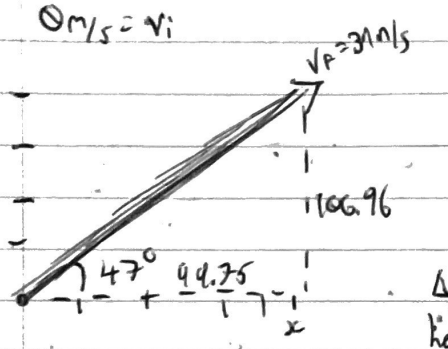
# Rocket problem

part 1 First were going to focus on just the acceleration of the rocket.

| given: | find: |
|---|---|
| $47° = \theta$ | $? = \Delta y$ |
| $7.5s = t$ | $? = \Delta x$ |
| $5.2 m/s^2 = a$ | $? = v_f$ |
| $0 m/s = v_i$ | |

- I decided to get $v_f$, along with $\Delta y$ and $\Delta x$.
$\Delta x$ is the goal of the problem and $\Delta y$ is needed for later steps (when package hits ground)
- $v_f$ is also needed for the projectile portion




Since the rocket is accelerating at an angle, we need to incorporate that into the equation.
I used the equation $\Delta x = v_i \cdot t + \frac{1}{2} a t^2$

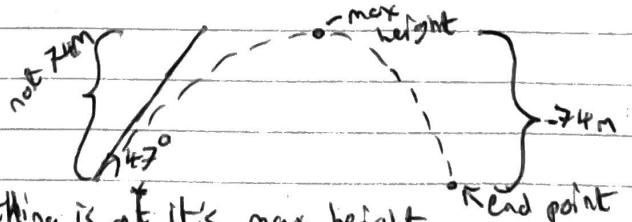
$\Delta y = 0 \cdot 7.5 + 5.2 \sin(47) 7.5^2$
Height = 106.96 m

$\Delta x = 0 \cdot 7.5 + 5.2 \cdot \cos(47) 7.5^2 = 99.75$ m
Distance it travelled east →

I also used $v_f = v_i + at$
$v_f = 0 + 5.2 * 7.5$
$v_f = 39 m/s$

part 2 From there I needed to find only $\Delta y$ and $\Delta x$ until the parachute opened.
Now the rocket was a projectile, that stopped a 74m below its peak.

given:
$v_i = 39 m/s$
$\theta = 47°$
$a = -9.8 m/s^2$




Given when something is at it's max height, its $v_f$ is 0, I was able to calculate the time it took to reach its apex.

$v_f = v_i + a \cdot t$
$0 = 39 \cdot \sin 47 + -9.8 \cdot t$
$t = 2.9 s$

I then used $\Delta y = \left(\frac{v_i + v_f}{2}\right) \cdot t$ to find the distance travelled up.
I then added all the $\Delta y$s:
$106.96 + 41.38 - 74 = 74.29$ m ← height before parachute

$\Delta y = \left(\frac{39 \cdot \sin 47 + 0}{2}\right) \cdot 2.9$
$\Delta y = 41.38$ m

I also calculated the time it would take to fall using $\Delta y = v_i \cdot t + \frac{1}{2} a t^2$
$-74 = 0 \cdot t + -9.8 \cdot \frac{1}{2} \cdot t^2$
$t = 3.88$

I then added the times and got $\Delta t = 6.78$ and multiplied by the velocity ($39 \cdot \cos 47$) because $v_x$ is constant due to no outside forces acting on it. I got 180.25 m summing $\Delta x = 250$ m east in the whole trip.

part 3 This was the easy part. $\Delta x = 280\,m$ and $\Delta y = 74.29\,m$. Since the parachutes velocities are given, and no acceleration is acting on them, we just need to find the time it takes for it to fall to the ground, and see how far it goes west.

| given: | Find: | | |
|---|---|---|---|
| $y_i = 74.29\,m$ | $\Delta x = ?$ | First find t: | See how far it travelled west |
| $x_i = 280\,m$ | | $-74.29 = -8 \cdot t$ → | $\Delta x = -15 \cdot 9.28$ |
| $v_x = -15\,m/s$ | | $t = 9.28\,s$ | $\Delta x = 139.2\,m$ |
| $v_y = -8\,m/s$ | | | $280 - 139.2 = \boxed{140.8\,m}$ |

- The rocket lands 140.8 m east of where it launched from.