Answer on Question #77332 – Math – Calculus

Question

A 6 foot boy throws the javelin with an initial speed of 87 feet per second at an angle of 38° with the horizontal. Mark threw approximately 180′ at the Pasco Invite. Does the boy described above beat Mark?

Solution

The equations of motion

$$x(t) = x(0) + (v_0 \cos\theta)t$$

$$y(t) = y(0) + (v_0 \sin\theta)t - \frac{1}{2}gt^2$$

We have that

$$x(0) = 0, y(0) = 6\ ft, v_0 = 87\frac{ft}{s}\ , \theta = 38°; g = 32.17405\ \frac{ft}{s^2}$$

Find the total time of the flight

We need to find the time $t_{fly} > 0$ when $y(t_{fly}) = 0$

$$y(t) = 0$$

$$6 + (87 \sin 38°)t - \frac{32.17405}{2}t^2 = 0, t > 0$$

$$16.087025t^2 - (87 \sin 38°)t - 6 = 0$$

$$t = \frac{87 \sin 38° \pm \sqrt{(87 \sin 38°)^2 - 4(16.087025)(-6)}}{2(16.087025)}$$

Since $t > 0$, we take

$$t = \frac{87 \sin 38° + \sqrt{(87 \sin 38°)^2 + 24(16.087025)}}{32.17405} \approx 3.438\ (s)$$

$$t_{fly} = 3.438\ s$$

The total horizontal distance

$$x(t_{fly}) = 0 + (87 \cos 38°)(3.438) \approx 235.7\ (ft)$$

$$235.7\ ft > 180\ ft$$

Yes, the boy described above beats Mark.