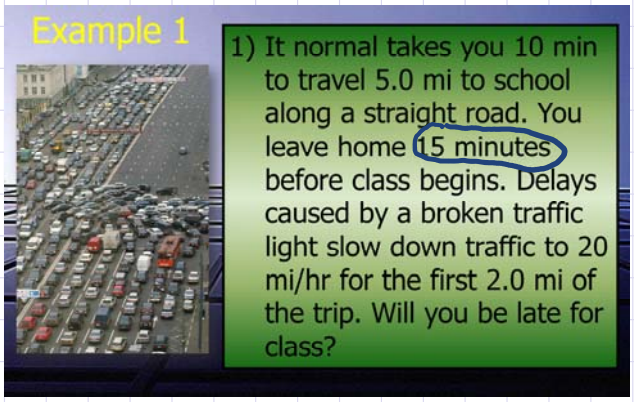
Example 1

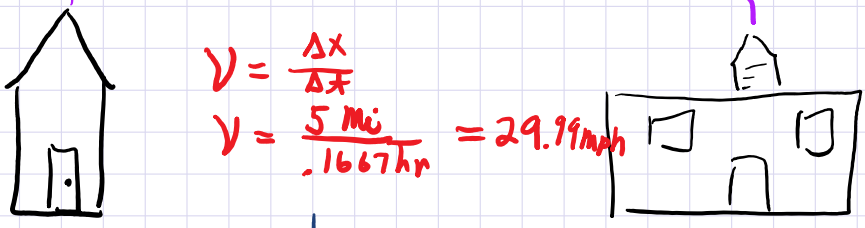
Sunday, August 23, 2015 12:32 PM



$\Delta t_{tot} = \Delta t_1 + \Delta t_2$

$\Delta t_{tot} = 12 \text{ min}$

$\Delta X = 5 \text{ mi}$ $\quad \Delta t = 10 \text{ min}\left(\frac{1 \text{ hr}}{60 \text{ min}}\right) = .1667 \text{ hr}$



$v = \frac{\Delta X}{\Delta t}$

$v = \frac{5 \text{ mi}}{.1667 \text{ hr}} = 29.99 \text{ mph}$

$v_1 = 20 \text{ mph}$

$\Delta X_1 = 2 \text{ mi}$

$\Delta t_1 = ?$

$v_1 = \frac{\Delta X_1}{\Delta t_1}$

$\Delta t_1 = \frac{\Delta X_1}{v_1}$

$\Delta t_1 = \frac{2 \text{ mi}}{20 \frac{\text{mi}}{\text{hr}}}$

$\Delta t_1 = .1 \text{ hr}$

$\Delta t_1 = .1 \text{ hr}\left(\frac{60 \text{ min}}{1 \text{ hr}}\right) = 6 \text{ min}$

$\Delta X_2 = 3 \text{ mi}$

$\Delta t_2 = ?$

$\Delta t_2 = \frac{\Delta X_2}{v}$

$\Delta t_2 = \frac{3 \text{ mi}}{29.99 \text{ mi/hr}}$

$\Delta t_2 = .1 \text{ hr}$

$\Delta t_2 = 6 \text{ min}$

Example 2

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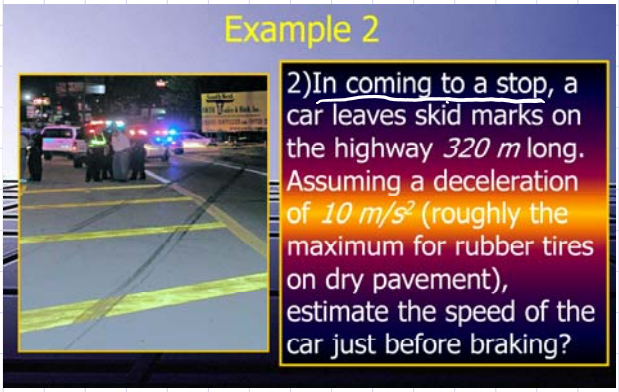

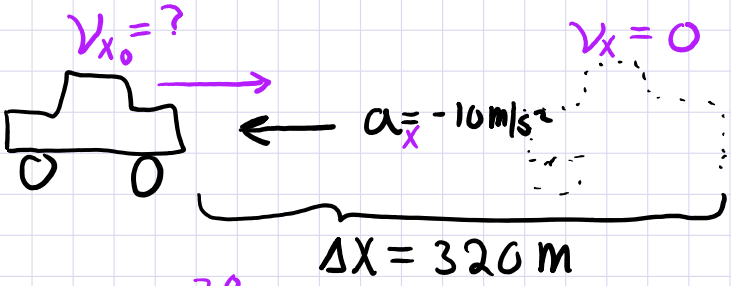

$$v_x^2 = v_{x_0}^2 + 2a_x\Delta x \quad (v_x = 0)$$

$$v_{x_0} = \sqrt{-2a_x\Delta x}$$

$$v_{x_0} = \sqrt{+2(+10\ m/s^2)(320m)}$$

$$v_{x_0} = 80\ m/s$$

Example 3

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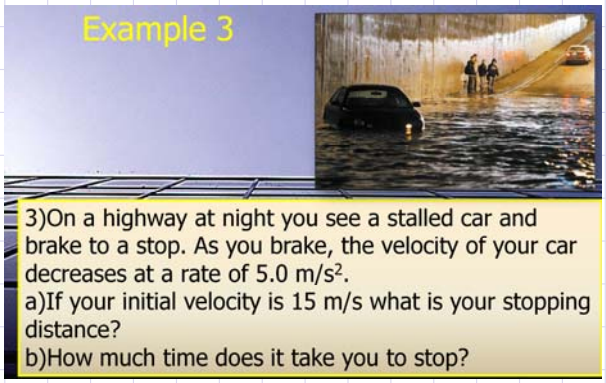

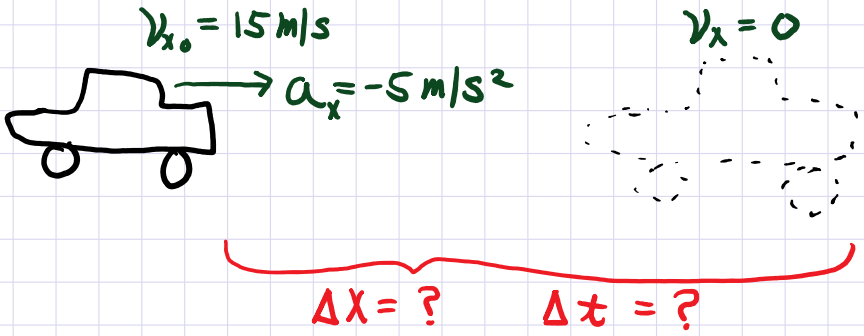

b) $t = ?$

$v_x = v_{x_0} + a_x t$ ($v_x \to 0$)

$t = \frac{-v_{x_0}}{a_x}$

$t = \frac{-15\ m/s}{-5\ m/s^2}$

$t = 3\ s$

a) $\Delta x = ?$

$\Delta x = v_{x_0} t + \frac{1}{2} a_x t^2$

$\Delta x = (15\ m/s)(3s) + \frac{1}{2}(-5\ m/s^2)(3s)^2$

$\Delta x = 45\ m - 22.5\ m$

$\Delta x = 22.5\ m$

Example 4

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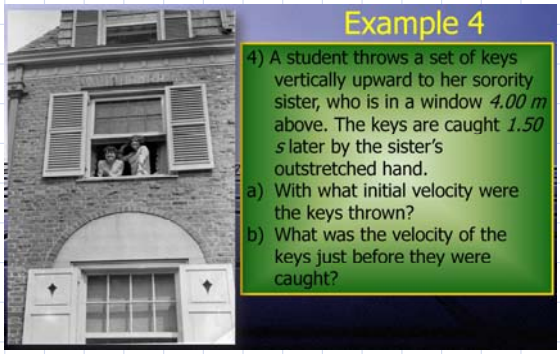

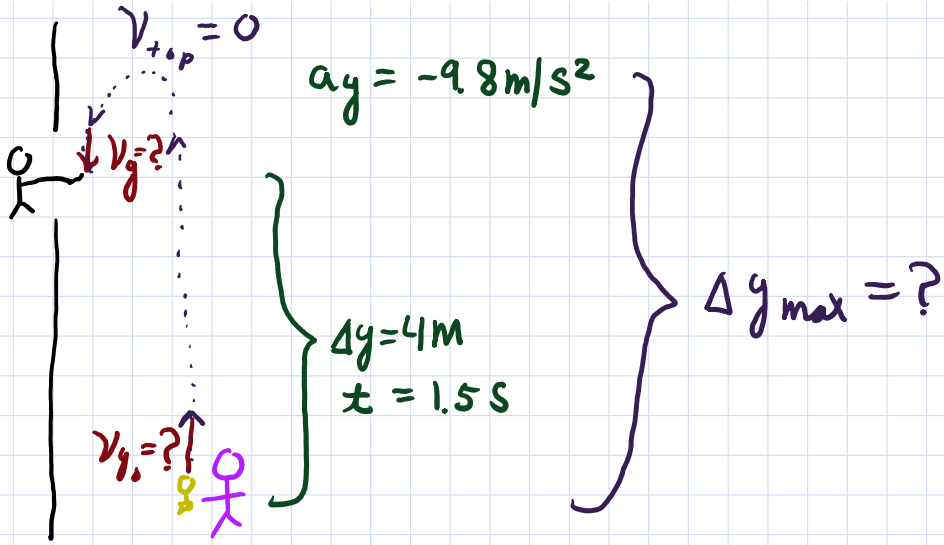

a) $\Delta y = v_{y_0} t + \frac{1}{2} a_y t^2$

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

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

$v_{y_0} = \frac{4\ m}{1.5\ s} + \frac{1}{2}(+9.8\ m/s^2)(1.5\ s)$

$v_{y_0} = 10.0167\ m/s \approx 10.02\ m/s$

b) $v_y = ?$

$v_y = v_{y_0} + a_y t$

$v_y = (10.0167\ m/s) + (-9.8\ m/s^2)(1.5\ s)$

$v_y = -4.68\ m/s$

c) $\Delta y_{max} = ?$

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

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

$\Delta y_{max} = \frac{-v_{y_0}^2}{2 a_y} = \frac{+(10.0167\ m/s)^2}{2(+9.8\ m/s^2)}$

$\Delta y_{max} = 5.12\ m$

Example 5

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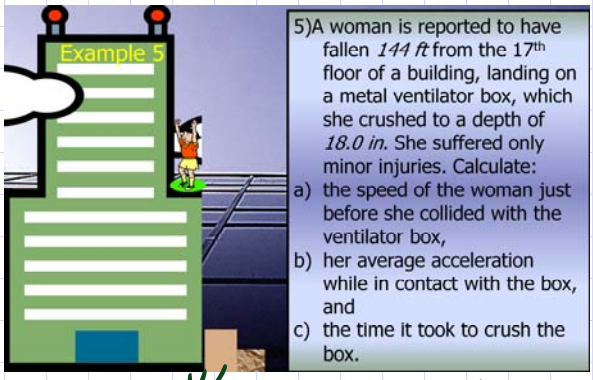
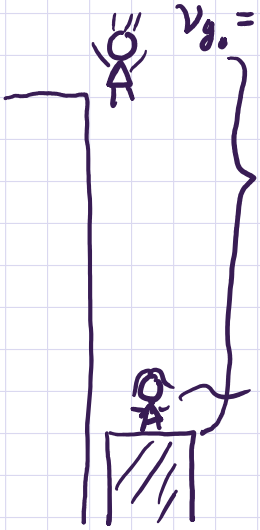


5) A woman is reported to have fallen *144 ft* from the 17th floor of a building, landing on a metal ventilator box, which she crushed to a depth of *18.0 in*. She suffered only minor injuries. Calculate:

a) the speed of the woman just before she collided with the ventilator box,

b) her average acceleration while in contact with the box, and

c) the time it took to crush the box.



$a_y = -9.8 m/s^2$

$\Delta y = -144 \text{ft} \left(\frac{1m}{3.28 \text{ft}}\right) = -43.9m$

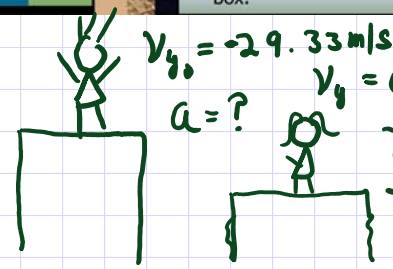
a) $v_y^2 = v_{y_0}^2 + 2a_y \Delta y$ ($v_{y_0} \to 0$)

$v_y = \sqrt{2 a_y \Delta y}$

$v_y = \sqrt{2(+9.8 m/s^2)(+43.9m)}$

$v_y = -29.33 \text{ m/s}$

b)



$-18 \text{ in} \left(\frac{1 \text{ft}}{12 \text{in}}\right)\left(\frac{1m}{3.28 \text{ft}}\right)$

$\Delta y = -.4573m$

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

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

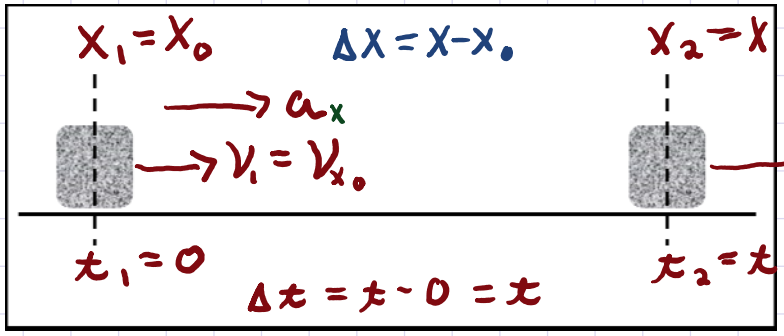
$a_y = \frac{-(-29.33 m/s)^2}{2(-.4573m)}$

$a_y = 940.57 \text{ m/s}^2$

c) $v_y = v_{y_0} + a_y t$ ($v_y \to 0$)

$t = -\frac{v_{y_0}}{a_y} = +\frac{(-29.33 m/s)}{940.57 m/s^2}$

$t = .0312 s$



$$\bar{v} = \frac{\Delta x}{\Delta t}$$

$$\frac{v_x + v_{x_0}}{2} = \frac{\Delta x}{t}$$

① $$\Delta x = \left[\frac{v_x + v_{x_0}}{2}\right] t$$

No a!

$$\Delta x = \frac{(v_{x_0} + a_x t + v_{x_0})}{2} t$$

$$\Delta x = \frac{(2v_{x_0} + a_x t)}{2} t$$

③ $$\Delta x = v_{x_0} t + \tfrac{1}{2} a_x t^2$$

No v_x

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

$$a_x = \frac{v_x - v_{x_0}}{t}$$

② $$v_x = v_{x_0} + a_x t$$

No Δx

$$\Delta x = \left(\frac{v_x + v_{x_0}}{2}\right) t$$

$$t = \Delta x \left(\frac{2}{v_x + v_{x_0}}\right)$$

$$v_x = v_{x_0} + a_x \left[\Delta x \left(\frac{2}{v_x + v_{x_0}}\right)\right]$$

$$v_x = v_{x_0} + 2 a_x \Delta x \left(\frac{1}{v_x + v_{x_0}}\right)$$

$$v_x - v_{x_0} = 2 a_x \Delta x \left(\frac{1}{v_x + v_{x_0}}\right)$$

$$(v_x + v_{x_0})(v_x - v_{x_0}) = 2 a_x \Delta x$$

$$v_x^2 - v_{x_0}^2 = 2 a_x \Delta x$$

④ $$v_x^2 = v_{x_0}^2 + 2 a_x \Delta x$$

No t