A rocket accelerates for 4.5 s, straight up. Its acceleration is 33 m/s\(^2\). How high did it go?

\[ V_f = V_i + at \]
\[ D = V_i T + \frac{1}{2} aT^2 \]
\[ V_f^2 = V_i^2 + 2aD \]

\[ D_1 = 334.13 \text{ m} \]
\[ V_f = 0 + 33(4.5) \]
\[ V_f = 148.5 \text{ m/s} \]

\[ D_2 = 1125.11 \text{ m} + 334.13 \text{ m} \]

\[ D_T = 1459.24 \text{ m} \]
Projectile motion Ch 3
What would hit the ground first, something moving with a horizontal velocity, or something dropped straight down at the exact same time?
How to solve a projectile problem
1. Break it into X and Y components
2. Write down what you are given and what you need to find
3. May have to solve in the X direction first

Evan runs off a 20 m cliff at 5m/s, How long is he in the air? How fast is he going when he hits the ground? How far out did he go? At what angle did he hit the ground with?

\[
\begin{align*}
Y & \quad X \\
\Delta D= & \quad t= \\
V_i= & \quad V_x= \\
V_f= & \quad \Delta X= \\
a= & \quad \quad \quad \quad \\
t= & \quad \\
V_o= & \quad \quad \quad \quad \\
Angle= & \quad 
\end{align*}
\]
3) \[ D = V_i T + \frac{1}{2} a T^2 \]
\[ D = 0 + \frac{1}{2} (9.8)(1.7)^2 \]
\[ D = 2.4 \text{m} \]

6) \[ D = V_i T + \frac{1}{2} a T^2 \]
\[ 54 = 0 + \frac{1}{2} (9.8) T^2 \]
\[ T = 3.32 \text{ s} \]

Y
- \[ V = ? \]
- \[ V_i = 0 \]
- \[ a = 9.8 \text{ m/s}^2 \]
- \[ V_f = ? \]
- \[ T = ? \]

X
- \[ V = 28.7 \text{ m/s} \]
- \[ D = 19.6 \text{ m} \]
- \[ T = 3.32 \text{ s} \]
- \[ D = VT \]
- \[ 130 = V(3.32) \]
- \[ V = 39.16 \text{ m/s} \]
16)

\[ V_0 = 11.7 \text{ m/s} \]
\[ \theta = 65^\circ \]
\[ V_x = 4.6 \text{ m/s} \]
\[ V_y = 9.97 \text{ m/s} \]

\[ V_f = V_{i_y} + at \]
\[ \Delta Y = 2.92 \text{ m} \]
\[ V_f = V_i^2 + 2 \cdot a \cdot D \]
\[ 0 = 9.97 + 2(9.8)(D) \]
\[ D = 5.07 \text{ m} \]

\[ \Delta X = 2.92 \text{ m} \]

\[ V_f = V_i \cdot \tan \theta \]
\[ T = \frac{D}{V_i} \]
\[ D = V_i T \]
\[ \Delta Y = 1.72 \text{ m} \]

36)

\[ V_i = 64.95 \text{ m/s} \]
\[ V_f = V_i \cdot \frac{1}{2} \cdot a \cdot T \]
\[ a = -9.87 \text{ m/s}^2 \]

\[ D = V_i T + \frac{1}{2} \cdot a \cdot T^2 \]
\[ D = 64.95(7.2) + \frac{1}{2}(-9.8)(7.2)^2 \]
\[ D = 44.22 \text{ m} \]

\[ \Delta Y = \frac{1}{2} \cdot a \cdot T^2 \]
\[ \Delta Y = -33.22 \text{ m} \]
What if it goes off at an angle?

\[ Y \]

\[ \Delta D = \]
\[ V_i = \]
\[ V_f = \]
\[ a = \]
\[ t = \]

\[ X \]

\[ t = \]
\[ V_x = \]
\[ \Delta X = \]

\[ V_o = \]
\[ \text{Angle} = \]
Projectile Motion off of a cliff

A ball is thrown with an initial velocity of 20 m/s at an angle of 25° off of a 100m cliff. How far out does it land, and at what speed does it land?
\[ T = \boxed{22.025} \]
\[ -6.78 \text{s} \]

\[ 0 = 74.69T - 4.9T^2 + 732 \]

\[ 0 = V_i T + \frac{1}{2} a T^2 \]

\[ -732 = 74.7T - 4.9T \]

\[ 0 = \]

\[ DX = 36 \text{m} \]
What is the original velocity of a cannonball that lands 500m away from its original spot and was fired at an angle of $60^\circ$?

\[ V \cos \theta = \frac{\Delta x}{t} \]

\[ T = \frac{\Delta x}{V \cos \theta} \]

\[ V = V_i + at \]

\[ -V_o \sin \theta = V_o \sin \theta + at \]

\[ -2V_o \sin \theta / a = t \]

\[ \Delta x / V_o \cos \theta = 2V_o \sin \theta / a \]

\[ V_o = \sqrt{a \Delta x / 2 \sin \theta \cos \theta} \]