


Example 2

Wednesday, September 9, 2015 7:08 AM

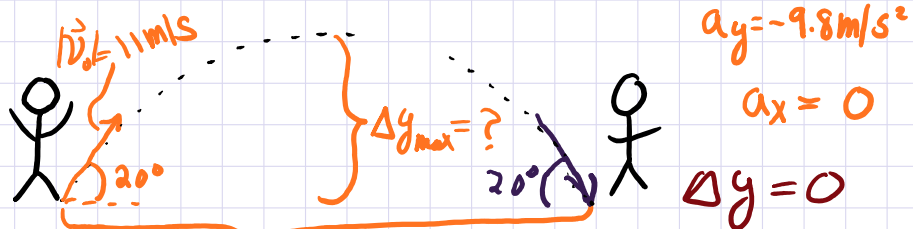
Example 2



2) A long jumper leaves the ground at an angle of 20.0° above the horizontal and at a speed of 11.0 m/s .

a) How far does he jump in the horizontal direction?

b) What is the maximum height reached?



$$v_x = |\vec{v}_0| \cos(20^\circ) = (11 \text{ m/s}) \cos(20^\circ) = 10.34 \text{ m/s}$$

$$v_{y0} = |\vec{v}_0| \sin(20^\circ) = (11 \text{ m/s}) \sin(20^\circ) = 3.74 \text{ m/s}$$

$$\Delta y^0 = v_{y0} t + \frac{1}{2} a_y t^2$$

$$0 = v_{y0} t + \frac{1}{2} a_y t^2$$

$$0 = (v_{y0} + \frac{1}{2} a_y t) t$$

$$t = 0 \quad v_{y0} + \frac{1}{2} a_y t = 0$$

$$\frac{1}{2} a_y t = -v_{y0}$$

$$t = \frac{-2v_{y0}}{a_y}$$

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

$$t = .775$$

$$\Delta X = v_x t$$

$$\Delta X = (10.34 \text{ m/s})(.775)$$

$$\Delta X = 7.96 \text{ m}$$

$$v_x = 10.34 \text{ m/s}$$

$$v_y = -3.7 \text{ m/s}$$

b) Δy_{max}

$$v_y^2 = v_{y0}^2 + 2 a_y \Delta y_{\text{max}}$$

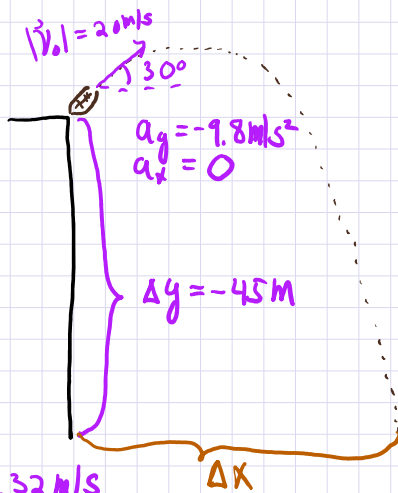
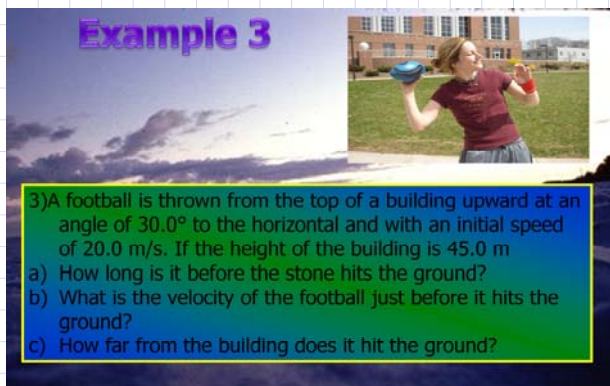
$$\Delta y_{\text{max}} = \frac{-v_{y0}^2}{2 a_y}$$

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

$$\Delta y_{\text{max}} = .698 \text{ m}$$

Example 3

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$$v_x = |v_0| \cos(30^\circ) = (20 \text{ m/s}) \cos(30^\circ) = 17.32 \text{ m/s}$$

$$v_y = |v_0| \sin(30^\circ) = (20 \text{ m/s}) \sin(30^\circ) = 10 \text{ m/s}$$

a) $\Delta y = v_{y0} t + \frac{1}{2} a_y t^2$

$$\frac{1}{2} a_y t^2 + v_{y0} t - \Delta y = 0$$

$$t^2 + \frac{2v_{y0}}{a_y} t - \frac{2\Delta y}{a_y} = 0$$

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

$$1t^2 - 2.045t - 9.195 = 0$$

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

$$t = \frac{2.045 \pm \sqrt{(-2.045)^2 - 4(1)(-9.195)}}{2}$$

$$t = \frac{2.045 \pm \sqrt{40.885}}{2} = \frac{2.045 \pm 6.395}{2}$$

$$t = \frac{2.045 + 6.395}{2} \quad \text{or} \quad \frac{2.045 - 6.395}{2}$$

$$t = 4.22 \text{ s}$$

~~$$-2.25$$~~

b) $v_x = 17.32 \text{ m/s}$

$$v_y = v_{y0} + a_y t$$

$$v_y = (10 \text{ m/s}) + (-9.8 \text{ m/s}^2)(4.22 \text{ s})$$

$$v_y = -31.356 \text{ m/s}$$

$|\vec{v}| = ?$
 $\theta = ?$

c) $\Delta x = v_x t$

$$\Delta x = (17.32 \text{ m/s})(4.22 \text{ s}) = 73.1 \text{ m}$$