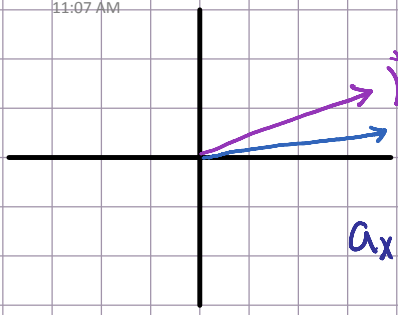
Homework 4
Chapter 3
Problems 2, 12, 14, 22, 57

Sunday, September 25, 2011
11:07 AM



$\vec{a} = ?$

$\vec{v}_1 = (625\ km/hr, 415\ km/hr)\ @\ 3.85\ s$ ($173.6\ m/s$, $115.28\ m/s$)

$\vec{v}_2 = (838\ km/hr, 365\ km/hr)\ @\ 6.52\ s$ ($232.78\ m/s$, $101.39\ m/s$)

$\Delta t = 6.52\ s - 3.85\ s = 2.67\ s$

$$a_x = \frac{v_{2x} - v_{1x}}{t} = \frac{232.78\ m/s - 173.6\ m/s}{2.67\ s} = 22.16\ m/s^2$$

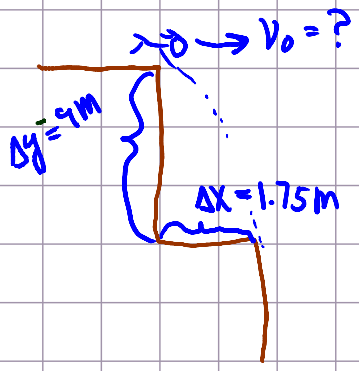
$$a_y = \frac{v_{2y} - v_{1y}}{t} = \frac{101.39\ m/s - 115.28\ m/s}{2.67\ s} = -5.2\ m/s^2$$

$$|\vec{a}| = \sqrt{a_x^2 + a_y^2} = \sqrt{(22.16\ m/s^2)^2 + (-5.2\ m/s^2)^2} = 22.76\ m/s^2$$

$$\theta = \tan^{-1}\left(\frac{a_y}{a_x}\right) = \tan^{-1}\left(\frac{-5.2\ m/s^2}{22.16\ m/s^2}\right) = 13.2^\circ \text{ below (+) x axis}$$

Chapter 3
Problem 12

Monday, September 26, 2011
10:02 AM



$$\Delta y = \cancel{v_{0y} t}^{0} + \tfrac{1}{2} a_y t^2$$

$$t = \sqrt{\frac{2\Delta y}{a_y}}$$

$$t = \sqrt{\frac{2(-9m)}{-9.8 m/s^2}}$$

$$t = 1.36 s$$

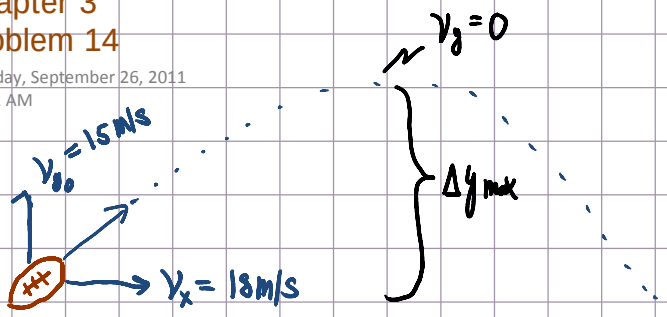
$$\Delta x = v_x t$$

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

$$v_x = \frac{1.75 M}{1.36 s} = 1.29 m/s$$

Chapter 3
Problem 14

Monday, September 26, 2011
10:02 AM



b) $v_y^2 = v_{y_0}^2 + 2a_y \Delta y_{max}$

$$\Delta y_{max} = \frac{-v_{y_0}^2}{2a_y} = \frac{-(15\,m/s)^2}{2(-9.8\,m/s^2)}$$

$$\Delta y_{max} = 11.48\,m$$

a) $v_y = v_{y_0} + a_y t$

$$t = \frac{-v_{y_0}}{a_y} = \frac{-15\,m/s}{-9.8\,m/s^2} = 1.53\,s$$

c) $\Delta y = v_{y_0} t + \frac{1}{2} a_y t^2$

$0 = t\left(v_{y_0} + \frac{1}{2} a_y t\right)$

$t = 0 \quad v_{y_0} + \frac{1}{2} a_y t = 0$

$$t = \frac{-2v_{y_0}}{a_y}$$

$$t = \frac{-2(15\,m/s)}{-9.8\,m/s^2}$$

$t = 3.06$ which is ½ of part a.

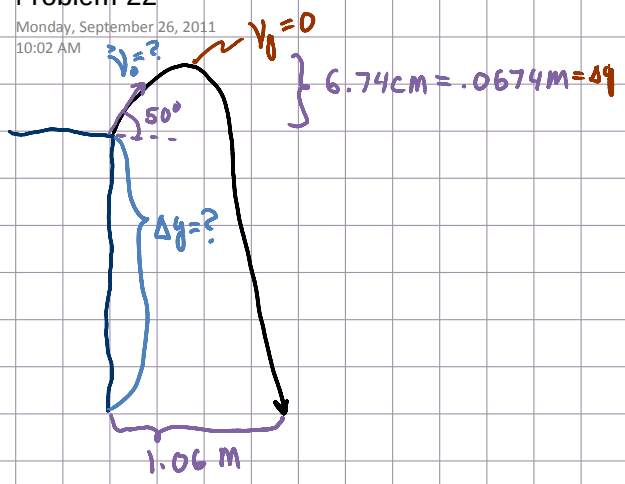
d) $\Delta x = v_x t$

$\Delta x = (18\,m/s)(3.06\,s)$

$\Delta x = 55.08\,m$ //

Chapter 3
Problem 22

Monday, September 26, 2011
10:02 AM



a) $v_y^2 = v_{y_0}^2 + 2a_y \Delta y$ ($v_y^2 \to 0$)

$v_{y_0} = \sqrt{-2a_y \Delta y}$

$v_{y_0} = \sqrt{-2(-9.8 m/s^2)(.0674 M)}$

$v_{y_0} = 1.15 m/s$

$v_{y_0} = |\vec{v}_0| \sin(50°)$

$|\vec{v}_0| = \frac{v_{y_0}}{\sin(50°)} = \frac{1.15 m/s}{\sin(50°)} = 1.5 m/s$

b) $v_x = |\vec{v}_0| \cos(50°)$

$v_x = (1.5 m/s)\cos(50°) = .96 m/s$

$\Delta x = v_x t$

$t = \frac{\Delta x}{v_x} = \frac{1.06 M}{.96 m/s} = 1.099 s$

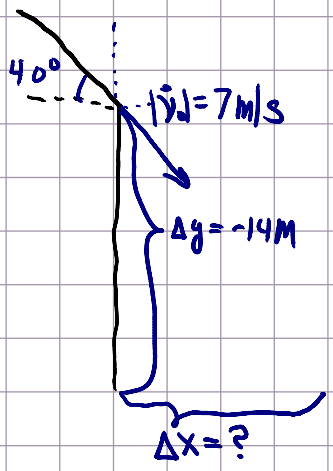
$\Delta y = v_{y_0} t + \frac{1}{2} a_y t^2$

$\Delta y = (1.15 m/s)(1.099 s) + \frac{1}{2}(-9.8 m/s^2)(1.099 s)^2$

$\Delta y = -4.66 M$ //

Chapter 3
Problem 57

Monday, September 26, 2011
10:02 AM



$$\Delta x = v_x t \qquad t = ?$$

$$v_x = |\vec{v}_0| \cos(40^\circ) = 5.36\ m/s$$
$$v_{y_0} = |\vec{v}_0| \sin(40^\circ) = -4.5\ m/s$$

$$\Delta y = v_{y_0} t + \tfrac{1}{2} a_y t^2$$

$$\tfrac{1}{2} a_y t^2 + v_{y_0} t - \Delta y = 0$$

$$t^2 + \frac{2v_{y_0}}{a_y} t - \frac{2\Delta y}{a_y} = 0$$

$$t^2 + \frac{2(-4.5\ m/s)}{-9.8\ m/s^2} t - \frac{2(-14\ m)}{-9.8\ m/s^2} = 0$$

$$t^2 + (.9185)t - (2.857\ s^2) = 0$$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-.9185 \pm \sqrt{(.9185)^2 - 4(1)(-2.857\ s^2}}{2}$$

$$t = \frac{-.9185 \pm 3.55}{2} = 1.291\ s \text{ or } -2.209\ s$$

$$\Delta x = v_x t = (5.36\ m/s)(1.291\ s) = 6.9\ m$$