PHYS 1230-1530, Rawitscher, Spring 2009
Quiz-2 Feb. 5

G R

Name, (1230?) (1530?)

A rock is thrown into the air, with an initial speed of $v_0 = 12 m/s$, and an initial angle with the horizontal $\theta_0 = 37^0$. If z and x are the vertical and horizontal coordinates of this ballistic trajectory, then the equation of the trajectory, as written down in class, is $z = a\,x + b\,x^2$ where
$a = \tan(\theta_0)$; $b = -\frac{g}{2v_0^2\cos^2(\theta_0)}$. For the values of θ_0 and v_0 given above,
$a = 0.7536$; $b = -0.0534$; $Range = -\frac{a}{b} = 14.125\ m$

1. At what times does the rock reach the x –coordinates $x_1 = 3.531\ m$ and $x_2 = 7.062\ m$

$v_x = v_0 \times \cos\theta_0 = 12 \times \cos(37) = 9.58\ m/s$

$t_1 = \frac{x_1}{v_x} = 0.3684 \qquad t_2 = \frac{x_2}{v_x} = 0.7369$

2. What is the average velocity *vector* for the time interval for which x goes from $x_1 = 3.531\ m$ to $x_2 = 7.062\ m$? Note: *vector* means
i) that you need to give the x and the z components of this average velocity vector, and
ii) give the magnitude and the angle with respect to the horizontal.

$\bar{v}_x = 9.584\ m/s$

$\bar{v}_z = 1.801\ m/s$

$z1 = a \cdot x1 + b\,x_1^2 = 1.995$

$z2 = a \cdot x2 + b\,x_2^2 = 2.659$

$\vec{\bar{v}} = \frac{r_2 - r_1}{t_2 - t_1} = \frac{(z_2 - z_1)}{t_2 - t_1}\hat{j} + \frac{x_2 - x_1}{t_2 - t_1}\hat{i} = 1.801\ m/s\ \hat{j} + 9.584\ m/s\ \hat{i}$

$\bar{v} = \sqrt{(1.801)^2 + (9.584)^2} =$ ~~9.571~~ ~~m/s~~ $9.751\ m/s$

$\tan\theta = \frac{\bar{v}_z}{\bar{v}_x} = 0.188$

$\theta = 10.64^\circ$