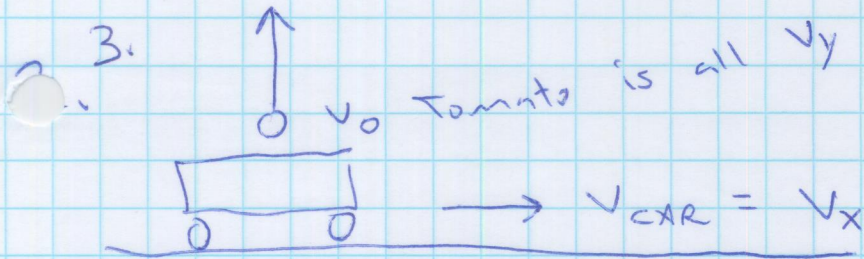


## Group problems #2

1. You are dropping supplies to a research group on a small island. As you fly over the island, should you release the supply package as you are directly over the island, before you reach it, or after you have passed it? Make a motion diagram of the package after you release it to explain.
2. To shoot an arrow into a target, should you aim the arrow directly at the target? Above it? Below it? Explain why.
3. You are traveling in a convertible with the top down. The car is moving at a constant velocity of  $25 \text{ m/s}$ , due east along flat ground. You throw a tomato straight upward at an initial speed of  $11 \text{ m/s}$ . How far has the car moved when you get a chance to catch the tomato? Where relative to you does the tomato land, if there is no air resistance?
4. A hot-air balloon is rising straight up with a speed of  $3.0 \text{ m/s}$ . A ballast bag hanging on the side of the gondola breaks loose when the gondola is  $9.5 \text{ m}$  above the ground. How much time elapses before the ballast bag hits the ground?

GP # 2

↑ +



What is  $\Delta t$   
as tomato  
goes up &  
back down.

To Apex:

$$v_{APEX} = v_0 + g \Delta t_A$$
$$0 = (+11 \text{ m/s}) + (-9.8 \text{ m/s}^2) \Delta t_A$$

$$\Delta t_A = 1.12 \text{ s}$$

so total  
time in air =  $2 \Delta t_{APEX} = 2.24 \text{ s}$

During this time, car travels

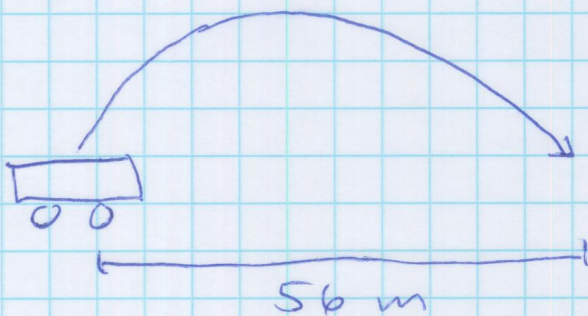
$$\Delta x = v_0 \Delta t + \frac{1}{2} a_x \Delta t^2$$

$$\Delta x = (25 \text{ m/s}) (2.24 \text{ s}) + 0$$

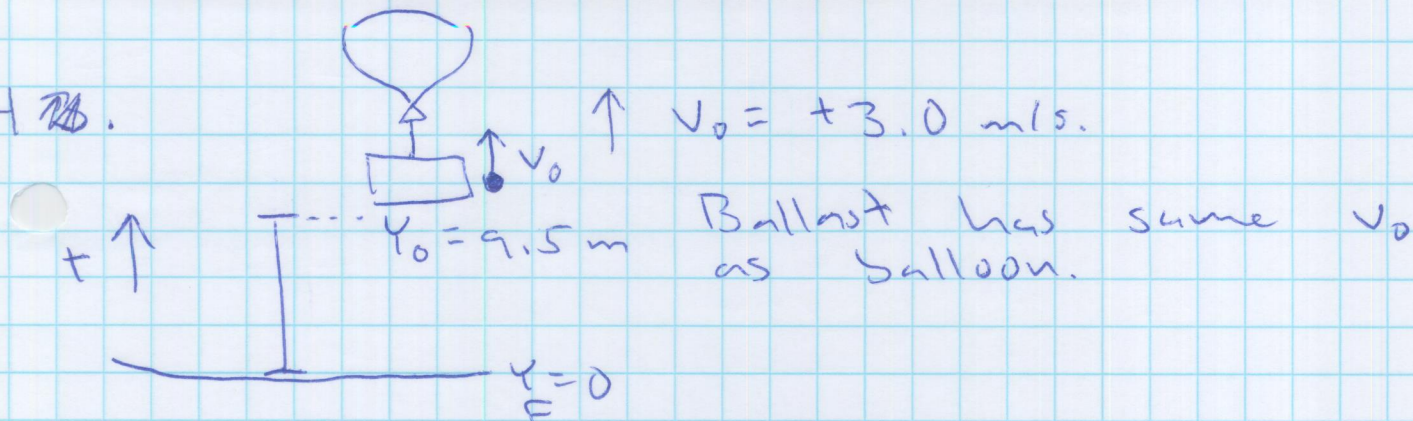
$$\Delta x = 56 \text{ m}$$

Tomato also has  $v_x = 25 \text{ m/s}$ .  
So lands back in car.

Tomato's actual path is



4 ~~78~~.



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

$$0 = 9.5 \text{ m} + \left(+3.0 \frac{\text{m}}{\text{s}}\right) \Delta t + \frac{1}{2} (-9.8 \text{ m/s}^2) \Delta t^2$$

$$4.9 \Delta t^2 + -3 \Delta t + -9.5 = 0$$

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

$$t = \frac{3 \pm \sqrt{3^2 - 4(4.9)(-9.5)}}{2(4.9)}$$

$$t = \frac{3 \pm 14}{9.8}$$

$$t = 1.73 \text{ s}$$