Answer on Question 72494, Physics, Other

Question:

A football is kicked with an initial velocity of $10\ m/s$ at an angle of 25°. If it hits the ground $1.5\ s$ later, how far does it travel?

Solution:

Let's first find the projections of the initial velocity of the football on axis x and y:

$$v_{0x} = v_0 cos\alpha = 10\ \frac{m}{s} \cdot cos25^{\circ} = 9.1\ \frac{m}{s},$$

$$v_{0y} = v_0 sin\alpha = 10\ \frac{m}{s} \cdot sin25^{\circ} = 4.23\ \frac{m}{s}.$$

Then, we can find the flight time of the football. Let's consider the motion of the football in the vertical direction. We can find the time t_{rise} that the football need to reach the maximum altitude from the kinematic equation:

$$v = v_{0y} - gt_{rise},$$

here, v_{0y} is the projection of the initial velocity of the football on axis y, $v = 0$ is the velocity of the football at maximum altitude, $g = -9.8\ \frac{m}{s^2}$ is the acceleration due to gravity.

Then, we get:

$$t_{rise} = \frac{v_{0y}}{g} = \frac{4.23\ \frac{m}{s}}{9.8\ \frac{m}{s^2}} = 0.43\ s.$$

Finally, we can find the flight time of the football multiply t_{rise} by 2 (and we can clearly see that the time flight of the football in the initial condition of the question is incorrect):

$$t_{flight} = 2 \cdot t_{rise} = 2 \cdot 0.43\ s = 0.86\ s.$$

Let's consider the motion of the football in the horizontal direction. We can find how far does the football travel from the formula:

$$x = v_{0x} \cdot t_{flight} = 9.1\ \frac{m}{s} \cdot 0.86\ s = 7.82\ m.$$

Answer:

$x = 7.82\ m.$