

# University Physics 1A

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September 11th, 2017

## Kinematic Equations Review

Bob drops a ball from rest out the window of a building. At the very same instant Phyllis releases a ball upward with an initial speed of 11.0m/s from a point 20.0m directly below Bob.

$$d = x_o + v_o t + \frac{1}{2} a t^2$$
$$d = 0 + 11t + \frac{1}{2} a t^2 = 20 + 0t + \frac{1}{2} a t^2$$
$$11t = 20$$
$$t = \frac{20}{11}$$

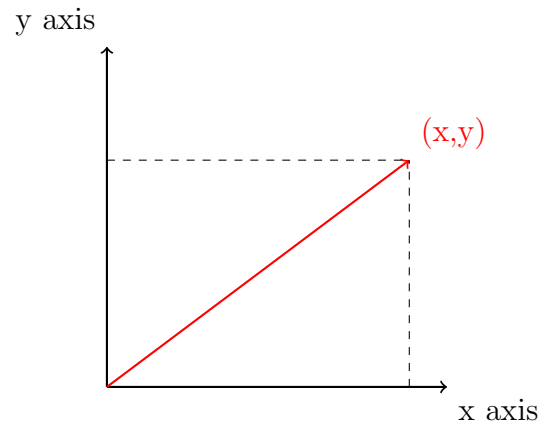
The balls collided at time  $t = \frac{20}{11}s$ .

$$d = 20 + 0t + \frac{1}{2}(-9.81)t^2$$
$$= 20 - \frac{1}{2}(9.81)\left(\frac{20}{11}\right)^2$$
$$\approx 3.77m$$

The balls collided at distance  $d = 3.77m$ . Is the ball thrown by Phyllis moving upwards or downward when the collision occurred.

$$v = v_o + at$$
$$= 11 + at^2$$
$$= 11 + (-9.8)\left(\frac{20}{11}\right)$$
$$\approx -6.8m/s$$

## 2D Kinematics



$$\vec{x} = \text{position vector} = x\hat{i} + y\hat{j}$$

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

$$\vec{a} = \frac{dv_x}{dt}\hat{i} + \frac{dv_y}{dt}\hat{j}$$

### Example

Given that the initial velocity is  $(A, B)$  at  $t = 0$ , find the velocity given:

$$a = (C + Dt^2, Et)$$

$$v = (Ct + \frac{1}{2}Dt^2 + A, \frac{1}{2}Et^2 + B)$$

## 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)