Conceptual Questions

1. Ignoring air resistance, the acceleration of a Projectile is vertically downward at all time $\downarrow -9.81 \frac{m}{s^2}$

2. 

$V_{yi} = 0$, The x component, on The other hand is always $V_0 \cos\theta$. ∴ the Projectile V_{Avg} has magnitude of $V_0 \cos\theta$ + point B in the positive x DIR.

3. The Projectile was Launched at an angle of 30° above the positive AXIS; When it landed its direction of Motion was 30° below the positive AXIS hence it change direction was 60° Counter clock wise

7. Less than 45°. see figure 4-9

9. a) from the child point of view of the parents the scoop of ice Cream falls Straight down B) Parents Point of view Parabolic trajectory

Conceptual Exercises

1. a) You + the ball have the same horizontal component of Velocity ∴ the ball will come down in your hand.

3. The Divers are in Free fall for the same Amount of time. It follows that Diver 2 covers
   b) twice the distance.

5. a) Proj A, B + C
   b Proj C, B, A

6. a) $A > B > C$ for initial Speed
   b) $A = B = C$

Sec 4.1

$\Delta X = 4800\,m$

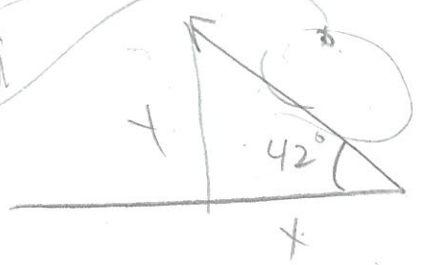
1. $V_i = 3.2\,\frac{m}{s}\left(\frac{1505}{}\right)$ $t = 25\,min\left(\frac{60\,s}{1\,min}\right) = 1500\,s$

$\theta = 42°$

$X = V_x t$

$V = \frac{x}{T}$

$VT = x$



a) West = $-3567\,m$ =

b) North = $3210\,m$ =

$Y = V_y t$

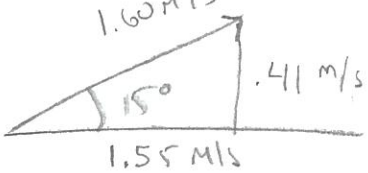
2. $V_i = 1.60\,\frac{m}{s}$

$\theta = 15°$ N of E

$T = ?$

a) 20 cm E.

b) 30 cm N.



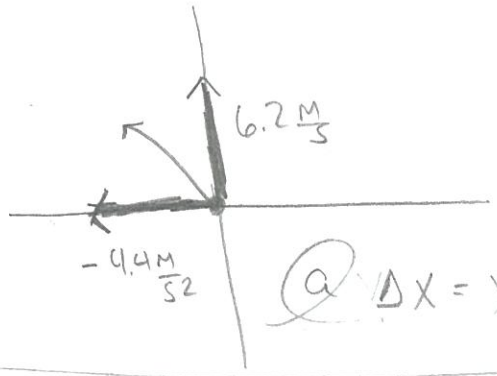
$1.55\,\frac{m}{s} = \frac{20\,m}{T}$

a) $T = 12.9\,s$

b) $1.41\,\frac{m}{s} = \frac{30\,m}{T}$

$T = 73.2\,s$

4.



$Y = 6.2\,m/s$

$a = -4.4\,\frac{m}{s^2}$

a) $T = 5.0\,s$

a) $\Delta X = V_i t + \frac{1}{2} a t^2$

$0 + \frac{1}{2} - 4.4\,m/s^2 \cdot 5^2 = -55\,m$

a) $V = \frac{Y}{T} = VT = Y$

$\left(6.2\,\frac{m}{s}\right)(5.0\,s) =$ 31 m

b) $V_x = V_{0x} + at$

$-4.4\,\frac{m}{s^2} \cdot 5$

$= -22\,\frac{m}{s}$

$Y = 6.2\,m/s$

5.

$V_x = 2.10\,cm/s \times 10^9\,\frac{cm}{s}$

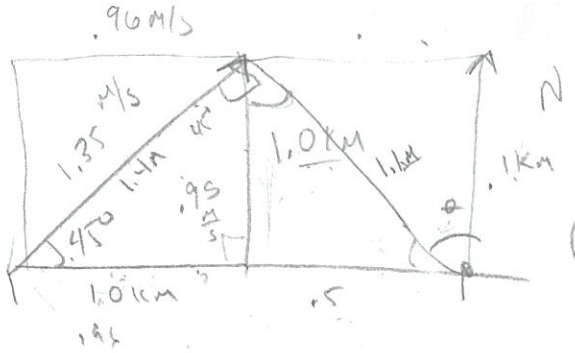
$a_T = 5.30 \times 10^{17}\,\frac{cm}{s^2}$

$T =$ $\Delta X = 6.20\,cm$

c) Increase w/ time

(X component of the Velocity continually increases in the negative direction

6.



$\theta = \tan^{-1}\left[\frac{.5}{1.0}\right] = 26.6°$

$V_2 = \frac{1.4M}{1.35\frac{M}{S}} = \frac{1.1M}{X}$

1.1 m/s

Section 4.3

7.

$\Delta Y = \frac{1}{2} g t^2$

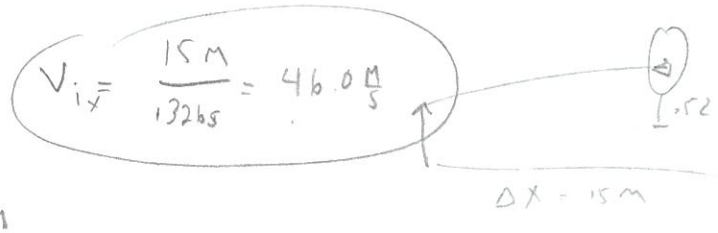
$\Delta X = 15M$

$V_i = ?$

$\Delta Y = .52cm$

$t = ?$

$V_{ix} = \frac{15M}{.3265} = 46.0\frac{M}{S}$



$t = \sqrt{\frac{2\Delta Y}{g}} =$

$t = .326\ sec$

8. $\Delta Y = 108m$

$V_{ix} = 3.60\frac{M}{S}$

$V_{fy} = ?$

$g = -9.81\frac{M}{S^2}$

$t = ?$

$t = \sqrt{\frac{2 \cdot 108}{-9.81\frac{M}{S^2}}} = 4.7s$

$V_{fy}^2 = \cancel{V_{iy}^0}^2 + 2g\Delta Y$

$V_{fy} = \sqrt{2 \cdot 9.81 \cdot 108}$

$V_{fy} = 46.1\frac{M}{S}$

$V_{fy} = 46.0\frac{M}{S}$

$V_{fx} = 3.60$

$V_{fy} = \cancel{V_{iy}^0} + 2g\Delta Y$

$V_f = \sqrt{2\left(9.81\frac{M}{S}\right) 108M}$

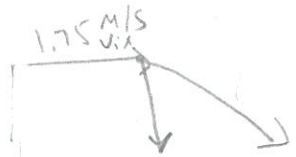
$V_{fy} = 7.67\ m/s$

9. $V_{ix} = 1.75\ m/s$

$\Delta Y = 3.00m$

$V_f = ?$

$t = .78s$



$V_{fy} = V_f = 7.87\frac{M}{S}$

$V = \sqrt{1.75\frac{M}{S} + 7.67\frac{M}{S}}$

11. $\Delta X = 18\,m$

$V_i = 32\frac{m}{s}$

$\Delta Y = ?$

$V_i = \frac{\Delta X}{T} = 32\frac{m}{s} = \frac{18\,m}{T}$ $\quad t = .56s$

$\Delta Y = \frac{1}{2} g t^2 \Rightarrow = .5 \cdot 9.81 \cdot .56^2$

a) $\boxed{\Delta Y = 1.5\,m}$

b) gets shorter

c) decreases

13. $V_i = 2.70\frac{m}{s}$

$t = 2.10s$

$\Delta X = 5.67\,m$

or $V_{fy} = V_i + gt^2$

$20.6\,m/s$

a) $V_{ix} = ?$ $(2.70\,m/s)$

b) V_i

$\Delta Y = \frac{1}{2}\, 9.81\,m/s \cdot (2.10\,s)^2$

$21.6\,m$

$V_{fy}^2 = V_i^2 + 2g\Delta Y$

$V_{fi} = 20.6\,m/s$

c) y - stays the same

x - increase

16. $\Delta Y = 9.0\,m$

$\Delta X = 3.5\,m$

$V_i = ?$

$t = \sqrt{\frac{2\Delta Y}{g}} = 1.4s$

$V_i = \frac{3.5\,m}{1.4s} = 2.5\frac{m}{s}$

17. $V_i = 3.3\frac{m}{s}$

$\theta = (?) -66°$

$V_f = ?$ $(8.1\frac{m}{s})$ $3.3\,m/s$

$V_{fy} = V_i + gt$

a) $.75s$ data $= -7.4\frac{m}{s}$

$\tan\theta^{-1}\left[\frac{-7.4}{-3.3}\right]$

20. $(1.69\,m)$

$\Delta Y = 555ft\left(\frac{12''}{1ft}\right)\left(\frac{2.54cm}{1in}\right)\left(\frac{1\,m}{100cm}\right) =$

$V_i = 5.0\frac{m}{s}$

$\Delta X = ?$

$t = \sqrt{\frac{2 \cdot 1.69}{9.81}} = 5.9s$

$\Delta X = V_{ix} T =$

$29.5\,m$

Sec. 4.4

23. $V_i = 17.0 \text{ m/s}$
$\theta = 35$

a) $13.9 \frac{m}{s} = V_i \cos\theta$

b) $t = ?$

$= V_i \sin\theta_i$

9.75 m/s

$g = \frac{V}{T} \quad \frac{V}{g}$

$V_f = -9.75 \text{ m/s}$

$V_i = 9.75 \text{ m/s}$

$\frac{-9.75 \text{ m/s} - 9.75 \text{ m/s}}{-9.81 \text{ m/s}}$

$t = 1.99$

24. $V = 9.75 \text{ m/s} \downarrow$

$V_i \sin\theta = V_{y_i} = V_{y_f}$

26. $V_i = 9.50 \text{ m/s}$

$\theta = 25°$

$t = ?$

$V_i \sin\theta_{y_i} = 4.01 \text{ m/s}$

$V_i \sin\theta_{y_f} = -4.01 \text{ m/s}$

so $a = \frac{\Delta V}{T} = \frac{V_f - V_i}{g} = t$

$t = 1.82 \text{ s}$

31. $V_i = 30.0 m/s$

a) $V_1 = 30.0 m/s$

Max length $\theta = 45°$

$$\text{Range}_{MAX} = \frac{V_0^2 \sin\theta}{g} = 91.7M$$

32. $\Delta Y = ?$

$\Delta X = 91.7M$

$V_0 = 30.0 m/s$

$t =$ no time

$\Delta Y = ?$

$$V_{fy}^2 = V_{iy}^2 + 2g\Delta y$$

V_{fy} at top $= 0$

MAX 45°

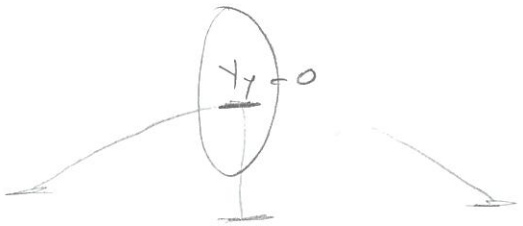
$$V_{iy} \sin\theta = 2g\Delta y$$

$$\Delta y = \frac{(30.0 m/s \cdot \sin 45°)^2}{(2 \cdot 9.81)} = 23m$$

Sec. 4.5

40. $V_i = 12.0 \text{ m/s}$

$\theta = 40°$



$V_f^2 = (V_i \sin\theta)^2 + 2g\Delta y$

$\frac{(-V_i \sin\theta)^2}{2g} = -\Delta y$

$= 3.03 \text{ m}$

45.

$Y = 2.00 \times 10^5 \text{ m}$

$g = 1.80 \text{ m/s}^2$

$V_i = ?$

$V_{f_{MAX}} = 0$ highest

max height $\theta = 45°$

$V_f^2 = V_i^2 + 2g\Delta y$

$V_i = \sqrt{-2g\Delta y}$

$= 848 \frac{\text{m}}{\text{s}}$

b) Less than bc g is greater

46. $g = 9.81 \text{ m/s}$

$V_i = 10.2 \text{ m/s}$

$\theta = 25°$

a) $t_1 = .25$

$t_2 = .50 \text{ s}$

$V_f = ?$

$t_{.25} =$

$t_{.50} =$

x direction does change

$V_x = V_x \cos\theta$ = constant

$9.24 \text{ m/s} \rightarrow$

$\downarrow t_{.25}$ $V_f = V_0 \sin\theta + gt$

$V_{fy} = 1.86 \text{ m/s}$

$t_{.25}$ $\sqrt{9.24^2 + 1.86^2} = 9.42 \text{ m/s}$ @ $11.3°$

25°

General Problems

52. $V_x = 4.87$ $\quad V_x = \frac{x}{T}$ so $T = \frac{x}{v}$

$x = 1.95m$ $\quad t = .40s$

h = ? $\quad \Delta y = \frac{1}{2} g t^2 = \Delta y = .784m$

59. $V_i = 11.2 m/s$ $\quad$ (A) 20°

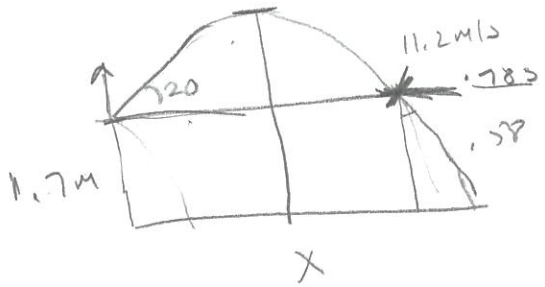
h = 5.0' $\left|\frac{1m}{3ft}\right|$ 1.7M

x = ?

$V_{i\,y} = 3.83 \frac{m}{s}$

Use height to find time

$R = \frac{V_i^2 \sin\theta^2}{g} - h$



V_f

$0 = 3.83 m/s + gt$

1.37s = 14.4m

69 B)

b) $V_i =$

$\theta = 25°$

$X = 35M$ $\quad R = \left(\frac{V_0^2}{g}\right) \sin 2\theta$ = Range formula

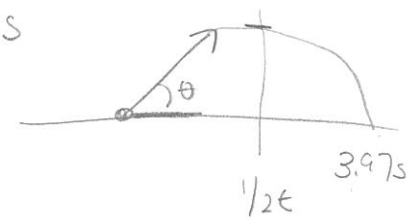
$V_0 = \sqrt{\frac{Rg}{\sin 2\theta}} = \sqrt{\frac{35M \cdot 9.81}{\sin 50°}} = 21 m/s$

$X = 35m$

69. $V_i = 21.5 m/s$

$t = 3.97s$

$\theta =$



a)

$V_{xi} = \frac{X}{t} = \frac{35m}{3.97}$

$V_{x_i} = 8.8 m/s$

$\theta = \tan^{-1}\left[\frac{19.4}{8.8}\right] = 66°$

$V_{f_{y_{top}}} = 0 \quad V_f = V_i + gt$

$V_{iy} = g\frac{1}{2}t$

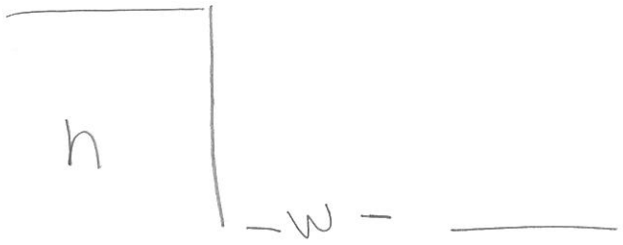
$V_{iy} = 19.4 m/s$

$V_x \cos\theta = \frac{x}{t}$

69 c) $t = \frac{X}{V_x \cos\theta} = \frac{35M}{(21 m/s \cdot \cos 25°)}$

$t = 1.8s$

74) $V_0 \rightarrow$



a) $t = \sqrt{\frac{2h}{g}}$ $\quad V_0 = \frac{x}{\sqrt{\frac{2h}{g}}}$ so $V_0 = \frac{w}{\sqrt{\frac{2h}{g}}}$

b) $V_{0_f} = V_{x_f}$

$V_{y_f} = \sqrt{2gh}$

$V_{f_y}^2 = V_y^2 + 2gh$

$V_{f_y} = \sqrt{2gh}$

$\theta = \tan^{-1}\left[\frac{y}{x}\right]$

So

$\tan^{-1}\left[\frac{\sqrt{2gh}}{V_0}\right]$