

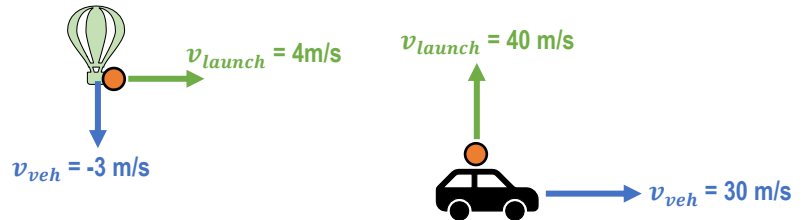
CONCEPT: RELEASING OR LAUNCHING PROJECTILES FROM MOVING VEHICLES

- You'll need to solve problems where projectiles are launched from vehicles *already moving* with velocity (_____).
- IF a projectile is simply dropped/released, then the moving vehicle and projectile move at the _____ velocity.

PROJECTILE DROPPED / RELEASED



PROJECTILE LAUNCHED / THROWN



$$v_{proj} = \underline{\hspace{2cm}}$$

- v_{proj} is the _____ of the launch velocity and the velocity it BORROWS from the moving vehicle.

EXAMPLE: A cart carrying a vertical missile launcher moves horizontally at a constant 60m/s to the right. The missile launches vertically upward at 80 m/s. What is the maximum height achieved by the rocket?



PROJECTILE MOTION

- 1) Draw paths in X&Y and points of interest
(Points of Interest: initial, final, max height, etc.)
- 2) Determine target variable
- 3) Determine interval and UAM equation
- 4) Solve

UAM EQUATIONS

X	Y
$\Delta x = v_x t$	$(1) v_y = v_{0y} + a_y t$ $(2) v_y^2 = v_{0y}^2 + 2a_y \Delta y$ $(3) \Delta y = v_{0y} t + \frac{1}{2} a_y t^2$ $*(4) \Delta y = \frac{1}{2} (v_{0y} + v_f) t$

VECTOR EQs

$$A = \sqrt{A_x^2 + A_y^2}$$

$$\theta_x = \tan^{-1} \left(\frac{|A_y|}{|A_x|} \right)$$

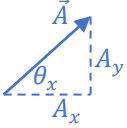
$$A_x = A \cos(\theta_x)$$

$$A_y = A \sin(\theta_x)$$

PROBLEM: A small plane flies horizontally at 20m/s at an altitude of 200m, when it launches a projectile at a speed of 65 m/s at 22.6° below the horizontal. What horizontal distance does the projectile travel before hitting the ground?

- A) 752 m
- B) 344 m
- C) 184 m
- D) 920 m

PROJECTILE MOTION
1) Draw paths in X&Y and points of interest <i>(Points of Interest: initial, final, max height, etc.)</i> 2) Determine target variable 3) Determine interval and UAM equation 4) Solve

UAM EQUATIONS		VECTOR EQs
X	Y	 $A = \sqrt{A_x^2 + A_y^2}$ $\theta_x = \tan^{-1} \left(\frac{ A_y }{ A_x } \right)$ $A_x = A \cos(\theta_x)$ $A_y = A \sin(\theta_x)$
$\Delta x = v_x t$	(1) $v_y = v_{0y} + a_y t$ (2) $v_y^2 = v_{0y}^2 + 2a_y \Delta y$ (3) $\Delta y = v_{0y} t + \frac{1}{2} a_y t^2$ *(4) $\Delta y = \frac{1}{2} (v_{0y} + v_f) t$	