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SNHU

5/22/23

# DIAGRAM

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| Create a diagram describing the horizontal and vertical motion of the payload. Remember that your diagram should visually represent the motion of the payload. |
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# INITIAL CALCULATIONS

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| Provide your calculations, including all relevant steps are included and your units are labeled. |

Given initial height at 2650 meters and miles per hour at 250

Gravity is a constant 9.8

X = (velocity)(t)

T(squared) = 2650(initial height) / 4.9(half of gravity) = 540.82

Square root t =23.26

Convert mph to meters per hour by multiplying by 1609.344 to get 402336meters an hour then divide by 3600 to get the m/s at 111.76 for x direction

For y movement

y=yo+vyo(t)+1/2ay(t)^2

2650(initial height)= 0(initial velocity)(times time) + 4.9(1/2 of gravity) times t(time)

2650 = 4.9t^2

T(squared) = 2650(initial height) / 4.9(half of gravity) = 540.82

Square root t =23.26

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| Describe the components of the kinematics equations used in your initial calculations below. |

I was given the distance from the ground at 2650 meters and the miles per hour of the payload at 250.

For y movement I use the initial height(y) = initial velocity(yo) + ½ gravity(a) time (t) squared equation to find my vertical velocity. 2650(initial height) = 0(initial velocity) (time)^2(23.26)^2 (4.9)(1/2 of gravity) 23.26^2(time)^2

2650 = 4.9t^2

Since our x movement is in a different measurement system than the y movement, convert it to meters. 1 mile is equal to 1609.344 meters, so I have to multiply 250mph by 1609.344m and get 402336 meters an hour then divide by 3600 for the seconds to get 111.76m/s

# MODIFIED SCENARIO ONE

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| Headwind in my area is 7mph on 5/22/23 |

## Diagram

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## Description

I chose to use my area’s head wind, Meadville, PA at 7 mph. to make it easier on myself I will convert it to meters a second by multiplying 7 by 1609.344 = 11265.408/3600 = 3.13m. All that I need to do for this is subtract 3.13m/s from my horizontal velocity of 111.76 to get 108.63m/s and multiply it by time (23.26) to get 2526.73 leading the payload to be dropped at 2526.73 instead.

# MODIFIED SCENARIO TWO

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| This catapult is located at a fixed point 400 meters away and 50 meters below the target site. The catapult is capable of launching the payload at 67 meters per second and an initial launch angle of 50 degrees. Using your knowledge of kinematics equations, determine whether this would be sufficient to deliver the payload to the drop site. |

## Diagram

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Given distance of 400m from target

Height of 50m below target

Initial speed of 67 m/s

Angle of 50 degrees

Y velocity 67\*sin(50)= 51.3

X velocity 67\*cos(50) = 43.6

Change in y = velocity(time)+-1/2 gravity)(time^2)

Y=51.3(9.29) +-4.9(9.29)^2 = 53.68691 making the catapult sufficient enough to deliver the payload over the cliff.

Adding the headwind changed the velocity of the plane by making it go slower. This made the plane travel less distance and thus delivered the payload closer to the starting point since it was still travelling for the same amount of time. The plane would need to fly for a longer duration if it was to deliver at the drop site.

Changing to a catapult instead of a plane had a shorter distance to target and the catapult was lower than the ground making it questionable whether it would deliver the payload.