

Question #36178

A fly ball is hit with an angle of 80 degrees with a initial speed of 40.0 m/s. How long does the fielder have to get underneath the ball? And what is the maximum height attained by the ball?

Solution:

Let

$$v_0 = 40 \text{ m/sec}$$

$$\alpha = 80^\circ$$

$$t = ?, H = ?$$

$H = v_{y0}t_h - \frac{1}{2}gt_h^2$ where t_h is the time of moving upward, v_{y0} is the vertical compound of initial velocity

$$v_y = v_{y0} - gt_h$$

Such as the velocity in the highest point is equal to zero

$$v_{y0} = gt_h, \mathbf{t_h} = \frac{v_{y0}}{g}$$

$$H = v_{y0} \frac{v_{y0}}{g} - \frac{1}{2}g \left(\frac{v_{y0}}{g}\right)^2$$

$$\mathbf{H} = \frac{1}{2} \frac{v_{y0}^2}{g}$$

The full time is $t = 2t_h$

$$\mathbf{t} = 2 \frac{v_{y0}}{g}$$

$$v_{y0} = v_0 \sin \alpha$$

$$\mathbf{H} = \frac{1}{2} \frac{(v_0 \sin \alpha)^2}{g}$$

$$\mathbf{t} = 2 \frac{v_0 \sin \alpha}{g}$$

$$\mathbf{t} = 2 \frac{40 * \sin 80}{9.8} = \mathbf{8 \text{ sec}}$$

$$\mathbf{H} = \frac{1}{2} \frac{(40 * \sin 80)^2}{9.8} = \mathbf{79.2 \text{ m}}$$

Answer: 8 sec, 79.2 m.