

Newton's 2nd Law Lab: Graphing Data With Excel

The following steps are specific to the Newton's Second Law lab; however, the information can be applied to any data for graphing purposes.

Graphing Velocity versus Time

Step 1: Input your data into an Excel spreadsheet file.

	A	B	C
1	Time (s)	Displacement (m)	Velocity (m/s)
2	0.1	0.015	
3	0.2	0.029	
4	0.3	0.040	
5	0.4	0.053	
6	0.5	0.065	
7	0.6	0.079	
8	0.7	0.090	
9	0.8	0.102	

Step 2: To calculate the velocity column, divide displacement by 0.1 s. You can do this in Excel by entering the following into cell C2: “=B2/.1”. Press Enter/Return.

	A	B	C
1	Time (s)	Displacement (m)	Velocity (m/s)
2	0.1	0.015	=B2/.1
3	0.2	0.029	
4	0.3	0.040	
5	0.4	0.053	
6	0.5	0.065	
7	0.6	0.079	
8	0.7	0.090	
9	0.8	0.102	

Step 3: Click and hold on the lower right corner of cell C2 and drag down to C9 to copy the formula into the rest of the cells for velocity.

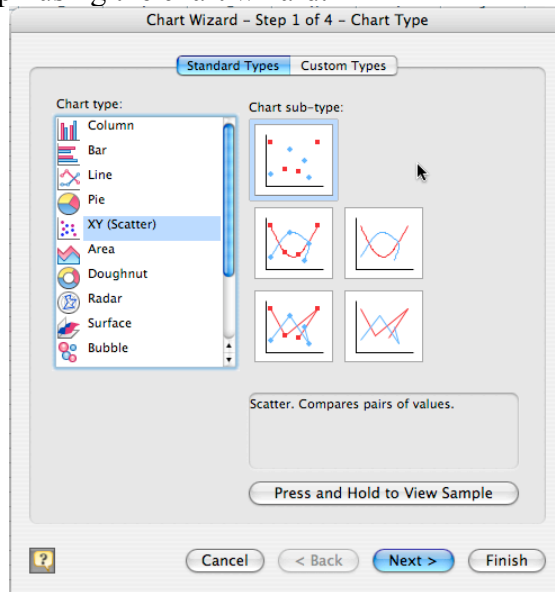
	A	B	C
1	Time (s)	Displacement (m)	Velocity (m/s)
2	0.1	0.015	0.15
3	0.2	0.029	
4	0.3	0.040	
5	0.4	0.053	
6	0.5	0.065	
7	0.6	0.079	
8	0.7	0.090	
9	0.8	0.102	



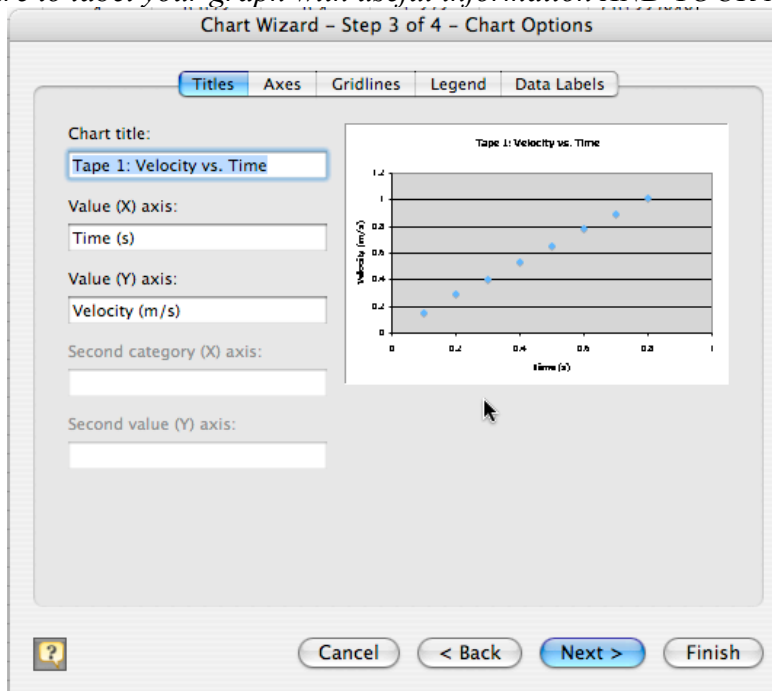
	A	B	C
1	Time (s)	Displacement (m)	Velocity (m/s)
2	0.1	0.015	0.15
3	0.2	0.029	0.29
4	0.3	0.040	0.4
5	0.4	0.053	0.53
6	0.5	0.065	0.65
7	0.6	0.079	0.79
8	0.7	0.090	0.9
9	0.8	0.102	1.02

Step 4: Select the data *only* from columns A and C by selecting the data in column A, then holding down “control”, and then selecting the data in column C.

Step 5: Create a Scatter Point graph using the chart wizard.

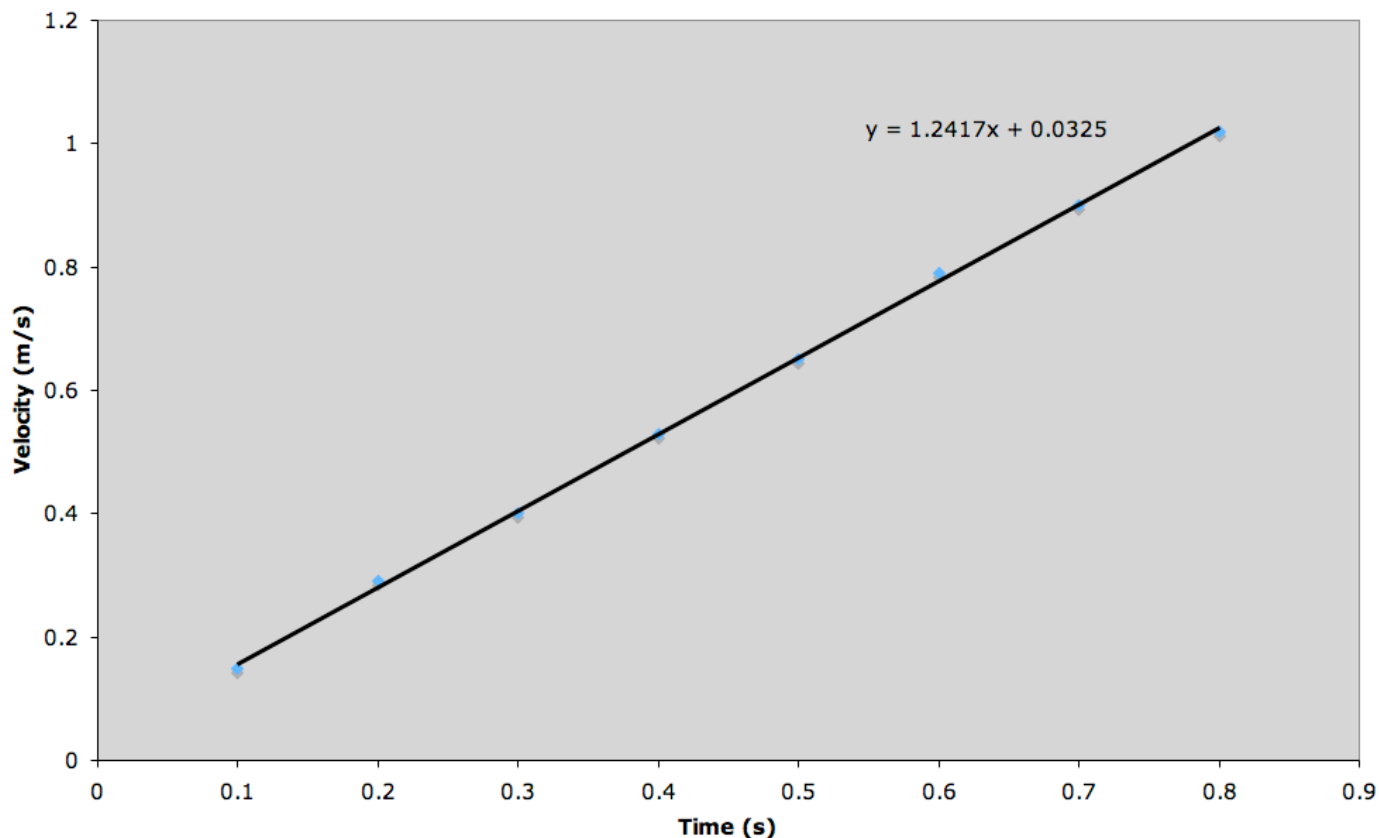


Be sure to label your graph with useful information AND YOUR NAME.



Step 6: Right-click on a data point on the graph and select “Add Trendline...”. Select “Linear”, and check the “Display Equation On Chart” box. The slope of the line is the acceleration (in this case it is 1.2417 m/s^2).

Tape 1: Velocity vs. Time



Step 7: Print the graph, and enter the slope information into your other data table. Repeat these steps for the other 4 ticket tapes.

STOP! DO NOT GO ON UNTIL YOU HAVE COMPLETED A “v vs. t” GRAPH FOR EACH OF 5 TICKER TAPES!!!

Completing Main Data Table (you will need to print this data table out)

Step 1: Input your data into an Excel spreadsheet file, including acceleration from ticker tape.

Step 2: Input the total mass, either manually or using a formula.

	A	B	C	D	E	F	G
	Tape	Force (N)	Mass M (kg)	Mass m (kg)	M+m (kg)	Acceleration from Ticker Tape (m/s^2)	Acceleration from $F = ma$ (m/s^2)
1							
2	1	2	1.173	0.2	=C2+D2	1.24	
3	2	4	0.973	0.4			
4	3	6	0.773	0.6			
5	4	6	2.373	0.6			
6	5	6	3.973	0.6			

Step 3: Column G is determined from Newton's 2nd Law; the acceleration is the force applied divided by the total mass being accelerated, or column B divided by column E.

	A	B	C	D	E	F	G
	Tape	Force (N)	Mass M (kg)	Mass m (kg)	M+m (kg)	Acceleration from Ticker Tape (m/s ²)	Acceleration from $F = ma$ (m/s ²)
1							
2	1	2	1.173	0.2	1.373	1.24	=B2/E2
3	2	4	0.973	0.4	1.373		
4	3	6	0.773	0.6	1.373		
5	4	6	2.373	0.6	2.973		
6	5	6	3.973	0.6	4.573		

Step 4: Limit the number of decimal places for column G by right-clicking the column and choosing "Format Cells..." → "Number".

	A	B	C	D	E	F	G
	Tape	Force (N)	Mass M (kg)	Mass m (kg)	M+m (kg)	Acceleration from Ticker Tape (m/s ²)	Acceleration from $F = ma$ (m/s ²)
1							
2	1	2	1.173	0.2	1.373	1.24	1.46
3	2	4	0.973	0.4	1.373		2.91
4	3	6	0.773	0.6	1.373		4.37
5	4	6	2.373	0.6	2.973		2.02
6	5	6	3.973	0.6	4.573		1.31

Tapes 1-3: Graphing Acceleration vs. Force (With Constant Total Mass)

Step 1: Select data for *tapes 1 through 3* from columns B and F.

Step 2: Graph this data. Add trendline and equation of trendline to the graph.

Tapes 3-5: Graphing Acceleration vs. Mass (With Constant Net Force)

Step 1: Select data for *tapes 3 through 5* from columns E and F.

Step 2: Graph this data. There is no need for a trendline as the graph will NOT be linear.

Graphing Acceleration x Mass vs. Net Force

Step 1: Create a new column called "Acceleration x Mass"; the data for this column will be column F times column E.

Step 2: Select the data for *all 5 tapes* from this new column and column B.

Step 3: Graph this data. Add trendline and equation of trendline to the graph.