

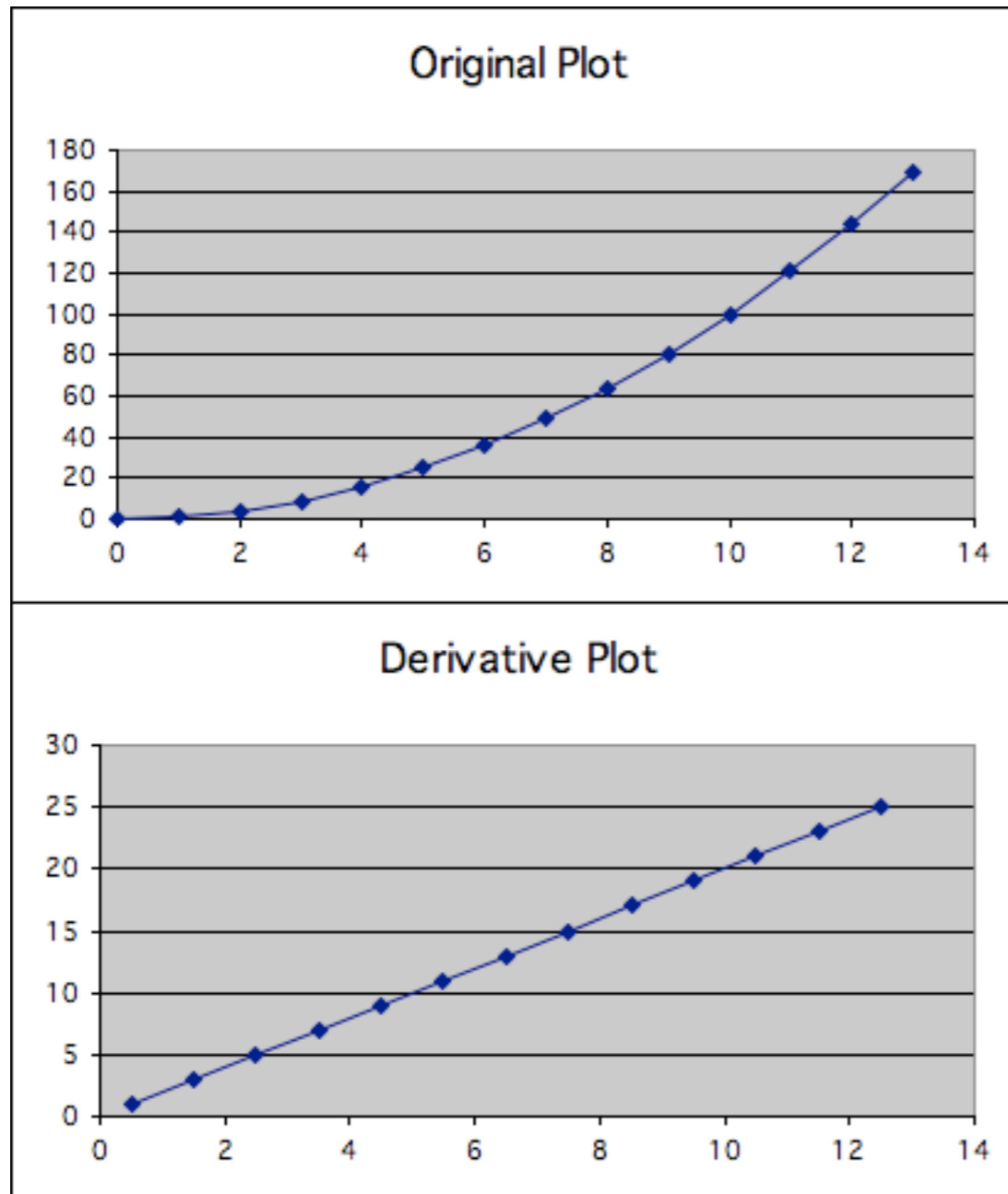
# Creating a Derivative Plot in Excel

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# Outline

- What is a derivative plot?
- Requirements
- 9 steps to create a derivative plot in Excel
- Demonstration

# Derivative Plot



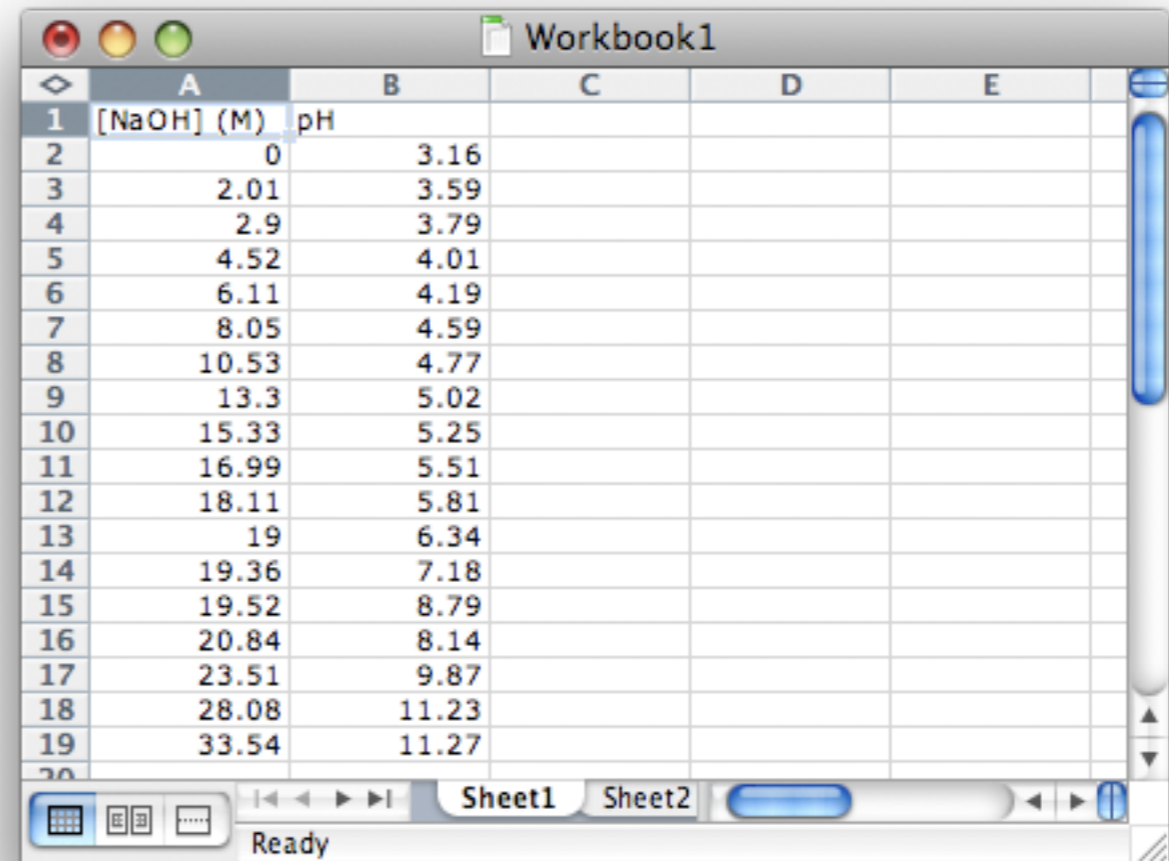
- Plots rate of change of experimental data
- Useful tool for visualizing relationships in experimental data
- Used in multiple fields, including economics and the sciences

# Requirements

- A computer with Microsoft Excel installed
- A set of experimental data with one dependent and one independent variable

# Step I

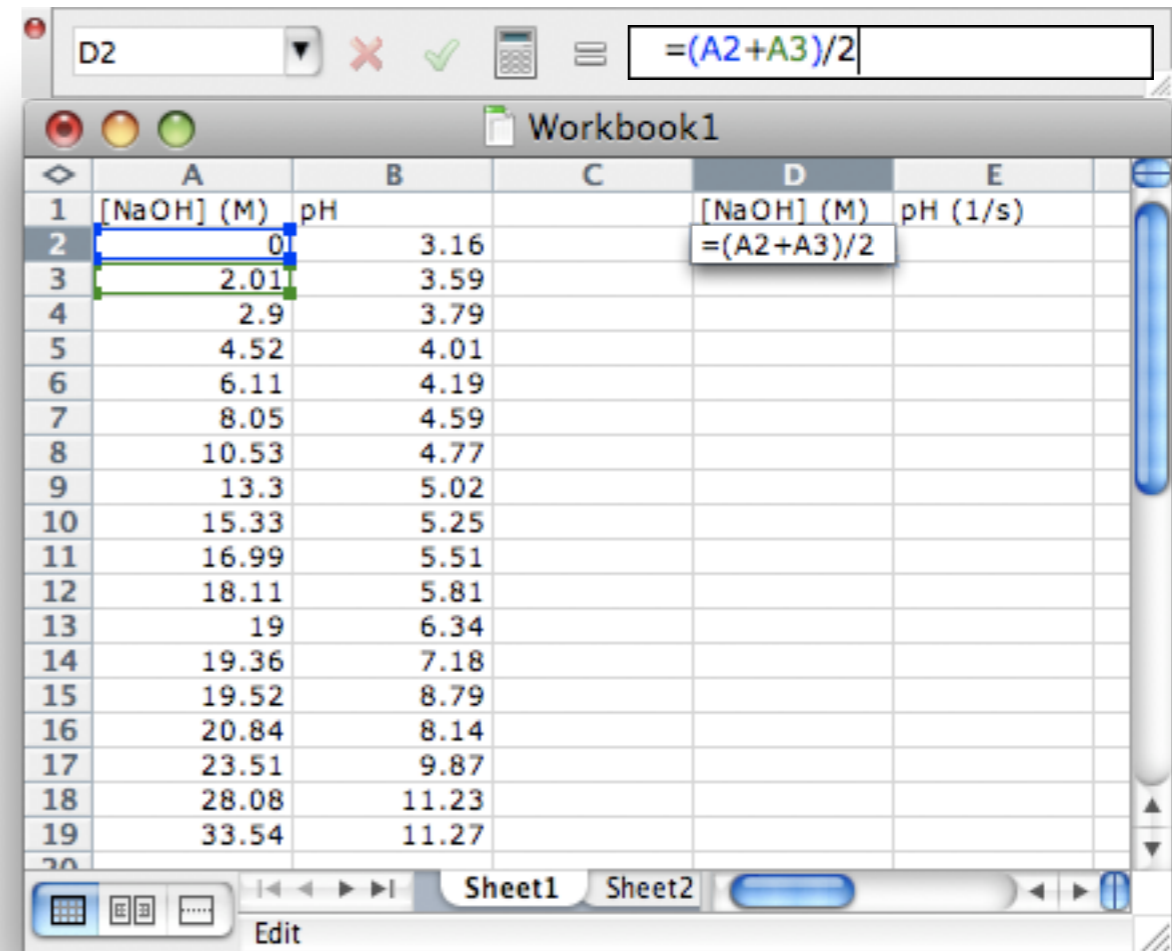
- Create a new Excel document.
- Enter the data, placing independent data in one column and dependent data in another.



	A	B	C	D	E
1	[NaOH] (M)	pH			
2	0	3.16			
3	2.01	3.59			
4	2.9	3.79			
5	4.52	4.01			
6	6.11	4.19			
7	8.05	4.59			
8	10.53	4.77			
9	13.3	5.02			
10	15.33	5.25			
11	16.99	5.51			
12	18.11	5.81			
13	19	6.34			
14	19.36	7.18			
15	19.52	8.79			
16	20.84	8.14			
17	23.51	9.87			
18	28.08	11.23			
19	33.54	11.27			
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# Step 2

- At the beginning of an empty column, enter the formula: **“(A2+A3)/2”**, for the independent data.

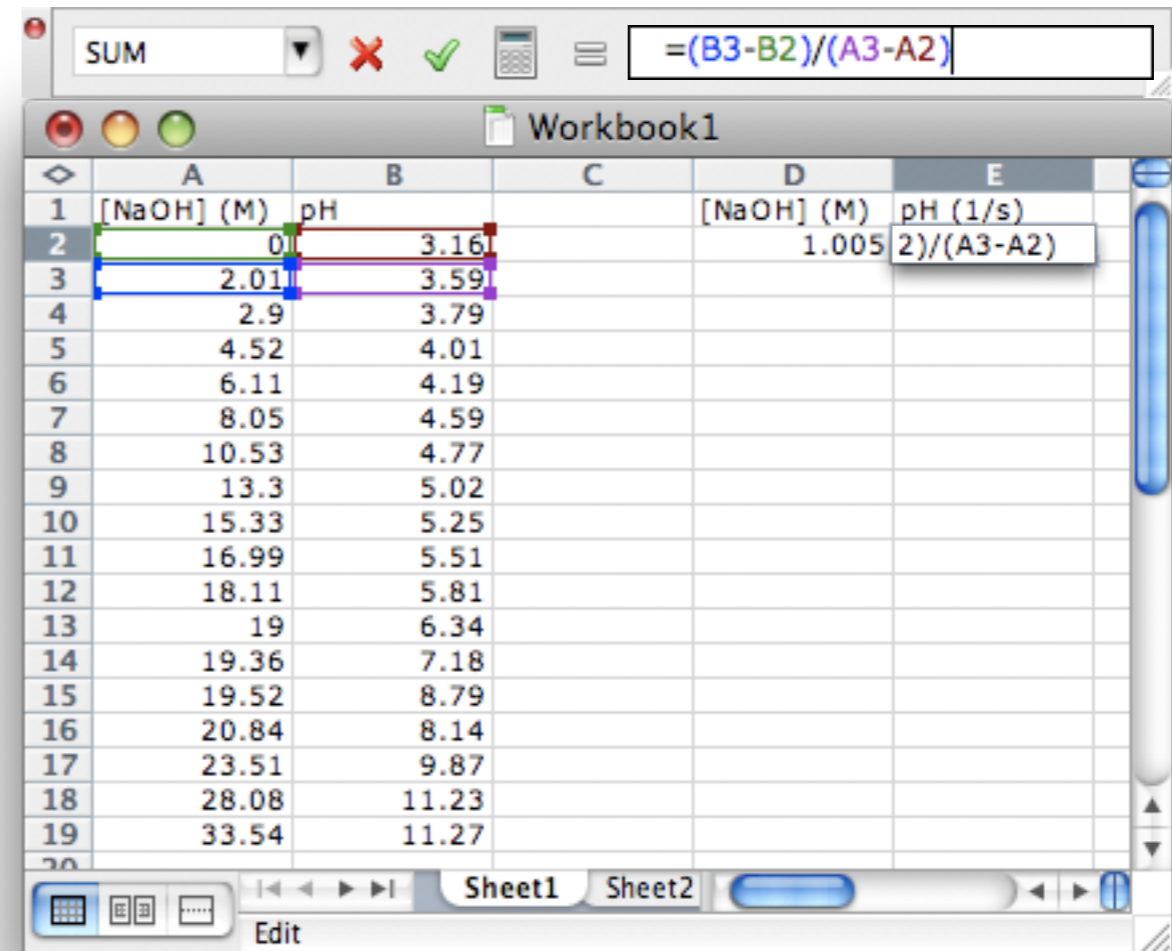


The screenshot shows a spreadsheet window titled "Workbook1" with two sheets, "Sheet1" and "Sheet2". The active sheet is "Sheet1". The spreadsheet has columns A through E. Column A is labeled "[NaOH] (M)" and column B is labeled "pH". Column D is labeled "[NaOH] (M)" and column E is labeled "pH (1/s)". The formula bar at the top shows the formula  $=(A2+A3)/2$  being entered into cell D2. The data in the spreadsheet is as follows:

	A	B	C	D	E
1	[NaOH] (M)	pH		[NaOH] (M)	pH (1/s)
2	0	3.16		$=(A2+A3)/2$	
3	2.01	3.59			
4	2.9	3.79			
5	4.52	4.01			
6	6.11	4.19			
7	8.05	4.59			
8	10.53	4.77			
9	13.3	5.02			
10	15.33	5.25			
11	16.99	5.51			
12	18.11	5.81			
13	19	6.34			
14	19.36	7.18			
15	19.52	8.79			
16	20.84	8.14			
17	23.51	9.87			
18	28.08	11.23			
19	33.54	11.27			

# Step 3

- At the beginning of another empty column, enter the formula, “ **$(B3-B2)/(A3-A2)$** ”, for the dependent values.



The screenshot shows a spreadsheet window titled "Workbook1". The active cell is E2, and the formula bar displays the formula  $= (B3 - B2) / (A3 - A2)$ . The spreadsheet contains the following data:

	A	B	C	D	E
1	[NaOH] (M)	pH		[NaOH] (M)	pH (1/s)
2	0	3.16		1.005	$(B3 - B2) / (A3 - A2)$
3	2.01	3.59			
4	2.9	3.79			
5	4.52	4.01			
6	6.11	4.19			
7	8.05	4.59			
8	10.53	4.77			
9	13.3	5.02			
10	15.33	5.25			
11	16.99	5.51			
12	18.11	5.81			
13	19	6.34			
14	19.36	7.18			
15	19.52	8.79			
16	20.84	8.14			
17	23.51	9.87			
18	28.08	11.23			
19	33.54	11.27			

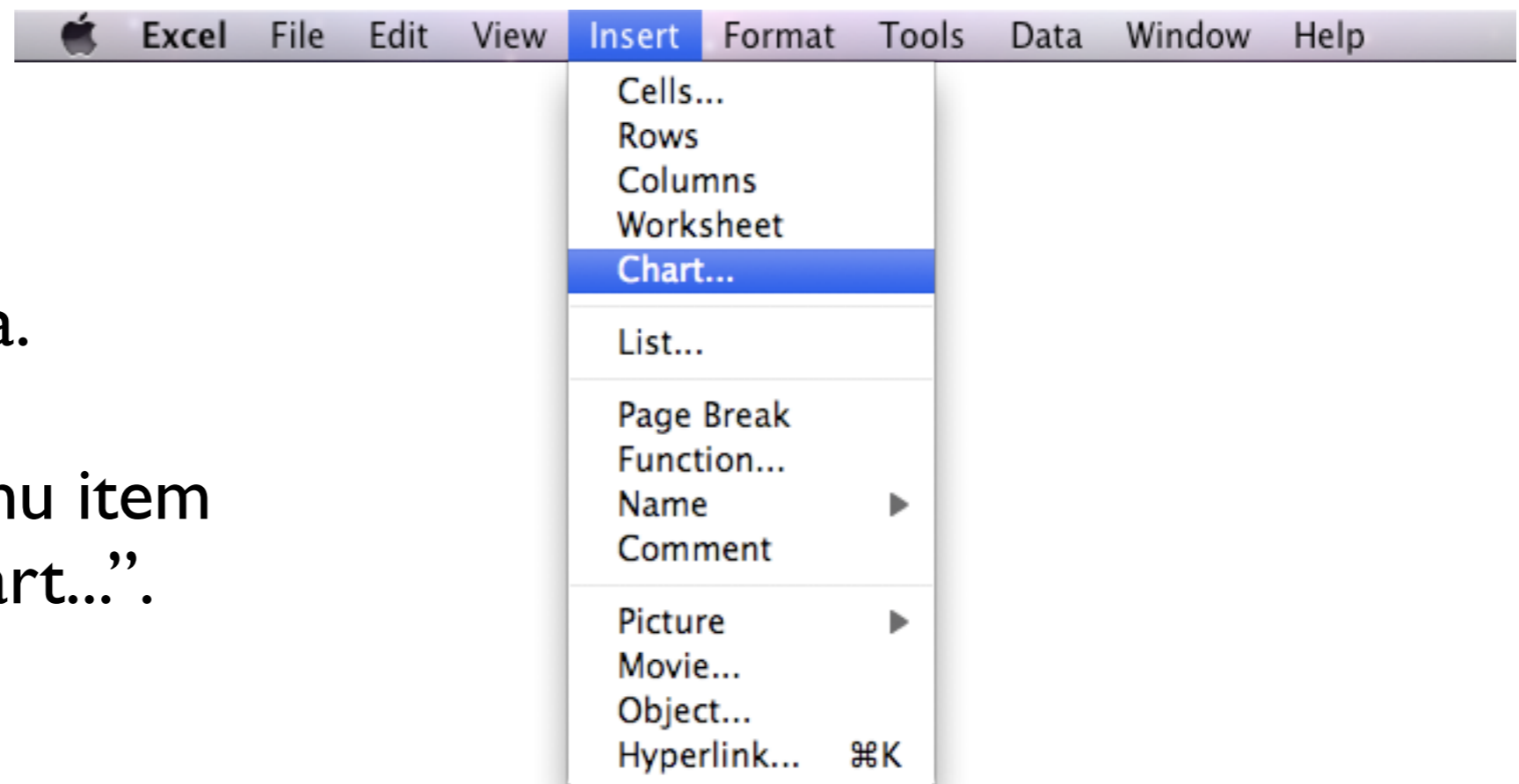
# Step 4

- Copy the formula from these two rows to the remaining rows.
- Be sure to have one less data point in the derivative data than in the original.

	A	B	C	D	E
1	[NaOH] (M)	pH		[NaOH] (M)	pH (1/s)
2	0	3.16		1.005	0.21393035
3	2.01	3.59		2.455	0.2247191
4	2.9	3.79		3.71	0.13580247
5	4.52	4.01		5.315	0.11320755
6	6.11	4.19		7.08	0.20618557
7	8.05	4.59		9.29	0.07258065
8	10.53	4.77		11.915	0.09025271
9	13.3	5.02		14.315	0.11330049
10	15.33	5.25		16.16	0.15662651
11	16.99	5.51		17.55	0.26785714
12	18.11	5.81		18.555	0.59550562
13	19	6.34		19.18	2.33333333
14	19.36	7.18		19.44	10.0625
15	19.52	8.79		20.18	-0.4924242
16	20.84	8.14		22.175	0.64794007
17	23.51	9.87		25.795	0.297593
18	28.08	11.23		30.81	0.00732601
19	33.54	11.27			

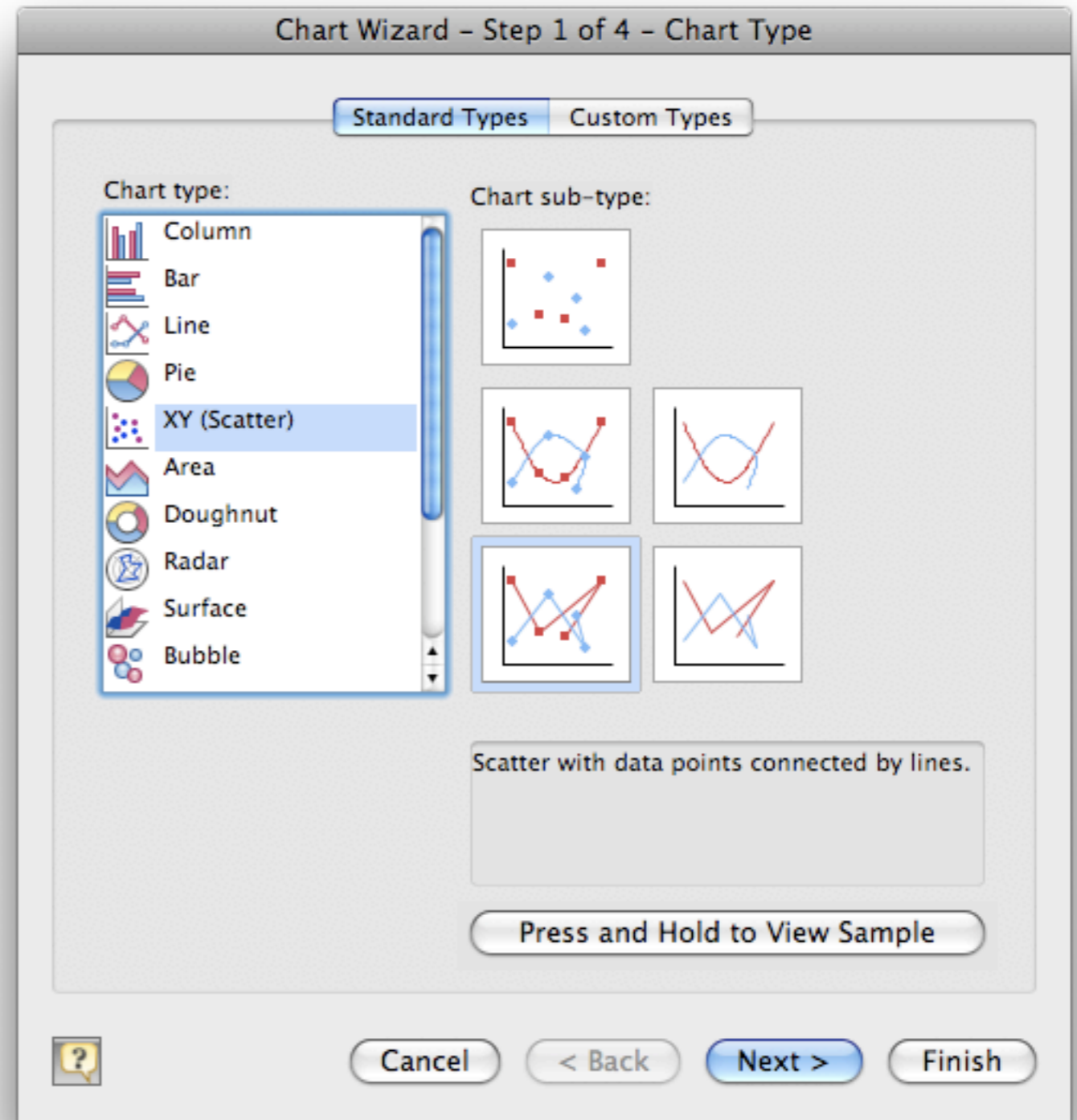
# Step 5

- Select the data.
- Select the menu item “Insert -> Chart...”.



# Step 6

- Select the “XY (Scatter)” chart type and the “Scatter with data points connected by lines.” sub-type.
- Click “Next >”.
- Click “Next >” again.



# Step 7

- Enter the chart title and axis labels.

Chart Wizard - Step 3 of 4 - Chart Options

Titles Axes Gridlines Legend Data Labels

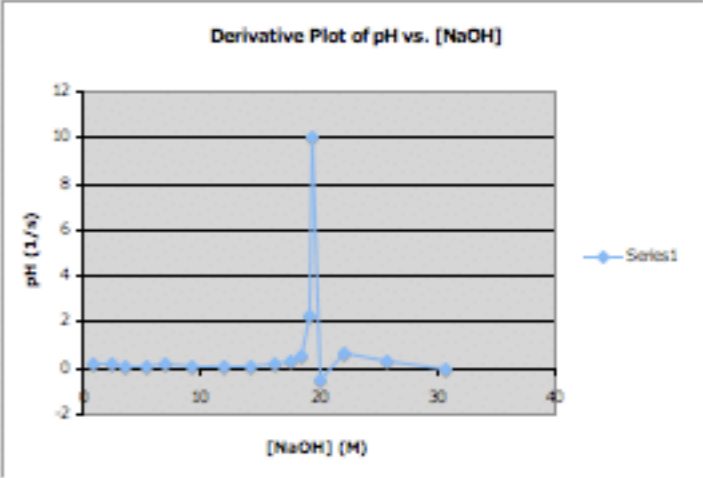
Chart title:  
Derivative Plot of pH vs. [NaOH]

Value (X) axis:  
[NaOH] (M)

Value (Y) axis:  
pH (1/s)

Second category (X) axis:

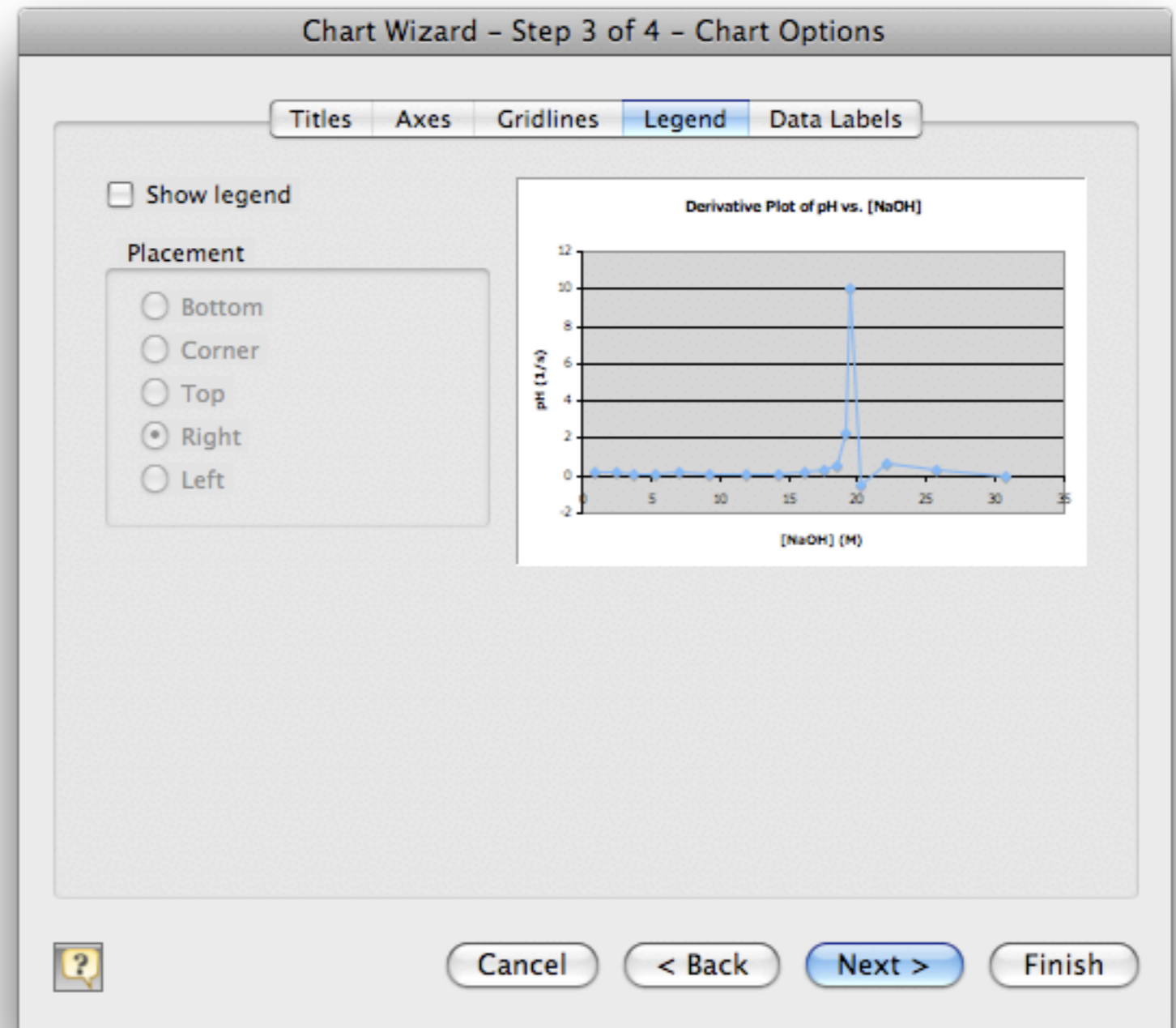
Second value (Y) axis:



Cancel < Back Next > Finish

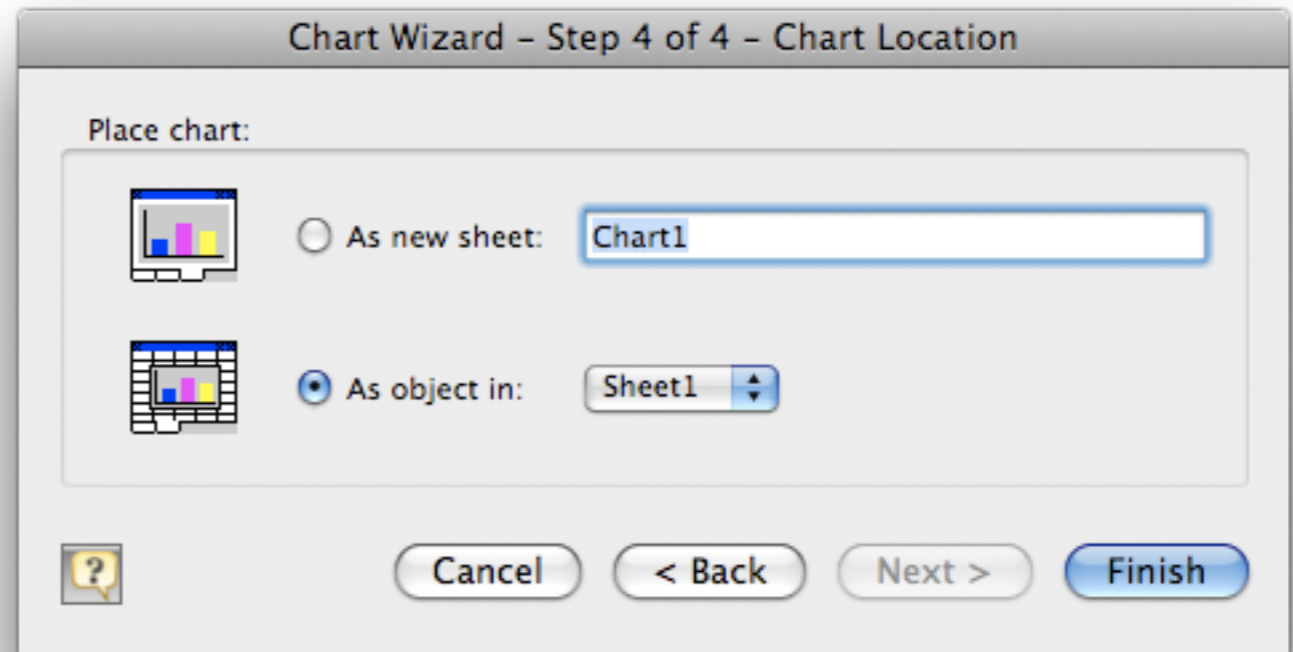
# Step 8

- Select the “Legend” tab and deselect “Show Legend”.
- Click “Next >”.



# Step 9

- Click “Finish”.



**Demo**

# Recap

- Derivative plots are useful for visualizing relationships in experimental data
- You can make a derivative plot in Excel in 9 short steps

