

# 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  $60^\circ$  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](mailto:alvin@omgimanerd.tech)