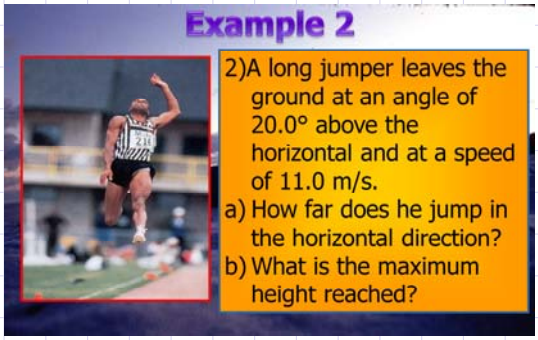
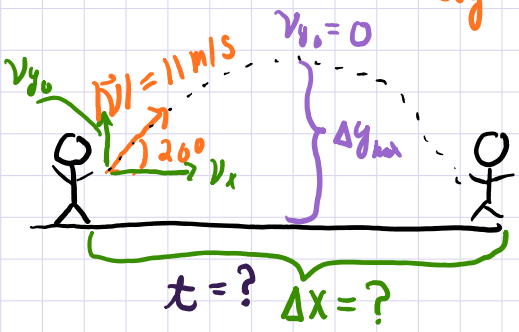
Example 2

Wednesday, September 9, 2015 7:08 AM





$v_x = |\vec{v}| \cos(20°)$
$v_x = (11\ m/s)\cos(20°)$
$v_x = 10.3\ m/s$

$v_{y_0} = |\vec{v}| \sin(20°)$
$v_{y_0} = (11\ m/s)\sin(20°)$
$v_{y_0} = 3.76\ m/s$

a) $\Delta x = v_x t$ → $\Delta x = (10.3\ m/s)(.767s)$
$\Delta x = 7.9\ m$

$\Delta y = v_{y_0} t + \frac{1}{2} a_y t^2$ ($\Delta y = 0$)

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

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

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

$\frac{1}{2} a_y t = -v_{y_0}$

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

$t = \frac{+2(3.76\ m/s)}{+9.8\ m/s^2}$

$t = .767s$

b) $v_y^2 = v_{y_0}^2 + 2 a_y \Delta y_{max}$ ($v_y = 0$)

$\Delta y_{max} = \frac{-v_{y_0}^2}{2 a_y}$

$\Delta y_{max} = \frac{+(3.76\ m/s)^2}{2(+9.8\ m/s^2)}$

$\Delta y_{max} = .72\ m$

extra: when landing

$v_y = v_{y_0} + a_y t$

$v_y = 3.76\ m/s + (-9.8\ m/s^2)(.767s)$

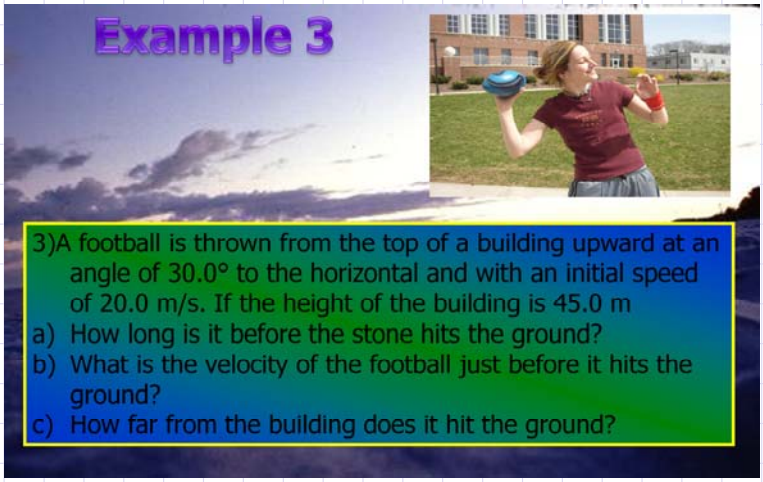
$v_y = -3.76\ m/s$

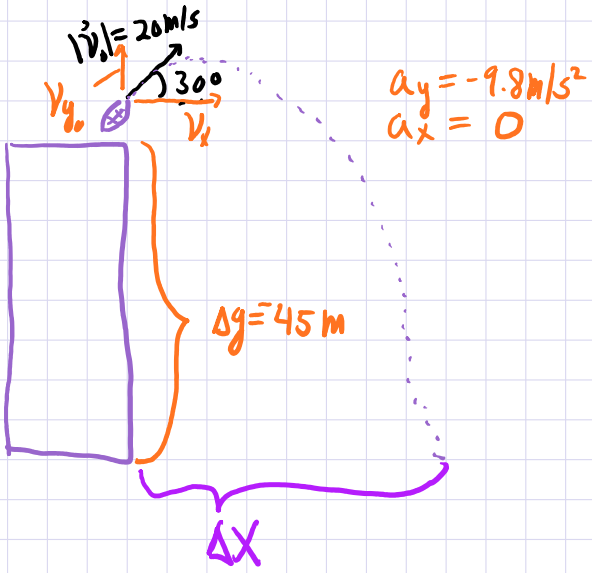
$v_x = 10.3\ m/s$

$$R = \frac{v_0^2 \sin(2\theta)}{g}$$

Example 3

Wednesday, September 9, 2015 7:08 AM





$v_x = |\vec{v}_0| \cos(30°)$ $\quad v_{y_0} = |\vec{v}_0| \sin(30°)$

$v_x = (20 m/s) \cos(30°)$ $\quad v_{y_0} = (20 m/s) \sin(30°)$

$v_x = 17.3 m/s$ $\quad v_{y_0} = 10 m/s$

a) $t = ?$

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

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

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

$t^2 + \frac{2(10 m/s)}{-9.8 m/s^2} t - \frac{2(-45 m)}{-9.8 m/s^2} = 0$

$t^2 - 2.04 s\, t - 9.18 s^2 = 0$

$a x^2 + b x + c = 0$

$1 \quad -2.04 s \quad -9.18 s^2$

$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$t = \frac{2.04 s \pm \sqrt{(-2.04 s)^2 - 4(1)(-9.18 s^2)}}{2}$

$t = \frac{2.04 s \pm 6.58 s}{2}$

$t = \frac{2.04 s + 6.58 s}{2}$ or $\frac{2.04 s - 6.58 s}{2}$

b) $v_x = 17.3 m/s$

$v_y = v_{y_0} + a_y t$

$v_y = 10 m/s + (-9.8 m/s^2)(4.31 s)$

$v_y = -32.24 m/s$

$|\vec{v}| = \sqrt{v_x^2 + v_y^2}$

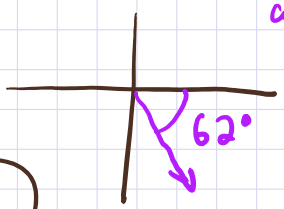
$|\vec{v}| = \sqrt{(17.3 m/s)^2 + (-32.24 m/s)^2}$

$|\vec{v}| = 36.59 m/s$

$\theta = \tan^{-1}\left(\frac{v_y}{v_x}\right)$

$\theta = \tan^{-1}\left(\frac{-32.24 m/s}{17.3 m/s}\right)$

$\theta = -61.78° \approx -62°$ below (+) x axis



$t = \frac{2.045 + 6.585}{2}$ or $\frac{2.045 - 6.585}{2}$

$t = 4.315$ or ~~-2.275~~

c) $\Delta X = V_x t$

$\Delta X = (17.3 \text{ m/s})(4.31 \text{ s})$

$\Delta X = 74.6 \text{ m}$

equations

Monday, September 14, 2015 7:55 AM

v_{y_0} a_y

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

$$\Delta y = \left(\frac{v_{y_0} + v_y}{2} \right) t$$

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

$$v_y^2 = v_{y_0}^2 + 2 a_y \Delta y$$

$$\Delta x = v_x t$$