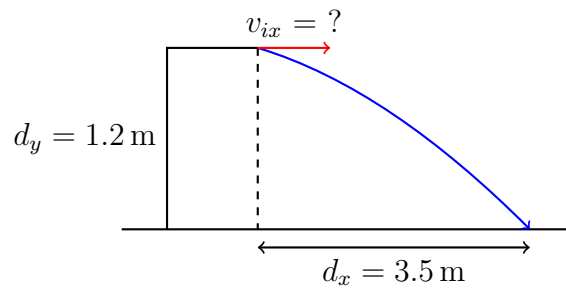


Projectile Motion Problem

Problem Statement

A ball is rolled off a desk that is 1.2 m tall, aiming to hit a target 3.5 m away from the base of the desk. The ball rolls horizontally off the edge. What must the initial horizontal velocity of the ball (v_{ix}) be to hit the target?

Step 1: Diagram



Step 2: Understand the Variables and Known Values

Horizontal	Vertical
$d_x = 3.5 \text{ m}$	$d_y = 1.2 \text{ m}$
$v_{ix} = ?$	$v_{iy} = 0 \text{ m/s}$
$v_{fx} = ?$	$v_{fy} = ?$
$a_x = 0 \text{ m/s}^2$	$a_y = 9.81 \text{ m/s}^2$
$t =$	$?$

Step 3: Use Vertical Motion to Find Time (t)

The vertical motion equation is:

$$d_y = v_{iy}t + \frac{1}{2}a_yt^2$$

Substitute $v_{iy} = 0$:

$$d_y = \frac{1}{2}a_yt^2$$

Rearrange to solve for t :

$$t = \sqrt{\frac{2d_y}{a_y}}$$

Substitute $d_y = 1.2 \text{ m}$ and $a_y = 9.81 \text{ m/s}^2$:

$$t = \sqrt{\frac{2(1.2)}{9.81}} = \sqrt{0.2445} \approx 0.494 \text{ seconds}$$

Step 4: Find Initial Horizontal Velocity

The horizontal motion equation is:

$$d_x = v_{ix}t + \frac{1}{2}a_xt^2$$

Since $a_x = 0 \text{ m/s}^2$, the equation becomes:

$$d_x = v_{ix}t$$

Rearrange to solve for v_{ix} :

$$v_{ix} = \frac{d_x}{t}$$

Substitute $d_x = 3.5 \text{ m}$ and $t = 0.494 \text{ s}$:

$$v_{ix} = \frac{3.5}{0.494} \approx 7.09 \text{ m/s}$$