Answer on Question #61855-Physics – Mechanics Relativity
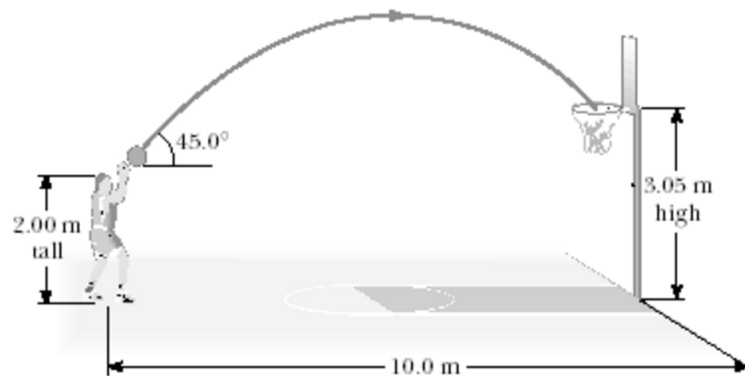
A basketball player, 2.00 m tall, wants to make a goal 10 m from the basket as shown in the figure attached hereto. If he releases the ball at an angle of 45 degrees to the horizontal, at what initial velocity must he shoot the ball so that it goes through the hoop without striking the backboard?

25 m/s

10 m/s

45 m/s

100 m/s

Solution

Since the angle is at 45 degrees let's look at y(t) first

$$y(t) = 2 + v_0 sin(45)t - \frac{1}{2}gt^2$$

and

$$x(t) = v_0 cos(45)t$$

when y(t)=3.05 and x(t)=10.

$$\begin{cases} 1.05 = v_0 \dfrac{\sqrt{2}}{2}t - \dfrac{1}{2}gt^2 \\ 10 = v_0 \dfrac{\sqrt{2}}{2}t \end{cases} \rightarrow t = \dfrac{10}{v_0 \dfrac{\sqrt{2}}{2}}$$

$$1.05 = 10 - \frac{1}{2}g\left(\frac{10}{v_0 \dfrac{\sqrt{2}}{2}}\right)^2$$

$$v_0 = \frac{20}{\sqrt{2}}\sqrt{\frac{9.8}{2(10-1.05)}} = 10\frac{m}{s}.$$

Answer: 10 m/s.