Multi-Step Rocket Problem

Vx/Vy too

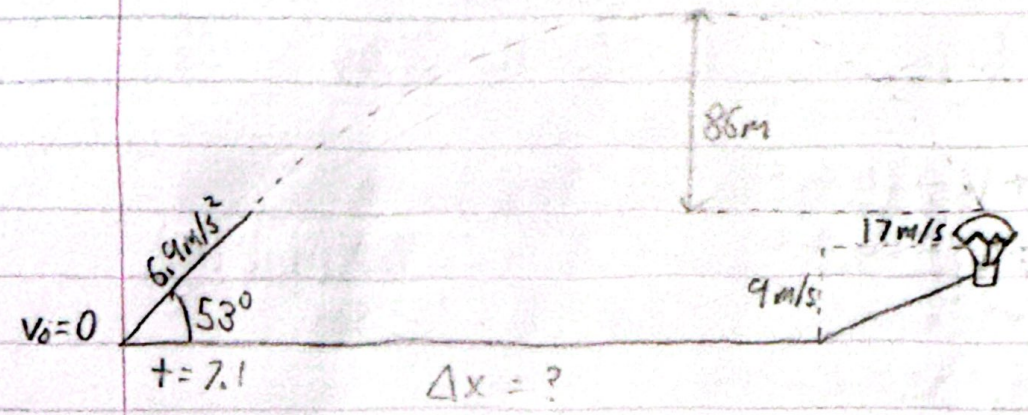
$V = \frac{\Delta x}{\Delta t} / \Delta x = V \cdot t$

$V = V_0 + at$

$\Delta x = \left(\frac{V_0 + V}{2}\right) t$

$V^2 = V_0^2 + 2a\Delta x$

$x = x_0 + v_0 t + \frac{1}{2}at^2$



Step 1: Engine Burn

$V = V_0 + at$

$V = 6.9 \cdot 7.1$

$V = 48.99$

$V_x = 48.99\cos(53) = 29.4829$

$V_y = 48.99\sin(53) = 39.1252$

$x = \left(\frac{29.4829}{2}\right)(7.1)$ $y = \left(\frac{39.1252}{2}\right)(7.1)$

$\Delta x = 104.664\text{ m}$ $y = 138.894\text{m}$

Step 2: Free Fall ↑

$y = y_0 + v_0 t + \frac{1}{2}at^2$

$y = 138.894 + 39.1252t - 4.9t^2$

graphed

$y = 217$ $x/t = 3.99$

$\Delta x = V_x \cdot \Delta t$

$\Delta x = 29.4829 \cdot 3.99$

$\Delta x = 117.637\text{ m}$

max h = 217m t @ max = 11.095

Continued

$\Delta h = 86m$

Step 3: Free Fall ↓

$h_f = 131 \quad h_0 = 217m$

$131 = 217 + V_y t - 4.9t^2$

$0 = 86 + V_y t - 4.9t^2$

$-86 = -4.9t^2$

$4.18939 = t$

$\Delta x = V_x \cdot t$

$\Delta x = 29.4824(4.18939)$

$\Delta x = 123.515$

Step 4: Parachute

$h_0 = 40m \quad h_f = 0m$

$V_x = -17 \text{ m/s} \quad V_y = -9 \text{ m/s}$

$131 = V_y \cdot t$

$131 = 9t$

$14.5556 = t$

$\Delta x = V_x \cdot t$

$\Delta x = -17 \cdot 14.5556$

$\Delta x = -247.445$

Step 5: Calculate

$\Delta x = 104.664m + 117.637m + 123.515m - 247.445m$

$\Delta x = 98.371 m$