

University Physics 1A

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2D motion

When we have projectiles traveling in 2D space:

$$\begin{aligned}\vec{x} &= x\hat{i} + y\hat{j} \\ \vec{v} &= \frac{dx}{dt}\hat{i} + \frac{dy}{dt}\hat{j} \\ \vec{v} &= v_x\hat{i} + v_y\hat{j} \\ \vec{a} &= a_x\hat{i} + a_y\hat{j}\end{aligned}$$

Projectile motion is a special case which ignores air resistance where:

$$a_x = 0 \quad a_y = -g$$

Example

Suppose we have a projectile be launched at an angle of 60° at 30m/s. How far has it traveled in the x direction when it is 8m above the ground and falling?

$$\begin{aligned}y &= y_0 + v_{o_y}t + \frac{1}{2}a_yt^2 \\ 8m &= 0 + 30 \sin(60)t + \frac{1}{2}(-9.8)t^2 \\ 4.9t^2 - 26t + 8 &= 0 \\ t &= 0.32s \quad t = 4.98s\end{aligned}$$

At these two times, the projectile is 8 meters above the ground.

$$\begin{aligned}x &= x_0 + v_{o_x}t + 0 = 0 + (15)(4.98) \\ &= 74.6m\end{aligned}$$

Work on practice problems in the Activities Manual.

Reminders and Homework

Complete the homework on TheExpertTA and WebAssign.

Remember to bring the Activities Manual

You can find all my notes at <http://omgimanerd.tech/notes>. If you have any questions, comments, or concerns, please contact me at alvin@omgimanerd.tech