Answer on Question #70476-Physics-Other

A football quarterback shows off his skill by throwing a pass 45.70 m downfield and into a bucket. The quarterback consistently launches the ball at 38.00 ◦ above horizontal, and the bucket is placed at the same level from which the ball is thrown.

What initial speed is needed so that the ball lands in the bucket? I got 21.5 m

By how much would the launch speed have to be increased if the bucket is moved to 48.70 m downfield?

Solution

Formula for the range of projectile is

$$x = \frac{v_0^2 \sin 2\theta}{g}$$

The initial speed is

$$v_0 = \sqrt{\frac{gx}{\sin 2\theta}} = \sqrt{\frac{(9.81)(45.7)}{\sin 2(38)}} = 21.5 \frac{m}{s}.$$

New speed is

$$v_0{}' = \sqrt{\frac{gx'}{\sin 2\theta}} = \sqrt{\frac{(9.81)(48.7)}{\sin 2(38)}} = 22.2 \frac{m}{s}.$$

The increase in speed is

$$v_0' - v_0 = 22.2 - 21.5 = 0.7 \frac{m}{s}.$$