


Example Problem #2

A hedgehog is launched at a speed of 25 m/s at an angle of 37° above the horizontal.

a) Find the x and y coordinates of its position at $t = 1.5$ s

Δx	v_{ix}	Δt	Δy	v_{iy}	v_{fy}	a_y	Δt
	$25 \cos 37^\circ$	1.5s		$25 \sin 37^\circ$		-9.81	1.5s
	20 m/s			15 m/s		m/s ²	



$$\Delta x = v_{ix} \Delta t$$

$$= 20(1.5)$$

$$\Delta x = 30 \text{ m}$$

$$\Delta y = v_{iy} \Delta t + \frac{1}{2} a_y \Delta t^2$$

$$= 15(1.5) + \frac{1}{2}(-9.81)(1.5^2)$$

$$\Delta y = 11.5 \text{ m}$$

b) Find speed of the ball at $t = 1.5$ s

↳ * Need v_{fx} and v_{fy}

$$v_{fx} = v_{ix} = \underline{20 \text{ m/s}}$$

$$v_{fy} = v_{iy} + a_y \Delta t$$

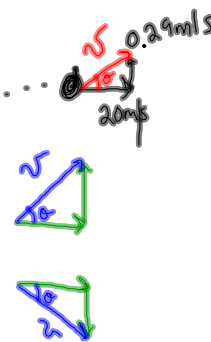
$$= 15 + (-9.81)(1.5)$$

$$v_{fy} = \underline{0.29 \text{ m/s}}$$

$$v = \sqrt{v_{fx}^2 + v_{fy}^2}$$

$$= \sqrt{20^2 + .29^2}$$

$$v = 20 \text{ m/s @ } 1.5 \text{ s}$$



c) direction @ 1.5 s

$$\theta = \tan^{-1} \left(\frac{\text{opp}}{\text{adj}} \right)$$

$$= \tan^{-1} \left(\frac{v_{fy}}{v_{fx}} \right)$$

$$= \tan^{-1} \left(\frac{0.3}{20} \right)$$

horizontal

Example 3

A projectile is fired with a speed of 50 m/s at an angle of 37° above the horizontal.

a) Find the position coordinates of the projectile at $t = 2$ s

$$\Delta x = 80 \text{ m} \quad \Delta y = 40 \text{ m}$$

b) Find the speed of the projectile at $t = 2$ s

$$v_{@2s} = 41.3 \text{ m/s}$$

c) Find the direction of motion at $t = 2$ s

$$\theta = 14^\circ \text{ above horizontal}$$

Example 4

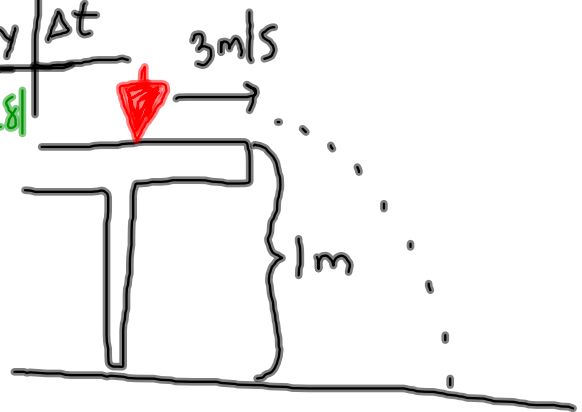
$$v_0 = 3 \text{ m/s} \quad \theta = 0$$

A spinning top is tossed horizontally with a speed of 3 m/s on top of a 1 m high table.

Δx	v_{ix}	Δt	Δy	v_{iy}	v_{fy}	a_y	Δt
	$3 \cos 0$ 3 m/s		-1 m	$3 \sin 0$ 0 m/s		-9.81	

a) Find the time of flight

$$\Delta t = 0.45 \text{ s}$$



b) Find the speed with which the top strikes the floor

$$v_{fx} = 3 \text{ m/s}$$

$$v_{fy} = -4.41 \text{ m/s}$$

$$v_{@ground} = 5.33 \text{ m/s}$$

c) Find the direction of motion

$$\theta = 55.77^\circ \text{ below horizontal}$$