**A&L Engineering**

**Supply Drop Plan**

**Instructions:** Respond to the prompts in the tables below and replace the text in brackets.

# 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. |

**Initial Horizontal Velocity**

250 mph

1 Km = 0.62 miles

1 mile = 1.61 km

250 x 1.61 = 402 Kmh

**Initial Vertical Velocity**

N/A = 0 Kmh

g = 9.80 m/s (rate of falling object in a vacuum)

**Solve for x**

Y = ---------- First we must solve for t

0 = -2650 + 4.9 ------------ (4.9 = g / 2)

2650 = 4.9

540.82 =

t = 23.26

x =

x = 0.11 Km/s \* 23.26

x = 2.6 Km

**Final Horizontal Velocity**

V = 402 Km/h

**Final Vertical Velocity**

141.64mp/h = 227.95 km/h

V =

V = 0 – 9.80(0.11)

V = -288

## Description

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

* Vertical and Horizontal Velocity are looked at as two different dimensions. Horizontal motion in the scenario remains constant at 250 mph (converted to 402.34 Kmh for proper units). There is acceleration of 0, since there is no change in horizontal velocity. Vertical velocity does change within the scenario due to gravity acting as a force upon the payload.
* First, we start with finding the vertical motion. There is no initial vertical velocity given, so we set it initially to 0. We then use the kinematic equation . This equation will assist in finding the final vertical velocity. Since the object is falling, the vertical velocity will be signed negative.
* The payload will be launched at a horizontal motion, which as stated, has a constant velocity at 402 KmH. The concept on vectors was used to solve this part of the problem. This was used to find this part because magnitude and direction will need to be accounted for.

# MODIFIED SCENARIO ONE

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| --- |
| Create a diagram showing the first modified scenario. Then adjust your initial calculations to incorporate the changing variables from the scenario and describe how these changed variables affect your calculations. |

## Diagram

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## Description

* The modification to the scenario is the fact that there is a headwind on the plane. The plane is flying through Jefferson City, MO, with the windspeed just under 10mph or 16 km/h.
* With the new force pushing on the plane, this will affect horizontal velocity of the payload when it is dropped.
* After calculating the external force, the horizontal velocity is negatively effected, creating a smaller window for the drop zone. The payload would have to be released closer to the drop zone.
* We then subtract the headwind from the constant horizontal velocity to get 386 km/h
* meaning the plane will have to drop the payload 2.54km from the drop zone now. The headwind affected this by 0.46km difference

# MODIFIED SCENARIO TWO

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| --- |
| Create a diagram showing the second modified scenario. Then adjust your initial calculations to incorporate the changing variables from the scenario and describe how these changed variables affect your calculations. |

## Diagram

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## Description

Horizontal Distance(d) = 400m

Height(h) = 50m

Launch angle (a) = 50 degrees

Initial launch velocity(v) = 67 m/s

* We have all the initial parts needed to calculate what is needed
* We will now calculate to ensure the payload will reach the dropzone safely through this method by using the equation v\*cos(a)
* = 64.65
* Now that we have v(x) , we must find v(y).
* = -17.58
* Next we find t with t = = = 6.19
* Next we must find vertical distance upward, so it will be positive in our solution. This is due to throwing an object upward over a space, making it positive.
* = (-17.58)(6.19) + 25(6.19)^2 = 78.56 m
* Since this distance in elevation is below this (50m) , the payload will reach the drop zone safely.