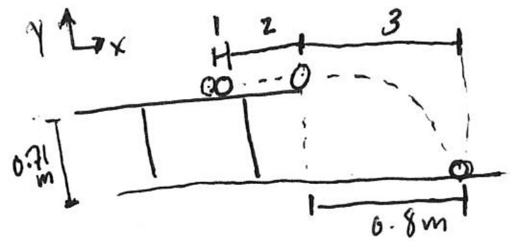
9/30 (some done of 9/26 & 9/27)



1. Acceleration
2. Constant velocity Rolly on table
3. Falling off Table

1. Acceleration

X	Y
a = ?	$a = 0\,m/s^2$
$V_0 = 0\,m/s$	$V_0 = 0\,m/s$
V_f = ?	$V_f = 0\,m/s$
$S_0 = 0\,m$	$S_0 = 0.71\,m$
S_f = ?	$S_f = 0.71\,m$

$t_f = 0.01\,s$
$t_0 = 0\,s$

2. Constant velocity Rolly on the table

X	Y
$a = 0\,m/s^2$	$a = 0\,m/s^2$
V_0 = ? } same	$V_0 = 0\,m/s$
V_f = ? }	$V_f = 0\,m/s$
$S_0 = 0\,m$	$S_0 = 0.71\,m$
$S_f = 0.4\,m$	$S_f = 0.71\,m$

$t_0 = 0\,s$
t_f = ?

3. ~~Acceleration~~ Falling off the table

X	Y
$a = 0\,m/s^2$	$a = -9.8\,m/s^2$
V_0 = ? }	$V_0 = 0\,m/s$
V_f = ? }	V_f = ?
$S_0 = 0\,m$	$S_0 = 0.71\,m$
$S_f = 0.8\,m$	$S_f = 0\,m$

$t_0 = 0\,s$
t_f = ?

We want to know the velocity with which the ball leaves the table & in horizontal, x, direction

Looking at #3

X

$s(t)_x = S_0 + V_0 t + \frac{1}{2}at^2$

$s(t_f)_x = S_{0x} + V_{0x} t_f + \frac{1}{2}a_x t_f^2 = S_{fx}$

$0.8 = 0 + V_{0x} t_f + \frac{1}{2} \cdot 0 \cdot t_f^2$ (→ 0)

$0.8 = 0 + V_{0x} t_f$ ← need to find t_f!

Look to Y to calculate t_f

Y

$s(t)_y = S_0 + V_0 t + \frac{1}{2}at$

$s(t_f)_y = S_{0y} + V_{0y} t_f + \frac{1}{2}a_y t_f = S_{fy}$

$0 = 0.71 + 0 \cdot t_f + \frac{1}{2}(-9.8) t_f^2$

$0 = 0.71 + (-4.9) t_f^2$

$-0.71 \quad -0.71$

$\frac{-0.71}{-4.9} = \frac{-4.9 t_f^2}{-4.9}$

$\sqrt{0.145} = \sqrt{t_f^2}$

$\boxed{0.38\,s = t_f}$

plug t_f into x eqn

$0.8 = 0 + V_{0x} t_f$

$\frac{0.8}{0.38} = \frac{V_{0x} \cdot 0.38}{0.38}$

$\boxed{2.1\,m/s = V_{0x}}$ ← This is the initial x velocity (and the velocity it has the whole time)

Now we will draw a piecewise function Graph for this scenario (for both x and y)

1. Acceleration
2. Constant x velocity/Rolling on Table
3. Falling off the table

First we need to figure out a couple of things for x:

① $s_0 = 0$

$s_f = 0 + 0.01 + \frac{1}{2} a (0.01)^2$

$a = \frac{2.1 m/s}{0.01s} = 210 m/s^2$

$s_f = \frac{1}{2}(210)(0.01)^2 = 0.01m$

$t_f = 0$

$t_0 = 0.01$

② $s_0 = 0.01m$

$s_f = 0.4m$

$t_0 = 0.01$

$t_f = \frac{0.39m}{2.1 m/s} + 0.01s = 0.2s$

③ $s_0 = 0.4m$

$s_f = 1.2m$

$t_0 = 0.2s$

$t_f = 0.38 + 0.2$
$= 0.58s$