



**EASTERN MEDITERRANEAN UNIVERSITY**  
**Department of Physics**  
**2016 Spring Semester PHYS101 Lab-Final Exam –Solution Set**

**Projectile motion in two dimensions:**

A steel ball is released from rest at the top of a curved track (point **A**). The steel ball is projected horizontally with an initial velocity  $v_0$  at the bottom of the curved track (point **B**). The steel ball falls down because of the gravitational acceleration  $g$ . Neglecting the effect of air resistance throughout the motion, the path of a projectile is always a parabola given by  $Y = -\left(\frac{1}{4h}\right)X^2$  where  $h$  is the vertical distance between the points **A** and **B**. Positions  $X$  and positions  $Y$  of the steel ball set in projectile motion are tabulated below.

$X (m)$	0.00	0.185	0.253	0.302	0.365
$Y (m)$	0.00	-0.150	-0.300	-0.450	-0.600
$x = X^2 (m^2)$	0.00	0.0342	0.0640	0.0912	0.133

The least square line is given as  $y = -4.61 x + 0.019$

a) Find the slope and the y-intercept **with units**. (2 Points)

- **slope = -4.61**
- **y - intercept = 0.019**

b) Using the equation  $Y = -\left(\frac{1}{4h}\right)X^2$  to find the experimental value of  $h$  in **m**. (2 Points)

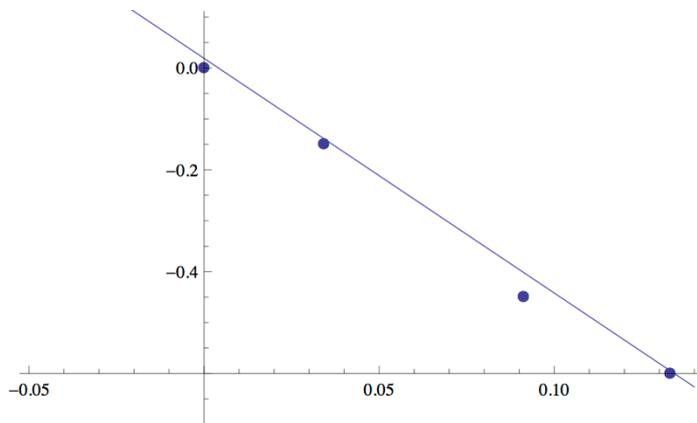
- **$h_{exp} = -\frac{1}{4h} = -4.61 \Rightarrow h_{exp} = \frac{1}{4 \times 4.61} = 0.054 m = 5.4 cm$**

c) If the real value of  $h$  is **5 cm**, find the percentage error of this experiment. (1 Point)

- **%error =  $\frac{|5-5.4|}{5} = 0.08 = 8\%$**

d) Plot the experimental data given in the table on the graph paper given on the next page (2 Points)

e) Plot the least square line into the graph paper on the next page (2 Points)



f) What is the acceleration of the steel ball at the landing point (1 Point)

- **$a = \vec{a} = \vec{g} = -g \hat{j}$**