

# Science Lesson Plan

## Summary of Lesson: Marble Launcher

For this lab I was a helper and the students were responsible for plotting the equation that models the marble launcher. This is something that has been done in years past using Excel and I switched the coding over to work in Matlab. At this point, from all of my prior lessons, students should be able to name the givens, write equations, and plot. I was there for questions and issues that arose. Many students had basic errors for example, not calling a variable by the same name when plotting or using it in an equation. Students were quick to ask for help without trying to figure on it out on their own or ask classmates. Then students also had to plot the “target”, which is a box with a specific height and distance from the launcher. This is something I had to give to them and then go over because we used both an “if-else” logarithm and then I found an easier way by using a “Heaviside Function”. You can see the M-File write up for each of these functions.

## Science Lesson Plan

**Teacher:** Molly Clay

**Period:**

**Class:** Honors Physics Lowell High School

**Date(s):** October 2011

<b>SETTING THE STAGE</b>	
<u>Essential Question</u>	Why is Matlab Important?
<u>Content Objective(s)</u> (Student-friendly)	Use Matlab to model a marble launching into box a given distance away
<u>Connection to previous or future lessons</u>	This is one of the labs that Matlab was used in order to model a theory.
<u>Critical Thinking Questions</u>	
<u>Key Vocabulary</u>	
<u>Materials Needed/Safety</u>	Laptops Notebooks Pencil
<b>ACTIVE INSTRUCTION</b>	
<ul style="list-style-type: none"> <li>Launch (Engage)</li> </ul>	The students will get the laptop outs...working with laptops directly in the classroom will grab the students attention
<ul style="list-style-type: none"> <li>Investigation (Explore)</li> </ul>	Students will work in groups with one main "Computer Person" who was the main student responsible for the coding of the model. But, every student in the group was responsible to knowing how the code works. The students used Matlab to model a marble launching from the "launcher" into a target with a specific range away as well as height.
<b>TIME FOR REFLECTION</b>	
<ul style="list-style-type: none"> <li>Summarization (Explain &amp; Extend)</li> </ul>	
<ul style="list-style-type: none"> <li>Assessment (Evaluate)</li> </ul>	NONE
<ul style="list-style-type: none"> <li>Homework</li> </ul>	NONE

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%Molly Clay
%Honors Physics
%November 1, 2011
%Marble Launcher

%Start M-File:
clc; clear all; close all;

%Givens:

Grav = 9.8;      %Acceleration due to gravity
                (m/s^2)
Vo = 7;          %Initial Velocity
Yo = .22;        %Height of the muzzle above
the ground(m)
Theta =45;      %Angle of Launcher (degrees)

%Target Givens:
rangetar = 1;    %Distance of Target
                (m)
heighttar = 1;  %Height of Target
                (m)

%Set up Distance Vector
X = 0:0.02:5;   %Range (m)

%Solve the Range Equation
%Y = Yo + sin(Theta)/cos(Theta).*X-
(.5*Grav)/(Vo*cos(Theta))^2.*X.^2;
Y =Vo/4*cosd(Theta)*X -
X.^3/Vo*tand(Theta);

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%Target Algorithm:
xtar = X;
ytar = heighttar*(heaviside(xtar-(rangetar-
0.06))-heaviside(xtar-(rangetar+0.06)));

%Plot both Range Equation and Target
hold on
plot(X,Y, '-b', 'LineWidth',1)
plot(xtar,ytar, '-r', 'LineWidth',1)
xlabel('Distance (m)')
ylabel('Height (m)')
title('Marble Launcher Model')
axis([0 5 0 3])
hold off

% for i=1:length(xtar)
%     if xtar(i) == rangetar -0.06
%         ytar(i) = heighttar;
%     elseif xtar(i) ==rangetar -0.04
%         ytar(i) = heighttar;
%     elseif xtar(i) ==rangetar-0.02
%         ytar(i) = heighttar;
%     elseif xtar(i) ==rangetar
%         ytar(i)=heighttar;
%     elseif xtar(i) ==rangetar +0.02
%         ytar(i) =heighttar;

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```
% elseif xtar(i) ==rangetar+0.04
%     ytar(i) =heighttar;
% elseif xtar (i) ==rangetar+0.06
%     ytar(i) =heighttar;
% else ytar(i)=0;
% end
% end
```