

21-P-KM-AG-001

You are practicing basketball passes with your friend. You throw the ball over your head straight to your friend with an initial velocity V and it reaches its maximum height T seconds into the throw. How far away is your friend standing?

$$\text{Take } g = 9.81 \frac{m}{s^2}$$

ANSWER:

First, apply the equations of motion to find the y-component of velocity.

$$v_f = v_i + at$$

$$0 = V_y - 10 \cdot T \rightarrow V_y = 10 \cdot T$$

Then, use the Pythagoras theorem to find the x-component of velocity.

$$V = \sqrt{V_x^2 + V_y^2}$$

$$V^2 = V_x^2 + V_y^2$$

$$V_x^2 = V^2 - V_y^2$$

$$V_x = \sqrt{V^2 - V_y^2}$$

Now knowing both the x-component of velocity and the time to reach its maximum height, find the distance it travels as the ball goes up and comes back down.

$$d = d_0 + v_0 t + \frac{1}{2} at$$

$$d = 0 + V_x \cdot 2T + 0 = 2V_x T$$