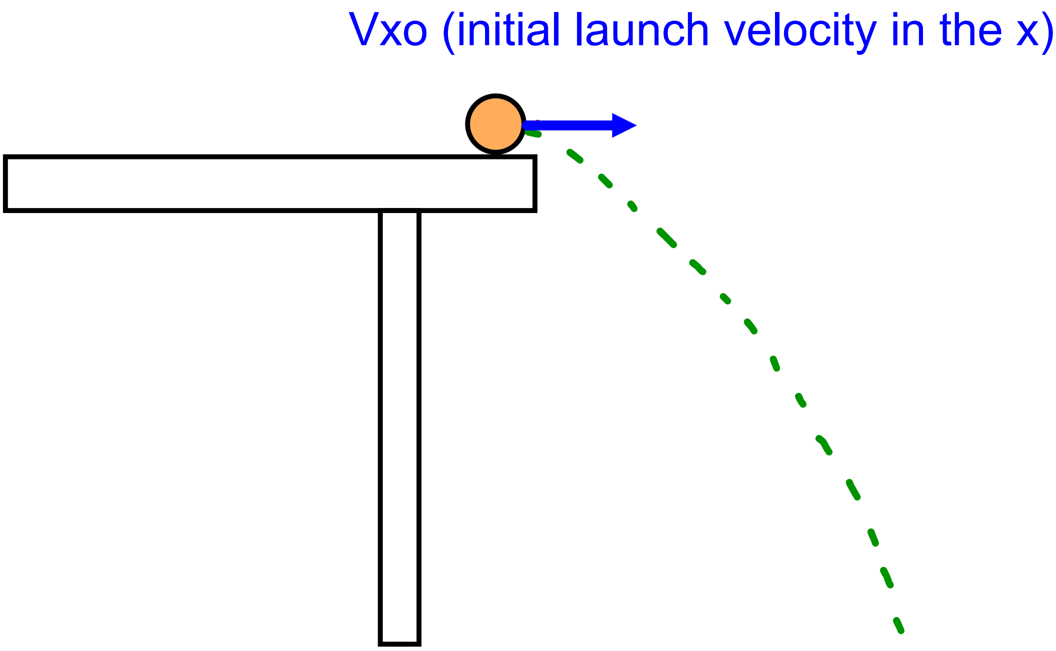
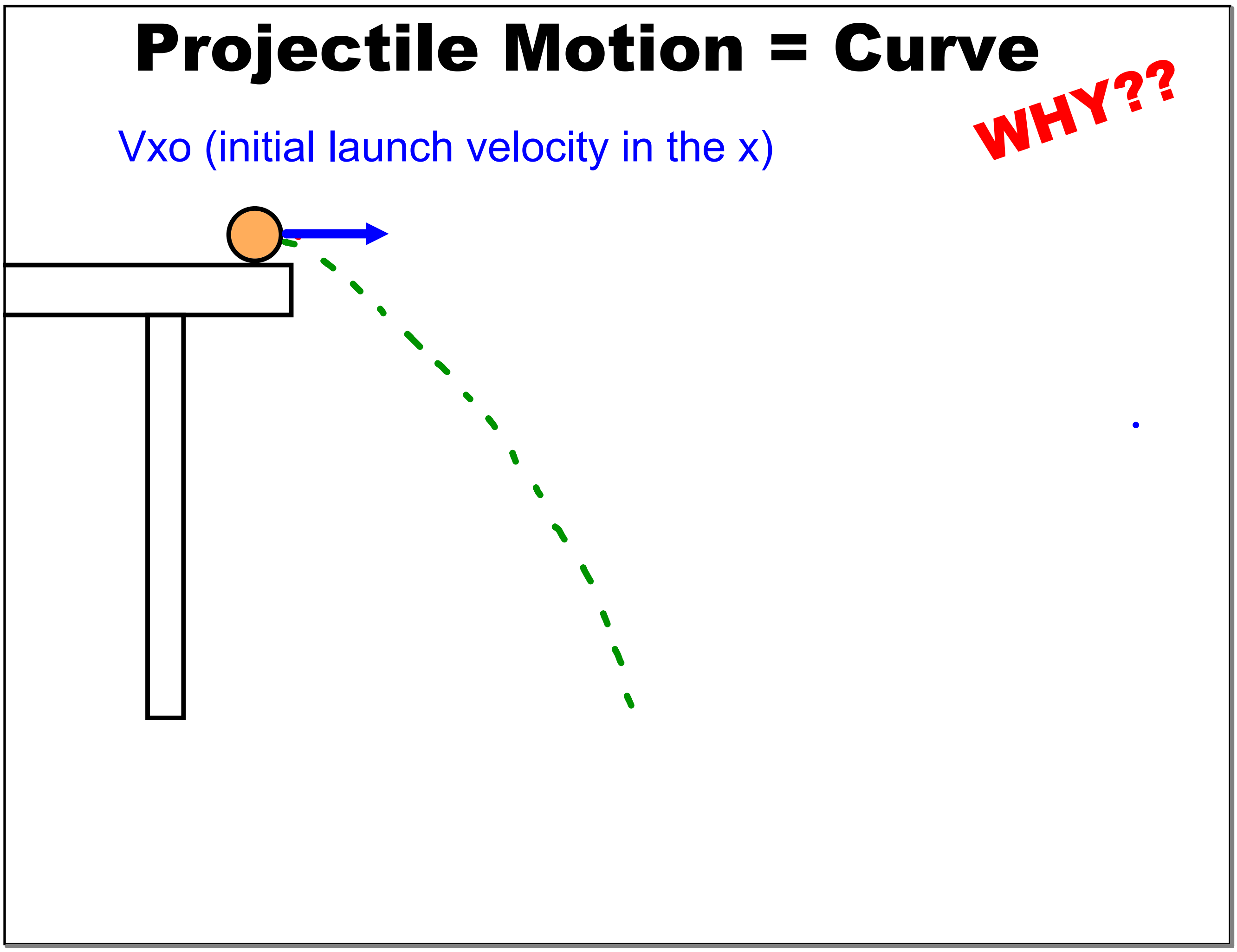
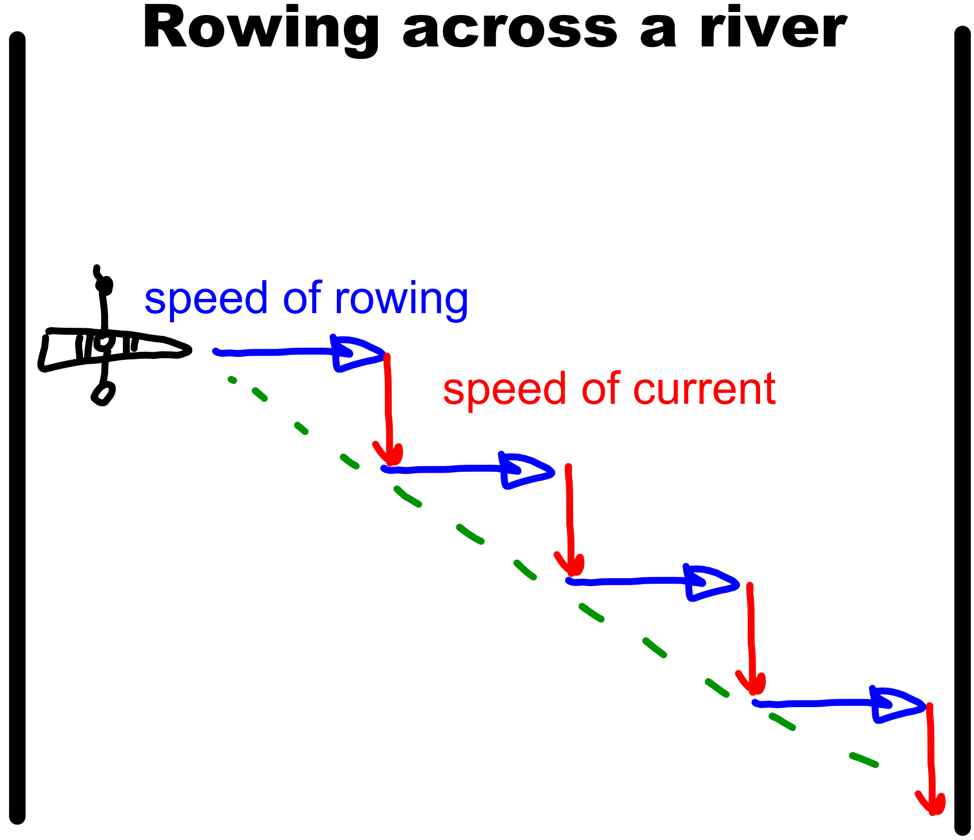
Let's Start with Horizontal Launches



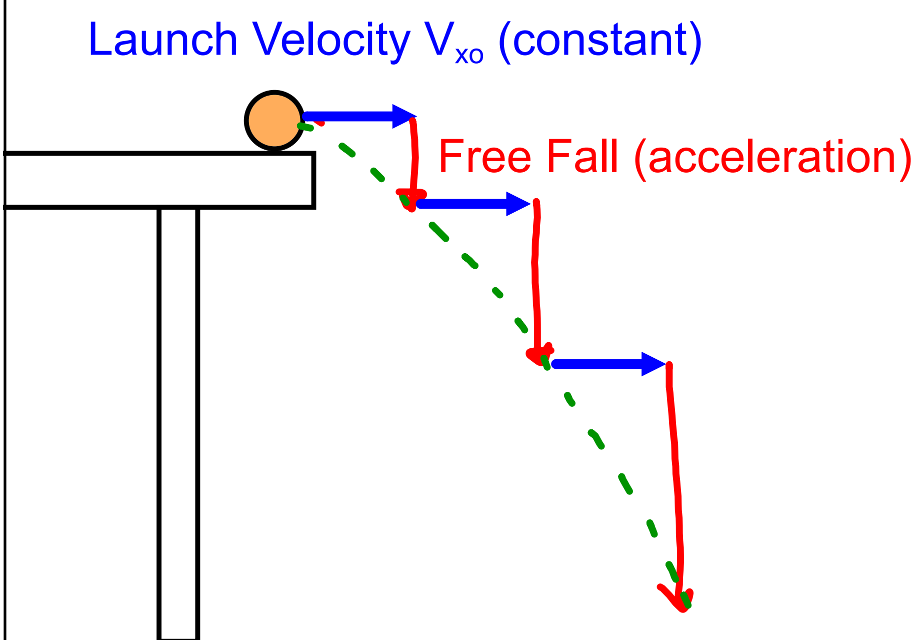

Projectile Motion = Curve
WHY??
Vxo (initial launch velocity in the x)

Rowing across a river



Projectile Motion: a curve

Note: horizontal launch means Vyo = 0



It's half of a parabola

Kinematics for Horizontal Launches?

X $a_x = 0$

$\Delta x = v_{xo}t + 1/2a_xt^2$

$v_x = v_{xo} + a_xt$

$v_x^2 = v_{xo}^2 + 2a_x\Delta x$

Y $v_{yo} = 0$

$\Delta y = v_{yo}t + 1/2a_yt^2$

$v_y = v_{yo} + a_yt$

$v_y^2 = v_{yo}^2 + 2a_y\Delta y$

Horizontal Launches

X	t =	Y
$\Delta x =$		$\Delta y =$
$v_{xo} =$		$v_{yo} = 0$
		$a = -10 \, m/s^2$

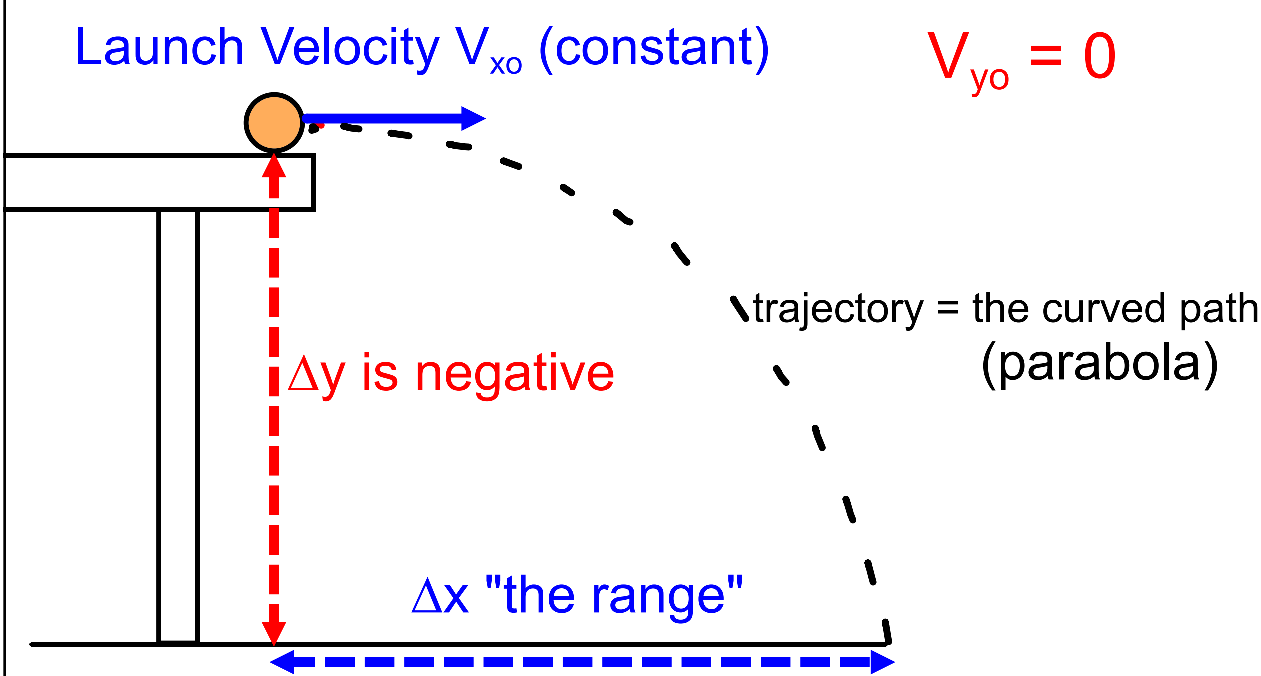
$$\Delta x = v_{xo}\, t$$

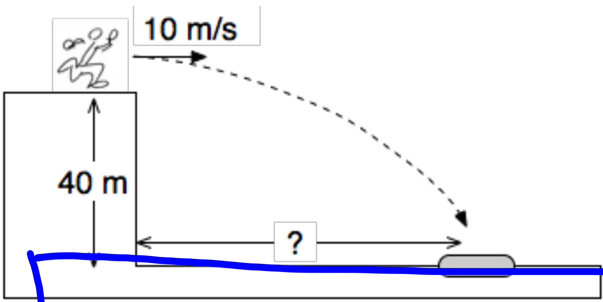
$$\Delta y = v_{yo}\, t + 1/2at^2$$

$$\mathbf{v_y} = v_{yo} + a_y t$$

$$\mathbf{v_y}^2 = v_{yo}^2 + 2a_y\Delta \mathbf{y}$$

Horizontally launched projectiles





The stuntperson is running off the cliff as shown.

a) About how far from the base of the cliff should we put the big poofy pad for landing?

b) How much time did the fall take?

$\Delta x = ?$

$v_{x0} = 10\,m/s$

$t = ?$

$\Delta y = -40\,m$

$v_{y0} = 0$

$a = -10\,m/s^2$

$\Delta x = v_{x0} t$

$\Delta x = 10t$

$\Delta x = (10)(2.8)$

$= 28\,m$

$\Delta y = v_{y0} t + \frac{1}{2} a t^2$

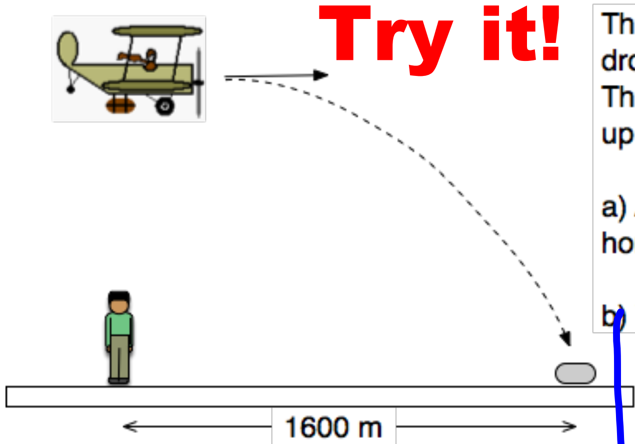
$-40 = 0 + \frac{1}{2}(-10)t^2$

$\frac{-40}{-5} = \frac{-5t^2}{-5}$

$8 = t^2$

$2.8\,s = t$

Try it!



The pilot (who clearly has no physics training) drops your package when directly overhead. The package lands 8 seconds later and you end up walking 1600 m to get it.

a) Assuming the airplane's velocity was horizontal, what was its velocity?

b) What was the airplane's altitude?

$\Delta x = 1600\,m$ $t = 8\,s$ $\Delta y = ?$

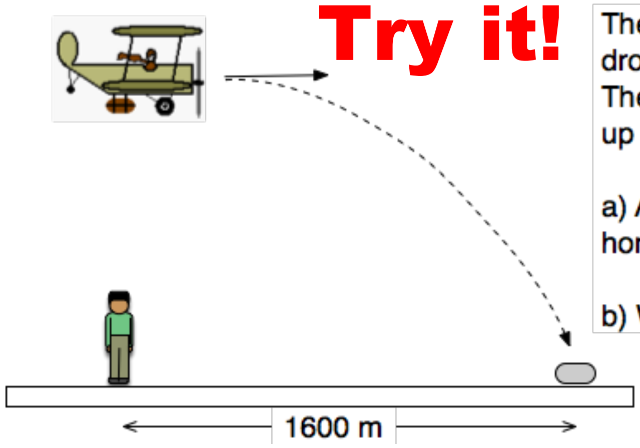
$v_{x0} = ?$ | $v_{y0} = 0$

$a = -10\,m/s^2$

a) 200 m/s

b) 320 m. (+ based on the phrasing of the question.)

Try it!



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$\Delta x = 1600\,m$

$v_{x0} =$

$t = 8\,s$

$\Delta y =$

$v_{y0} = 0$

$a_y = -10\,m/s^2$

$\Delta x = v_{x0} t$

$1600 = v_{x0}(8)$

$1600 = 8 v_{x0}$

$\frac{1600}{8} = v_{x0}$

$200\,m/s = v_{x0}$

$\Delta y = v_{y0} t + \frac{1}{2} a_y t^2$

$\Delta y = 0 + \frac{1}{2}(-10)(8^2)$

$\Delta y = -5(64)$

$\Delta y = -320\,m$

You should get: The airplane's velocity was 200 m/s and its altitude was 320 m.

Each person uses their own Hot Wheel.

1. Choose a Hot Wheel and use the BeeSpi to measure its velocity at the bottom of the ramp. **Hold on to the Hot Wheel.**

2. Do 3 trials and take an average.

trial	1	2	3	average
Vx (m/s)				

3. Measure the height of the table in METERS.

Height (m)	

4. Use the average Vx and the height to solve for how far from the base of the table it will land on the floor.

5. Let Mr. Mont know when you are ready to try it for real. If you hit the spot you predicted, you may receive a prize.