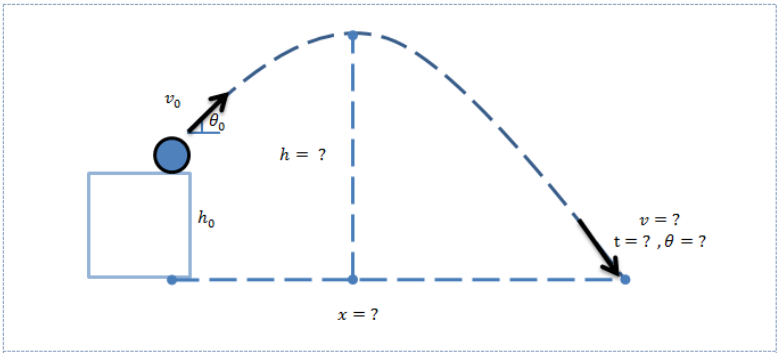
Lab Work 1 **Due Date: Apr.7.2020**



1. For the initially given parameters v_0: the magnitude of initial velocity vector, h_0: initial height, θ_0: the angle of the velocity vector with the horizontal axis, g: gravity;

Calculate the final velocity vector (its magnitude as well as its angle with the horizontal axis (v, θ)), the time passes during this travel (t), the horizontal distance it travels (x), and the maximum height it reaches to (h).

v_0, h_0, θ_0, g (input)

(v, θ), h, t, x (output)

Tasks:

- v_0=20, $\theta_0 = (0:1:90)$[degres] , h_0=30 Find outputs.
- v_0=(1:1:20), $\theta_0 = 75$, h_0=30 Find outputs.
- v_0=20, $\theta_0 = 75$, h_0=0:1:30 Find outputs.

Write two files for these purposes

`ballArc.cpp` - can be .cpp file for the function. Use function form which accepts the input and computes the output
`test_ballArc.cpp` - can be .cpp file to test ballArc.cpp

Mathematical expressions for the problem

π=3.141592

g=9.8

%assuming θ_0 is given in degrees not in radians

$v_{0y} = v_0 . sin(\pi . \theta_0/180)$

$v_{0x} = v_0 . cos(\pi . \theta_0/180)$

$t_{rise}=(v_{0y} - 0)/g$

$m.g.h_{rise} = \frac{1}{2} m.(v_{0y})^2 \rightarrow h_{rise}=0.5(v_{0y})^2/g$

$h_{fall} = h_{rise} + h_0$

$m.g.h_{fall} = \frac{1}{2} m.(v_y)^2 \rightarrow v_y = (2.g.h_{fall})^{0.5}$

$t_{fall}=(v_y - 0)/g;$

$x = v_{0x} . (t_{rise}+t_{fall})$

$v_x=v_{0x}$

$\theta=(tan^{-1}(-v_y/v_x))/\pi.180$

2. Given an empty sphere we can put a cone inside it.

The base and the top of it touch the sphere. Sphere is represented with a radius r_s the cone is represented with a radius r_c and a height h. Write a cpp code **`cone_in_a_Sphere.cpp`**

a) Initially given r_s=10 and $r_c = 8$ compute the h, the volume of the sphere and the cone

b) For a given set of r_c values ($0.1r_s$:0.1: r_s) Compute h values,
Plot r_c versus h, r_c versus the volume of the cone. (Excel, GNU-plot or any other mean for plotting)

c) Plot r_c versus the volume of the space inside the sphere but outside the cone (volume of the sphere – volume of the cone) try to figure out when it is at the minimum. (Excel, GNU-plot or any other mean for plotting)

- Submit your .cpp codes, your relevant tables, and plots, in one zipped folder.
- A suitable name for the folder can be KOM3550_YourName_YourNumber_Lab1.{zip/rar}. Write a relevant title for the email you are sending. KOM3550_YourName_YourNumber_ KOM3550_YourName_YourNumber_Lab1 is a good option.

"No other e-mails will be even opened".

Dr. Muharrem Mercimek

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a. The due date is firm and it is the midnight just before the next class. The files should be submitted by the end of the due date.
b. Submit your documents via e-mail to programming.kom@gmail.com