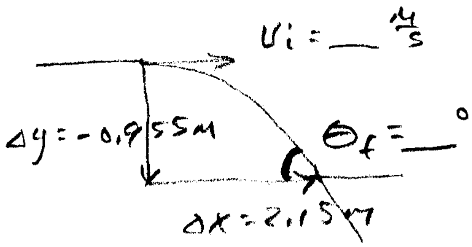
Honors Physics Test - Ch. 4 - 10-18-02 - Mr. Ward – 90 points total plus bonus, no max!

Name WARD _____ o

1. (30 pts) (Draw a good diagram and label it well.) A small toy car rolls off a horizontal desk 0.955 m high. It strikes the floor 2.15 m from the point under the edge of the desk. Calculate (a) speed of car as it left the desk (b) angle it hit at (hint: NOT 24°) (c) speed it hit at (d) time to hit the floor.



a = 9.8 m/s²

$v_{1y} = 0$ m/s

$\Delta y = v_{iy}t + \frac{1}{2}at^2$

$t = \sqrt{\frac{2\Delta y}{a}} = \sqrt{\frac{2(-0.955\,m)}{-9.8\,m/s^2}}$

d) $t = 0.441\,s$

$\Delta x = v_x t$

$v_x = \frac{\Delta x}{t} = \frac{2.15\,m}{0.441\,s}$

a) $v_x = 4.88\,m/s$

$v_{fy} = v_{iy} + at = -9.8\,m/s^2\,(0.441\,s)$

$v_{fy} = -4.32\,m/s$

$v_f = \sqrt{v_{fy}^2 + v_x^2} = \sqrt{(4.32\,m/s)^2 + (4.88\,m/s)^2}$

c) $v_f = 6.52\,m/s$

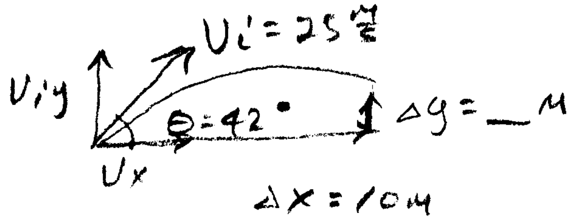
$\tan\theta = \frac{v_{fy}}{v_x}$ Q4

$\tan\theta = \frac{-4.32\,m/s}{4.88\,m/s}$

$\theta = -41.5°$

b) $\theta_f = 41.5°$

2. (30 pts) (Draw a good diagram and label it well.) A football is kicked at 25.0 m/s at an angle of 42°. I goes over a 4.00 m high fence which is 10.0 m away. (a) How long does it take to reach the fence? (b) How high above the fence is it when it passes over the fence? (c) Is it still going up or is it coming down as it goes over the fence? Show this answer with calculations.



$V_x = V_i \cos\theta$

$= 25\,\frac{m}{s} \cos 42°$

$\underline{V_x = 18.6\,\frac{m}{s}}$

$V_{iy} = V_i \sin\theta$

$= 25\,\frac{m}{s} \sin 42°$

$\underline{V_{iy} = 16.7\,\frac{m}{s}}$

$\Delta x = V_x t$

$t = \frac{\Delta x}{V_x}$

$= \frac{10\,m}{18.6\,\frac{m}{s}}$

a) $\boxed{t = 0.538\,s}$

$\Delta y = V_{iy} t + \frac{1}{2} a t^2$

$= 16.7\,\frac{m}{s}(0.538\,s) - 4.9\,\frac{m}{s^2}(0.538\,s)^2$

$\Delta y = 7.57\,m$

$\Delta y_f = 7.57\,m - 4\,m$

b) $\boxed{\Delta y_f = 3.57\,m}$

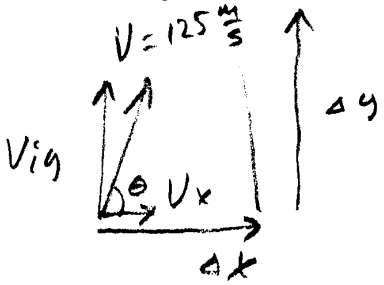
↙

$V_{fy} = V_{iy} + at$

$= 16.7\,\frac{m}{s} - 9.8\,\frac{m}{s^2}(0.538\,s)$

c) $\boxed{V_{fy} = 11.4\,\frac{m}{s}}$ ∴ going up because it is positive

3. (30 pts) (Draw a good diagram and label it well.) A model rocket is launched on level ground at 85° from the x-axis at 125 m/s. (a) How long is it in the air? (b) How high does it go? (c) How far along the x-axis does it go?



$a = 9.8 \frac{m}{s^2}$

$V_x = V_i \cos\theta$

$= 125 \frac{m}{s} \cos 85°$

$V_x = 10.9 \frac{m}{s}$

$V_{iy} = V_i \sin\theta$

$= 125 \frac{m}{s} \sin 85°$

$V_{iy} = 124.5 \frac{m}{s}$

$V_{fy}^{\,0} = V_{iy} + a t_{1/2}$

$t_{1/2} = \frac{-V_{iy}}{a}$

$= \frac{-124.5 \frac{m}{s}}{-9.8 \frac{m}{s^2}}$

$t_{1/2} = 12.7 s$

a) $\boxed{t_T = 25.4 s}$

$\Delta y = V_{iy} t_{1/2} + \frac{1}{2} a t_{1/2}^2$

$= (124.5 \frac{m}{s})(12.7 s) - 4.9 \frac{m}{s^2}(12.7 s)^2$

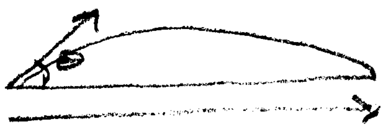
b) $\boxed{\Delta y = 791 m}$

$\Delta x = V_x t$

$= 10.9 \frac{m}{s}(25.4 s)$

c) $\boxed{\Delta x = 277 m}$

4. (EC: 15 pts) (Draw a good diagram and label it well.) A special long-jumping flea with no air resistance travels 7.25 m along level ground which takes 1.15 s. He takes off at a 35° angle with the ground. (a) What is the x-component of his speed? (b) What is the y-component of his velocity when he takes off? (c) How high above the ground does he get?



$\uparrow \Delta y = \_\ m$

$\Delta x = 7.25\ m$

$t = 1.15\ s$

$a = -9.8\ \frac{m}{s^2}$

$t_{1/2} = 0.575\ m$

$\Delta x = v_x t$

$v_x = \frac{\Delta x}{t}$

$= \frac{7.25\ m}{1.15\ s}$

a) $\boxed{v_x = 6.30\ \frac{m}{s}}$

$v_x = v_i \cos\theta$

$v_i = \frac{v_x}{\cos\theta}$

$= \frac{6.30\ \frac{m}{s}}{\cos 35°}$

$v_i = 7.69\ \frac{m}{s}$

$v_{iy} = v_i \sin\theta$

$= 7.69\ \frac{m}{s} \sin 35°$

b) $\boxed{v_{iy} = 4.41\ \frac{m}{s}}$

$\Delta y = v_{iy} t + \frac{1}{2} a t^2$

$= 4.41\ \frac{m}{s}(0.575\ s) - 4.9\ \frac{m}{s^2}(0.575\ s)^2$

c) $\boxed{\Delta y = 0.916\ m}$