Name: Paula Lince

Date: Monday September 8, 2019

Course: Physics 1111

Lab: Constant acceleration 1-D motion and data fitting

Grade: ___________

1) **Objective:** The objective of this lab was to learn how constant acceleration in 1-Dmotion works by running a simulation in Sage math. During this lab student also learned how to use data fitting. This lab will let students to understand the concepts of distance , acceleration ,and velocity of an object.

2) **Theory:** Students are expect to use the basic equation used to find acceleration, time, and distance.

Formulas:

- $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- $\Delta X = Vi * \Delta t + \frac{1}{2}(a)(t)^2$

3) **Procedure:**

I. Using Sage math plot an equation that will allow to run a simulation of a ball been throw up with an initial height of 1.0 m and an initial velocity of 2.1 m/s assuming that initial time is 0.

II. Base on the graph for part 2, sketch a plot showing ball's position at Y1 and Y2.

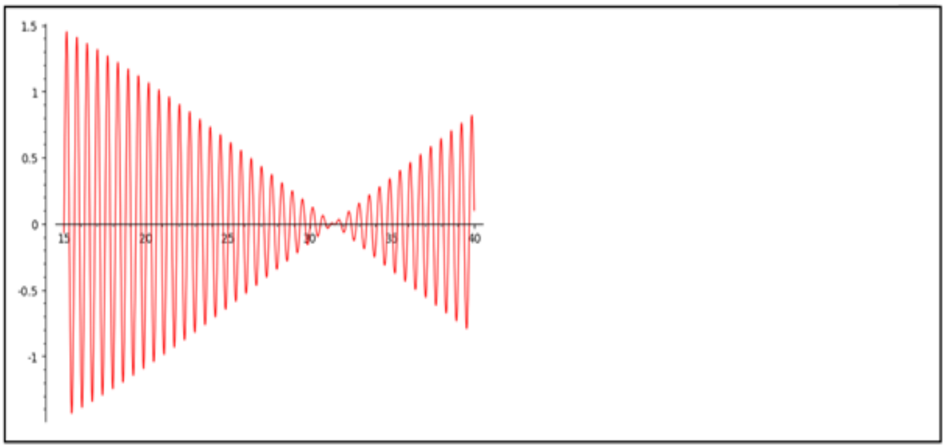
III. Base on the data given identify which line represents each parameter.

IV. Using the data given for planet 1 and 2, determine the initial position, initial velocity and initial acceleration of each planet.

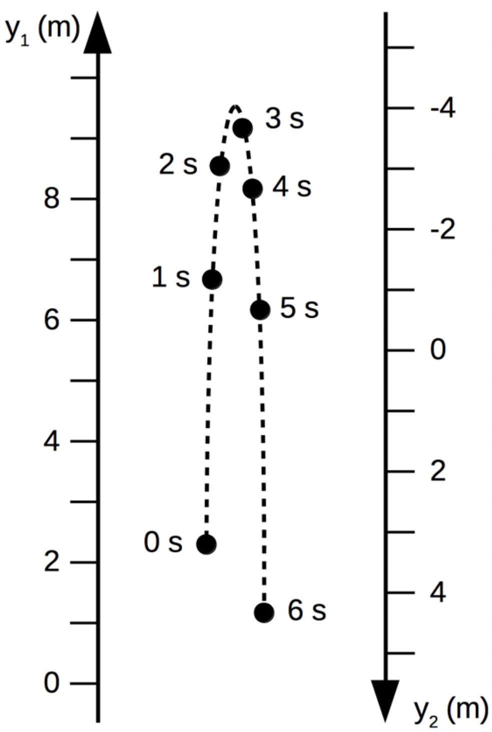
4) **Data:**

- **Part one:**

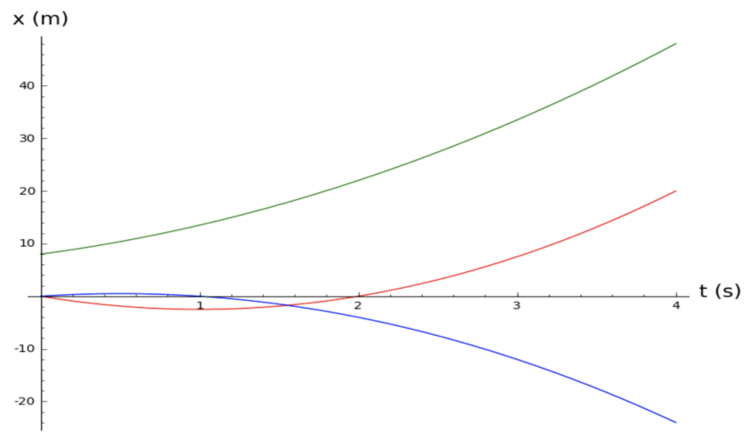
```
t = var("t")
p1 = plot(sin(10*t) + sin(10.1*t), (t, 15, 40), color="red")
g = Graphics()
g += p1
g.show()
```



- **Part two:**



- **Part Three**



Parameters for the identification of the colored curves			
First parameters	X_o = 0 m	V_o = -5 m/s	a = 5 m/s2
Second parameters	X_o = 0 m	V_o= 2 m/s	a = -4 m/s2
Third parameters	X_o = 8 m	V_o = 4 m/s	a = 3 m/s2

- **Part 4**

Planet 1:

time (s)
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50
y1 (m)
20.20
18.90
17.72
16.28
15.44
14.78
13.63
12.65
12.31
11.66
11.41
10.77
10.13
9.82

9.59	9.77
9.50	10.34
9.75	10.50
9.76	11.19
9.53	11.60
9.68	12.10

Planet 2:
time (s)
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50
y2 (m)
-15.35
-14.17
-13.23
-12.16
-11.25

-10.41	11.96
-9.37	15.47
-7.82	17.06
-5.67	19.96
-3.65	23.01
-2.49	26.00
0.09	30.62
2.12	32.30
6.17	34.93
8.58	40.45
9.04	

5) Calculations:

Part 1:

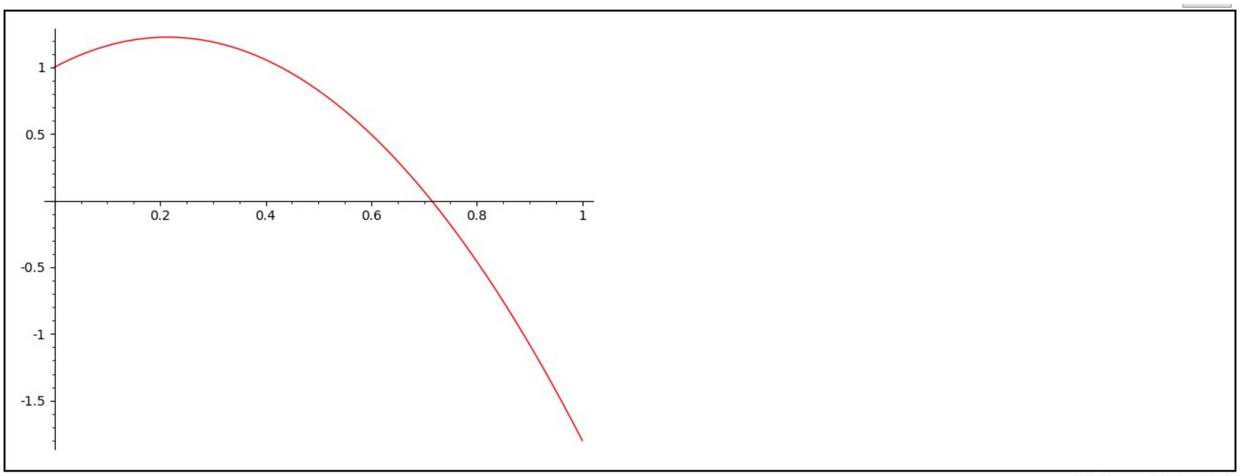
$$\Delta X_f = 1m * (2.1\ m/s)t + \frac{1}{2}(-9.8)(t)^2$$

TIME	DISTNACE
O s	1.0 m
0.2 s	1.2 m
0.4 s	1.0 m
0.6 s	0.50 m

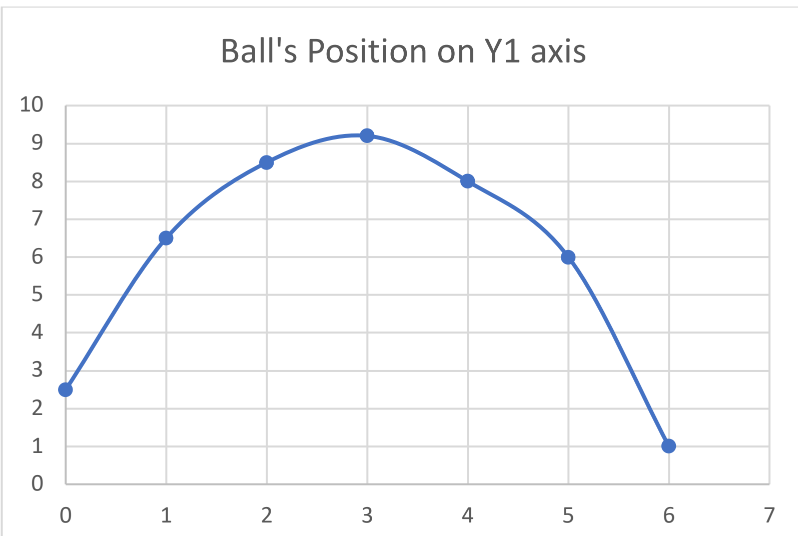
6) Results:

Part 1: Data inserted in Sage Math

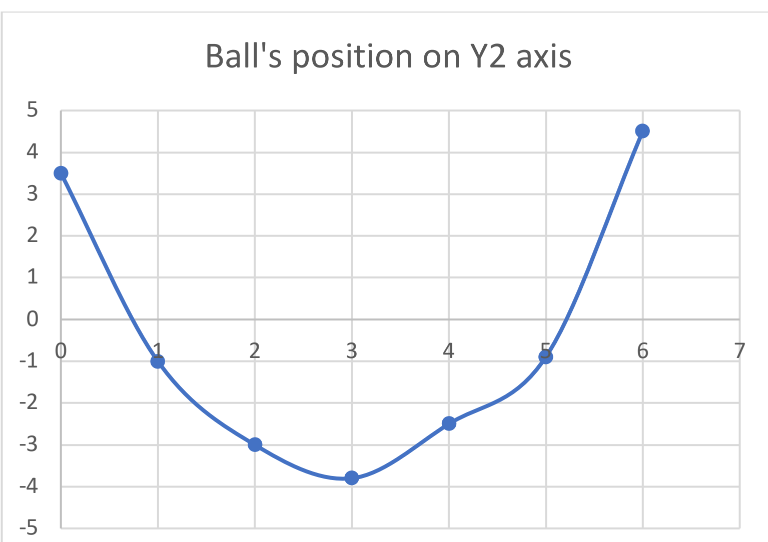
```
t = var("t")
p1 = plot (t^2*0.5*(-9.80) + t*2.1 +1, (t, 0, 1), color="red")
g = Graphics()
g += p1
g.show()
```



Part 2:

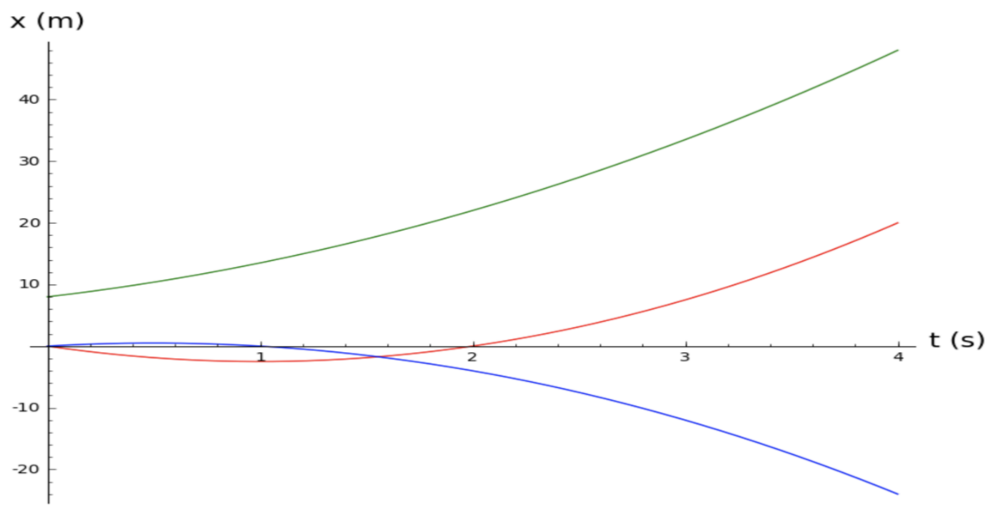


Y1 (m)	Time (s)
0	2.5
1	6.5
2	8.5
3	9.2
4	8
5	6
6	1



Y2(m)	Time (s)
3.5	0
-1	1
-3	2
-3.8	3
-2.5	4
-0.9	5
4.5	6

Part 3:

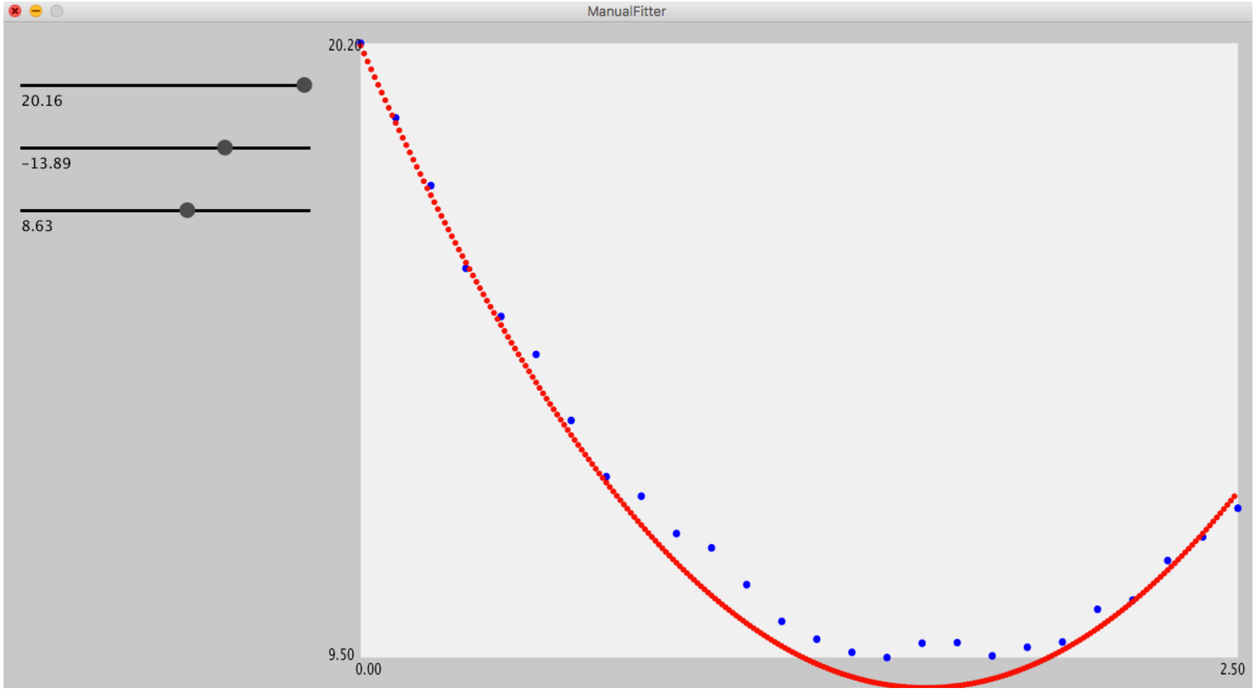


Parameters				color
First parameters	X_o = 0 m	V_o = -5 m/s	a = 5 m/s2	Red
Second parameters	X_o = 0 m	V_o= 2 m/s	a = -4 m/s2	Blue
Third parameters	X_o = 8 m	V_o = 4 m/s	a = 3 m/s2	Green

For each parameter, the student used the quadratic function to identify each line on the graph. This graph shows how acceleration works in an object with different magnitude. As an example, when a car is driving and its going down a hill the acceleration tends to decrease, but when is going up the hill usually the acceleration increases. We can identify each line by its acceleration, as the line red increases its direction, its acceleration also increases to 5 m/s^2, the same with the blue line as its direction decreases its acceleration decreases to -4m/s^2.

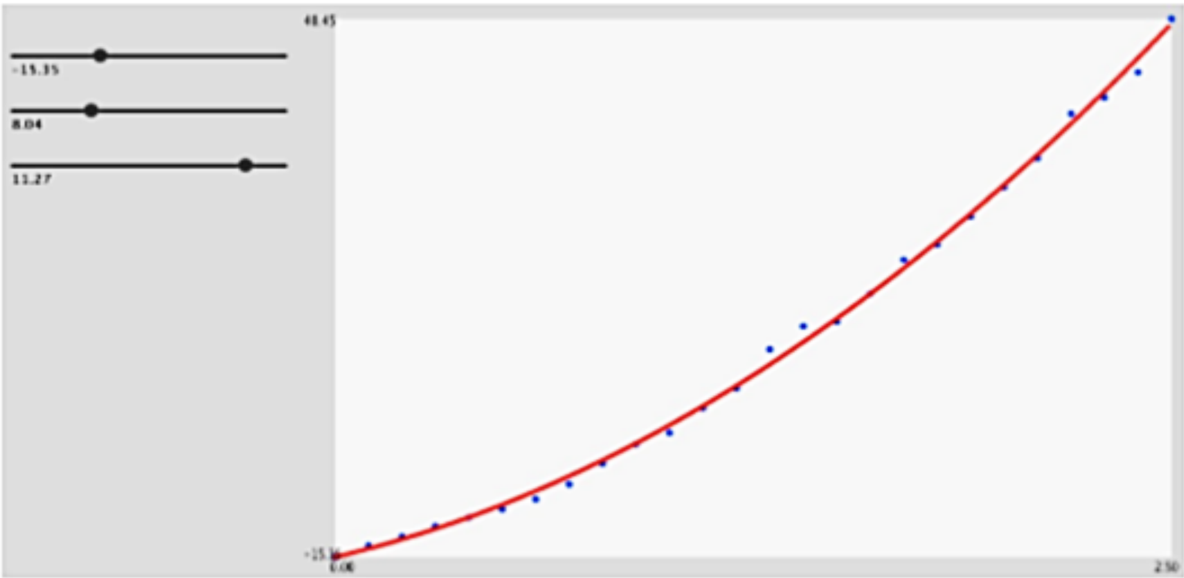
Part four:

Planet 1



Parameters for planet two	
Initial position (m)	20.16
Initial velocity (m/s)	-13.89
Acceleration (m/s^2)	8.27

Planet 2



Parameters for planet two	
Initial position (m)	-15.35
Initial velocity (m/s)	8.04
Acceleration (m/s^2)	13.27

Parameters for the planets				
	Acceleration (m/s^2)	**Orientation of the axis**	**Magnitude of initial velocity**	**Starting coordinates of the ball (m)**
Planet one	-8.27	Downward	Upward	(0.00, 20.16)
Planet two	-13.27	Downward	Upward	(0.00, -15.35)

7) **Analysis:** In conclusion, for each section of the lab the student was able to determine the acceleration of the object based on the equation learned in class. Also, how to analyze a data fitting.

8) **Comments:** During this lab I was able to learn how graph utilizing sage math.