Name: KEY

Date:

Section C D F

The Masters School
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Physics
DOBBS

Projectile Motion Worksheet

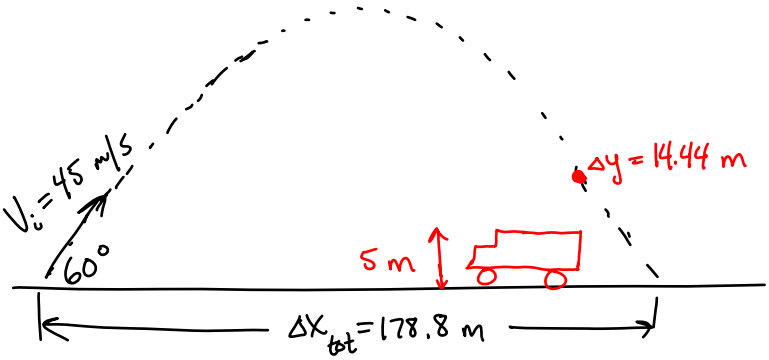
1. In our movie clip, Randall Rains (Nicolas Cage) is a car thief trying to escape the police. During his escape, he *almost* gets trapped as he finds traffic blocked by an accident on the highway. Luckily, a tow truck positioned at just the right place, at just the right time, and (*hey, what do you know*?) in just the right direction is available. So Rains decides to jump over the entire accident site. Let's assume that he launches at 100 mph (approximately 45 m/s), and that the bed of the tow truck is inclined at an angle of 60°.

   $\Delta x = ?$ a. If the average length of cars on the road is 10 m (considering paramedics trucks, fire trucks, tow trucks) how many cars can Rains fly over?

   $\Delta y = ?$ b. If the last car was a paramedics truck, with a vertical roof height of 5 meters, by how much does Rains clear the truck? (Assume the far edge of the truck is 170 m from launch)

   at 170 m, what is Δy?

http://youtube.com/watch?v=8Y_hcQQXxt8



a)

$\Delta x =$	$\Delta y = 0$
$V_{ix} = 22.5$	$V_{iy} = 38.97$
$V_{fx} =$	$V_{fy} =$
$a =$	$a = 9.81$
$\Delta t =$	$\Delta t =$

$\Delta y = V_i \sin\theta\, \Delta t - \frac{1}{2} g \Delta t^2$ (0 and 0)

$\frac{1}{2} g \Delta t^2 = V_i \sin\theta\, \Delta t$

$\Delta t = \frac{38.97}{4.905} = 7.945$ s

$\Delta x = V_x \Delta t$

$= (22.5)(7.945) = 178.8$ m

if cars are 10 m, he can fly over 17 cars

b)

$\Delta x = 170$ m	$\Delta y = ?$
$V_{ix} = 22.5$	$V_{iy} =$
$V_{fx} =$	$V_{fy} =$
$a =$	$a =$
$\Delta t =$	$\Delta t =$

$\Delta x = V_x \Delta t$

$\Delta t = \frac{\Delta x}{V_x} = \frac{170}{22.5} = 7.55$

$\Delta y = V_i \sin\theta\, \Delta t - \frac{1}{2} g \Delta t^2$

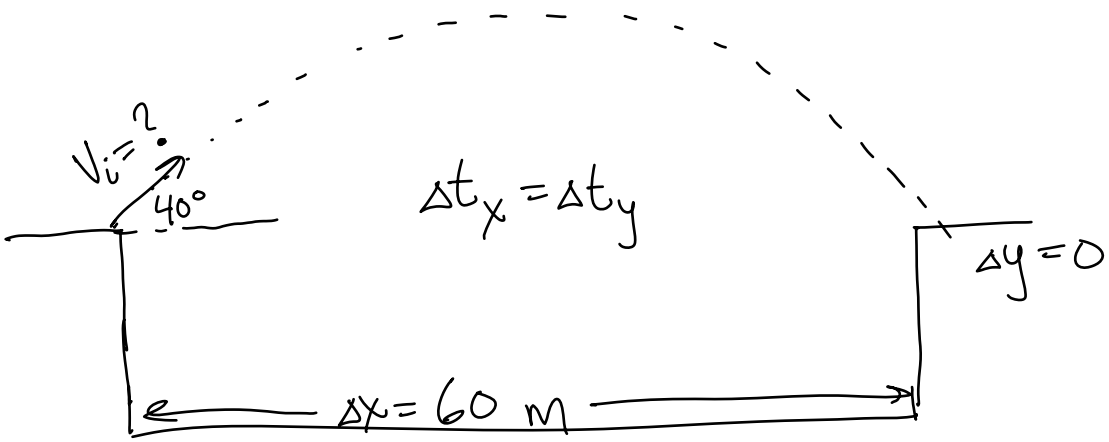
$\Delta y = 38.97\, \Delta t - (4.905) \Delta t^2$

$\Delta y = 14.44$ m

clears the truck by 9.44 m

A daredevil plans on jumping a 60 m wide canyon with his motorcycle, assumed to be at the same height on both sides. To do so, he positions a jump inclined at 40°.

c. What minimum speed must he achieve to clear the canyon? *(Hint: You do not know Vi, use system of equations using the fact that $\Delta t_x = \Delta t_y$)*



$\Delta x = 60$ m	$\Delta y = 0$ m
V_{ix} =	V_{iy} =
V_{fx} =	V_{fy} =
$a = 0$	$a = 9.81$
Δt =	Δt =

$$\Delta x = V_i \cos\theta \, \Delta t$$

$$\Delta t = \frac{\Delta x}{V_i \cos\theta}$$

$$\Delta y = V_i \sin\theta \, \Delta t - \frac{1}{2} g \Delta t^2$$

$$\frac{1}{2} g \Delta t^2 = V_i \sin\theta \, \Delta t$$

$$\Delta t = \frac{2 V_i \sin\theta}{g}$$

$$\frac{\Delta x}{V_i \cos\theta} = \frac{2 V_i \sin\theta}{g}$$

$$\Delta x \, g = 2 V_i \sin\theta \cdot V_i \cos\theta$$

$$\frac{\Delta x \, g}{2 \sin\theta \cos\theta} = V_i^2$$

$$24.47 \text{ m/s} = V_i$$