Suppose the left-centre field wall is 4.1 m high and located 100.8 m from home plate. A batter connects the ball 1.0 m above the ground at an angle of 45° and the ball has a speed of 31 m/s. Will this be a home run?

reference is where ball is contacted

$y > 3.1$ when $x = 100.8$

$3.1 = 4.1 - 1.0$

4.1 wall height; 1.0 ball hit above ground

$v_{y0} = 31\sin 45° = 21.9\ m/s$

$v_x = 31\cos 45° = 21.9\ m/s$

$x = 100.8\ m$

$y = ?$

Find time to reach fence

$v_x = \frac{x}{t}$

$21.9 = \frac{100.8}{t}$

$t = \frac{100.8}{21.9} = 4.6\ s$

use $y = v_{y0}t + \frac{1}{2}at^2$

$y = (21.9)(4.6) + \frac{1}{2}(-9.81)(4.6)^2$

$y = 100.74 - 103.78$

$y = -3.04\ m$

$y \not> 3.1\ m$

Not a H.R.

Home Run Question

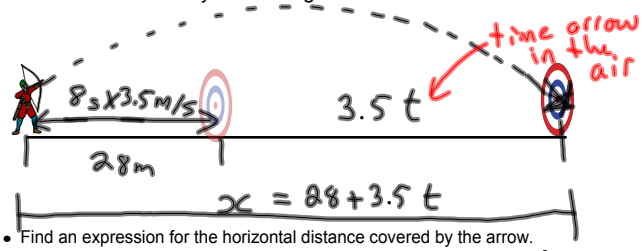
Suppose the left-centre field wall is 3 m high off the ground and located 105 m from home plate. A batter connects the ball 1.0 m above the ground at an angle of 55^{o} and the ball has a speed of 32 m/s. Will this be a home run?

(i.e when the ball has travelled 105 m horizontally is it higher than 2 m above the initial point of contact?)

- Break up the initial velocity into its components.
- Determine the time it takes to travel 105 m horizontally.
- Determine the height above the point of contact using the found time.
- If y > 2 m then it is a home run.

Hitting a Moving Target

In an archery skills competition an archer stands next to her target. A bell rings and the target begins to move away from the archer at 3.5 m/s but the archer must wait a certain amount of time before shooting. This archer releases the arrow 8.0 s after the bell has rung in an attempt to hit the moving target. Assuming the launch angle is 45° and the arrow is launched at the same height as the target, determine the initial speed of the arrow to successfully hit the target.



- Find an expression for the horizontal distance covered by the arrow.
- Write the expression for V_x using x/t and remember that $V_x = V\cos 45°$.
- Combine the above to have a formula for V.
- Write $V_{iy} = V\sin 45°$.
- Write the formula for vertical displacement, y.
- In the above substitute $V\sin 45°$ for V_{iy}.
- Now substitute the formula for V into the vertical displacement expression.
- Solve for t.
- Use that value to find V.

$$V_x = \frac{x}{t} \rightarrow V\cos 45 = \frac{28+3.5t}{t}$$

$$V = \frac{28+3.5t}{t\cos 45} \quad (1)$$

$$V_{y_0} = V\sin 45 \qquad y = V_{y_0}t + \frac{1}{2}at^2$$

zero $\rightarrow$ $$y = (V\sin 45)t + \frac{1}{2}at^2 \quad (2)$$

$$0 = \left(\frac{28+3.5t}{t\cos 45}\right)(\sin 45)\,t - 4.9t^2$$

$$0 = 28 + 3.5t - 4.9t^2$$

$$4.9t^2 - 3.5t - 28 = 0$$

$$t = \frac{-(-3.5) \pm \sqrt{(-3.5)^2 - 4(4.9)(-28)}}{9.8}$$

$$t = \frac{3.5 \pm 23.7}{9.8}$$

$$t = \frac{3.5+23.7}{9.8} \quad \text{and} \quad t = \frac{3.5-23.7}{9.8}$$

$t = 2.8\,s$

$t = -2.1\,s$ rejected!

$$V = \frac{28+3.5t}{t\cos 45}$$

$$= \frac{28+3.5(2.8)}{}$$