Physics 2414, Spring 2005
Group Exercise 4, Feb 24, 2005

Name 1: _____ OUID 1: _____

Name 2: _____ OUID 2: _____

Name 3: _____ OUID 3: _____

Name 4: _____ OUID 4: _____

Section Number: ____

Kinematics

Notation

a_x is the component of the vector $\vec{\mathbf{a}}$ along the x direction.

a_y is the component of the vector $\vec{\mathbf{a}}$ along the y direction.

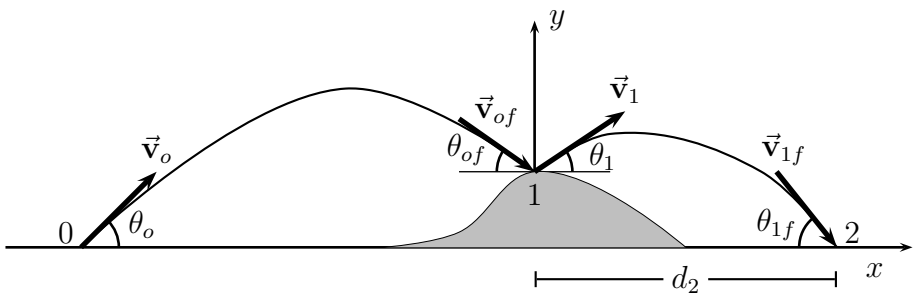

Figure 1

Problems

Gimp the golfer hits a ball at point '0' in x direction with an initial speed v_o at an angle θ_o with respect to the horizontal. The ball lands at point '1' on a hill 7.6 meters above the point '0'. The ball lands with a speed $v_{of} = 49\ ^m/_s$ at an angle of 31^o to the horizontal.

1. *Swinging up the hill:*

(a) The equations governing the motion of the ball in the uphill swing are

$$v_x = v_{ox} \qquad v_y = v_{oy} - gt \tag{1}$$

$$x_x = v_{ox}t \qquad y = v_{oy}t - \frac{1}{2}gt^2 \tag{2}$$

$$v_y^2 = v_{oy}^2 - 2gy \tag{3}$$

(b) Find the x-component and y-component of the velocity $\vec{\mathbf{v}}_{of}$ with which the ball hits the hill

$$v_{of\mathrm{x}} = \tag{4}$$

$$v_{of\mathrm{y}} = \tag{5}$$

(c) Before calculating the initial velocity $\vec{\mathbf{v}}_o$; why is it wrong to conclude that the magnitude of the initial velocity $\vec{\mathbf{v}}_o$ is equal to the magnitude of the final velocity $\vec{\mathbf{v}}_{of}$. Give a qualitative argument.

(d) Determine the x-component of the initial velocity $\vec{\mathbf{v}}_o$.

$$v_{o\mathrm{x}} = \tag{6}$$

(e) Determine the y-component of the initial velocity $\vec{\mathbf{v}}_o$.

$$v_{o\mathrm{y}} = \tag{7}$$

(f) What was the initial speed (magnitude of $\vec{\mathbf{v}}_o$) of the ball?

$$|\vec{\mathbf{v}}_o| = \tag{8}$$

(g) At what direction with the horizontal (θ_o) was the ball hit?

$$\theta_o = \tag{9}$$

2. *Swinging down the hill:*
Gimp hits the ball again, again in the x direction. He hits the ball from point '1' with a speed $v_1 = 40\ ^m/s$ at an angle $\theta_1 = 30^o$ with the horizontal. The ball lands at point '2' with a speed $v_{1f} = 42\ ^m/s$ at an angle $\theta_{1f} = 34^o$ with the horizontal.

(a) Write the equations governing the motion of the ball in the downhill swing.

(b) Find the x-component and y-component of the velocity $\vec{\mathbf{v}}_1$ with which the ball lands

$$v_{1\mathrm{x}} = \tag{10}$$

$$v_{1\mathrm{y}} = \tag{11}$$

(c) Find the x-component and y-component of the velocity $\vec{\mathbf{v}}_{1f}$ with which the ball lands

$$v_{1f\mathrm{x}} = \tag{12}$$

$$v_{1f\mathrm{y}} = \tag{13}$$

(d) How much time 't' did the ball take to reach point '2' from point '1'. (Hint: Use the equation $v_y = v_{1y} - gt$.)

$$t = \tag{14}$$

(e) What is the distance d_2 between the point '1' and point '2'.

$$d_2 = \tag{15}$$