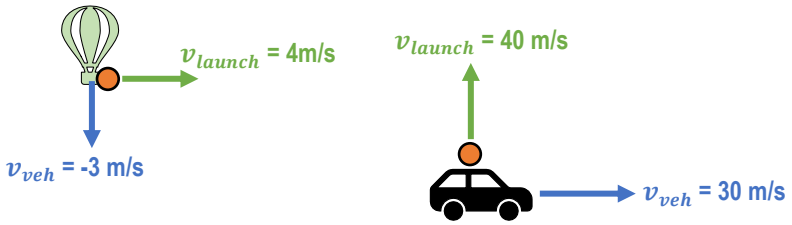
CONCEPT: RELEASING OR LAUNCHING PROJECTILES FROM MOVING VEHICLES

- 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

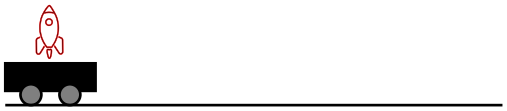
PROJECTILE LAUNCHED / THROWN



v_{proj} = _____

- 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?



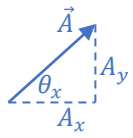
PROJECTILE MOTION

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



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

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

$A_x = A\cos(\theta_x)$

$A_y = A\sin(\theta_x)$

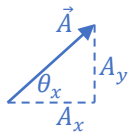
PROBLEM: A small plane flies horizontally at 20m/s at an altitude of 200m, when it launches a projectile at a speed of 65 m/s at 22.6° below the horizontal. What horizontal distance does the projectile travel before hitting the ground?

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

PROJECTILE MOTION
1) Draw paths in X&Y and points of interest *(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



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