Answer on Question #52426, Physics, Mechanics | Kinematics | Dynamics

A batsman hits a ball at 45 degree angle with horizontal and with a velocity of 20 m/s. The ball started to going over the bowler. A fielder from the mid-field ran to catch it. But the fielder could not reach in time. That's why the ball crosses the boundary line and it became a 6 run for the batsman. The ball travels 35 m at field. If the fielder is able to take catch at a height of 3 m, and if the fielder could reach in time to the boundary line, would he be able to catch the ball?

Solution:

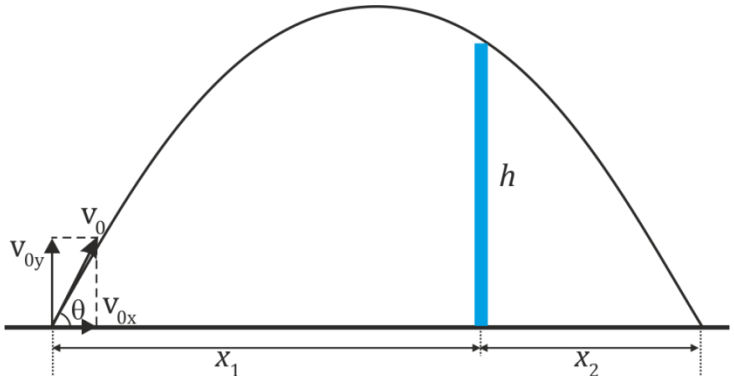
Given:

$x_1 = 35$ m,

$\theta = 45°$,

$v_0 = 20$ m/s,

$h = ?$



Neglecting air resistance, the projectile is subject to a constant acceleration g=9.81 m/s^2, due to gravity, which is directed vertically downwards.

Equations related to trajectory motion (projectile motion) are given by

$$\text{Horizontal distance,} \quad x = v_{0x}t$$

$$\text{Vertical distance,} \quad y = v_{0y}t - \frac{1}{2}gt^2$$

where v_0 is the initial velocity.

We have

$$x_1 = 35 \text{ m}$$

Thus, the time of ball's flight to the boundary line

$$t = \frac{x_1}{v_{0x}} = \frac{x_1}{v_0 \cos\theta} = \frac{35}{20 * \cos 45°} = 2.475 \text{ s}$$

$$\text{Vertical distance,}$$

$$h = y = v_0 \sin\theta\, t - \frac{1}{2}gt^{\ 2} = 20 \cdot \sin 45° \cdot 2.475 - \frac{9.8 \cdot 2.475^2}{2} = 4.986 \text{ m}$$

Hence, at the boundary line ball will be at ≈ 5 m height.

Answer: The fielder would **not be able** to catch the ball.