 = -3.4\,\frac{cm}{s}$
$C_1 = -8.2\,\frac{m}{s}$
$v(t) = (1.2t - 8.2)\,\frac{cm}{s}$
$v(1) = \boxed{-7.0\,\frac{cm}{s}}$ $v(6) = \boxed{-1.0\,\frac{cm}{s}}$

89) a) $v_f^2 = v_0^2 + 2a\Delta x$
$v_f = \sqrt{v_0^2 + 2a\Delta x} = \sqrt{(4.0\times10^5\,\frac{m}{s}) + 2(6.0\times10^{12}\,\frac{m}{s^2})(5.0\,cm)} = \boxed{8.7\times10^5\,\frac{m}{s}}$
b) $v_f = v_0 + at$ $t = \frac{v_f - v_0}{a} = (8.7\times10^5\,\frac{m}{s} - 4.0\times10^5\,\frac{m}{s})/6.0\times10^{12}\,\frac{m}{s^2}$
$= \boxed{7.8\times10^{-8}\,s}$

93) $\cancel{v_f^2} = v_0^2 + 2a\Delta x$
$a = \frac{-v_0^2}{2\Delta x} = -(30\,\frac{m}{s})^2/2(500\,m) = \boxed{-0.9\,\frac{m}{s^2}}$

97) $\cancel{v_f = v_0 + at}$ $\cancel{v_f^2 = v_0^2 + 2a\Delta x}$ $\Delta x = v_0 t + \frac{1}{2}at^2$
$\cancel{v_f = \sqrt{v_0^2 + 2a\Delta x} = \sqrt{(8\,\frac{m}{s})^2 + 2(0.5\,\frac{m}{s^2})(75\,m)}} =$
$75\,m = (8\,\frac{m}{s})t + \frac{1}{2}(-0.5\,\frac{m}{s^2})t^2$
$-\frac{1}{4}t^2 + 8t - 75 = 0$
$t = \frac{-8 \pm \sqrt{64-75}}{\frac{1}{2}}$ negative under $\sqrt{\ }$, means she doesn't actually finish the race.

101) $v_{0_w} = \frac{\Delta x - \frac{1}{2}at^2}{t} = (2.20\,m - \frac{1}{2}(9.8\,\frac{m}{s^2})(1.30\,s)^2)/1.30\,s = 7.91\,\frac{m}{s}$
$\cancel{v_f = v_0 + at}$ $v_f^2 = v_0^2 + 2a\Delta x$
$v_0 = \sqrt{v_f^2 - 2a\Delta x} = \sqrt{(7.91\,\frac{m}{s})^2 - 2(-9.8\,\frac{m}{s^2})(7.50\,m)} = \boxed{14.5\,\frac{m}{s}}$

105) $\cancel{v_f = v_0 + at}$ $\cancel{t = -\frac{v_0}{a}}$ $\cancel{v_f^2} = v_0^2 + 2a\Delta x$
1m $v_0 = \sqrt{-2a\Delta x} = \sqrt{-2(9.8\,\frac{m}{s^2})(-1.0\,m)} = 4.43\,\frac{m}{s}$
$t = \frac{-v_0}{a} = -\frac{4.43\,\frac{m}{s}}{-9.8\,\frac{m}{s^2}} = 0.45\,s \times 2 = \boxed{0.90\,s}$
0.3m $v_0 = \sqrt{-2a\Delta x} = \sqrt{-2(9.8\,\frac{m}{s^2})(-0.3\,m)} = 2.42\,\frac{m}{s}$
$t = \frac{-v_0}{a} = \frac{-2.42\,\frac{m}{s}}{9.8\,\frac{m}{s^2}} = 0.25\,s \times 2 = \boxed{0.50\,s}$

109) a) $\Delta x = \cancel{v_0 t} + \frac{1}{2}at^2 = \frac{1}{2}(9.8\,\frac{m}{s^2})(1.0\,s)^2 = \boxed{4.9\,m}$
b) $\cancel{v_f = v_0 + at}$ $v_f^2 = \cancel{v_0^2} + 2a\Delta x$ $v_f = \sqrt{2a\Delta x} = \sqrt{2(9.8\,\frac{m}{s^2})(75.0\,m)}$
$= \boxed{38.3\,\frac{m}{s}}$
$v_0 = v_f - at = 38.3\,\frac{m}{s} - (9.8\,\frac{m}{s^2})(1.0\,s) = 28.5\,\frac{m}{s}$
$\Delta x = v_0 t + \frac{1}{2}at^2 = (28.5\,\frac{m}{s})(1.0\,s) + \frac{1}{2}(9.8\,\frac{m}{s^2})(1.0\,s)^2 = \boxed{33.4\,m}$

113) $x(t) = 5.0t^2 - 4.0t^3$ m

a) $v(t) = x'(t) = (10.0t - 12.0t^2)\ \frac{m}{s}$

$a(t) = v'(t) = (10.0 - 24.0t)\ \frac{m}{s^2}$

b) $v(2) = ((10.0)(2_s) - 12.0(2_s^2))\frac{m}{s} = \boxed{-28\ \frac{m}{s}}$

$a(2) = (10.0 - 24.0(2))\frac{m}{s^2} = \boxed{-38\ \frac{m}{s^2}}$

c) position - max when $v = 0$

$10.0t - 12.0t^2 = 0$

$2t(-6t + 5) = 0$

$t = 0, \frac{5}{6}$ $\quad x(0) = 0 \quad x(\frac{5}{6}) = 1.16$ m

$t = \frac{5}{6} = \boxed{0.833\ s}$

d) see above, $t = 0, \frac{5}{6} = \boxed{0\ s}, \boxed{0.833\ s}$

e) see above, $x(\frac{5}{6}) = \boxed{1.16\ m}$

49) b, c $\longrightarrow +$

b) $v_f = v_0 + at$

$v_0 = v_f - at = +5.0\ \frac{m}{s} - (-1.3\ \frac{m}{s^2})(10\ s)$

$= \boxed{18.0\ \frac{m}{s}}$

c) $\cancel{v_f} = v_0 + at$ (0)

$t = \frac{-v_0}{a} = \frac{-(18.0\ \frac{m}{s})}{-1.3\ \frac{m}{s^2}} = \boxed{13.8\ s}$

81) $v(t) = 3.2t\ \frac{m}{s} \quad 0 \le t \le 5$

$v(t) = [16.0 - 1.5(t - 5.0)]\ \frac{m}{s} \quad 5 \le t \le 11.0$

$v(t) = 7.0\ \frac{m}{s} \quad t > 11.0$

a) $a(t) = v'(t) \quad a(t) = 3.2\ \frac{m}{s^2} \quad 0 < t \le 5.0\ s$

$a(t) = 1.5\ \frac{m}{s^2} \quad 5 \le t \le 11.0$

$a(t) = 0\ \frac{m}{s^2} \quad t \ge 11.0$

b) $x(t) = \int v\,dt = 1.6t^2 + C_1 \quad x(0) = 0;\ C_1 = 0$

$\hookrightarrow x(2) = 1.6(2^2) = \boxed{6.4\ m}$

$x(t) = (16.0t - 1.5(\frac{1}{2}t^2 - 5.0t))\,m + C_2$ for $5 \le t \le 11.0$

$x(5) = 1.6(5^2) = 40 = 16.0(5) - 1.5(\frac{1}{2}(25) - 25) + C_2$

$C_2 = 40 - 98.75 = -58.75$

$x(7) = 16.0(7) - 1.5(\frac{1}{2}(7^2) - 5.0(7)) - 58.75 = \boxed{69.0\ m}$

$x(t) = 7.0t + C_3 \quad t \ge 11.0 \quad x(11) = 77 + C_3 = 109 \rightarrow C_3 = 32$

$x(12) = 7.0(12) + 32 = \boxed{116\ m}$