PROJECTILE MOTION

Calculations: Determine Horizontal Distance Traveled by Rocket

1. Determine
   V_0

   V_0 = Rocket Length/Launch Time

   V_0 = (11in x 2.54cm/in)/(0.0254 s)

   V_0 = 1,100 cm/s = **11 m/s**

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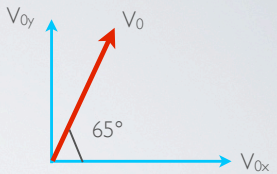
2. Determine V_{0y} and V_{0x}



For a launch angle of 65°

$V_{0y} = V_0\sin(65°) = (11\text{ m/s})\sin(65°) =$ **9.969 m/s**

$V_{0x} = V_0\cos(65°) = (11\text{ m/s})\cos(65°) =$ **4.648 m/s**

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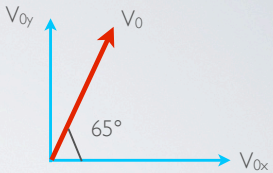
3. Determine total flight time (T)



The total flight time is equal to twice the time it takes for the rocket to reach its maximum height. At the maximum height, the rocket's velocity in the vertical direction is zero ($V_{y@max\ height} = 0$).

$V_{y@max\ height} = V_{0y} + a(T/2)$

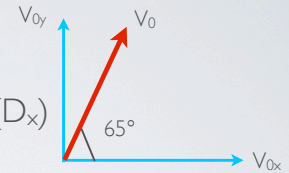
$T = 2(V_{y@max\ height} - V_{0y})/a$

$T = 2(0\text{ m/s} - 9.969\text{ m/s})/(-9.806\text{ m/s}^2) =$ **1.977 s**

PROJECTILE MOTION

Calculations

4. Determine horizontal distance traveled (D_x)



The horizontal distance traveled is equal to the rocket's horizontal initial velocity, multiplied by the total travel time.

$D_x = V_{0x} \times T$

D_x = 4.648 m/s x 1.977 s = **9.189 m**