

The Evils of Powerpoint 2007

Data Analysis

Ed Gatzke

ECHE 460, Spring 2010

Error Bars and m/b Error

- Use error bars if you have multiple measurements
 - Sometimes you need error bars in both the x and y direction
- Do not use error bars if you have a lot of measurements
 - Dynamic response sampled every second
- If you used a linear form of an equation, USE REGRESSION
 - This gives you uncertainty on slope and intercept, $m \pm dm$ and $b \pm db$
- Ideally propagate your error through your function
- Report with $\pm$, 5.23 ± 0.012 (use charmap for $\pm$ symbol)
- Example
 - Slope $m=h/(L_p C_p)$ and regression gives you dm , slope uncertainty
 - Your function is $h=m(L_p C_p)$ and you should find dh
 - You may have to assume uncertainty for other constants (or 0)

Microsoft Excel window titled "eche460demo - Microsoft Excel". The ribbon includes Home, Insert, Page Layout, Formulas, Data, Review, View, and Aspen. The Home ribbon is active, showing options for Clipboard, Font, Alignment, Number, Styles, Cells, and Editing.

The spreadsheet displays data in columns A through L and rows 1 through 22. The active cell is C7, containing the value 10.

The data in the spreadsheet is as follows:

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2			Relatively Simple Data									
3												
4			Assume you have some simple system where you have multiple measurements for each independent variable.									
5												
6		y (measured)	x (specified)									
7		20.3188	10									
8		18.6923	10									
9		19.5664	10									
10		40.3426	20									
11		43.5784	20									
12		42.7694	20									
13		58.6501	30									
14		63.0349	30									
15		60.7254	30									
16												
17												
18												
19												
20												
21												
22												

Note, this data was generated from the following model:
$$y = 2x + 0$$

With Normal noise, std=1 added to the measurement.

eche460demo - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Aspen

Paste Font Alignment Number Styles Cells Editing

SUM $\times$ $\checkmark$ f_x =AVERAGE(B7:B9)

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2		Relatively Simple Data										
3												
4		Assume you have some simple system where you have multiple measurements for each independent variable.										
5												
6		y (measured)	x (specified)	y avg								
7		20.3188	10	=AVERAGE(B7:B9)	Note, this data was generated from the following model: $y = 2x + 0$ With Normal noise, std=1 added to the measurement.							
8		18.6923	10									
9		19.5664	10									
10		40.3426	20	42.23013	Now, get mean and STD for each value!							
11		43.5784	20									
12		42.7694	20									
13		58.6501	30	60.80347								
14		63.0349	30									
15		60.7254	30									
16												
17												
18												
19												
20												
21												
22												

Sheet1 Sheet2 Sheet3

Edit 100%

Microsoft Excel window titled "eche460demo - Microsoft Excel". The ribbon includes Home, Insert, Page Layout, Formulas, Data, Review, View, and Aspen. The formula bar shows the formula =STDEV(B7:B9) .

The spreadsheet contains the following data:

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2		Relatively Simple Data										
3												
4		Assume you have some simple system where you have multiple measurements for each independent variable.										
5												
6		y (measured)	x (specified)	y avg	y std							
7		20.3188	10	19.52583	=STDEV(B7:B9)	Note, this data was generated from the following model: $y = 2x + 0$ With Normal noise, std=1 added to the measurement.						
8		18.6923	10									
9		19.5664	10									
10		40.3426	20	42.23013	1.6839557	Now, get mean and STD for each value!						
11		43.5784	20									
12		42.7694	20									
13		58.6501	30	60.80347	2.1934422							
14		63.0349	30									
15		60.7254	30									
16												
17												
18												
19												
20												
21												
22												

The bottom status bar shows "Edit", "Sheet1", "Sheet2", "Sheet3", and a zoom level of 100%.

eche460demo - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Aspen

Clipboard Font Alignment Number Styles Cells Editing

C17 fx X

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2		Relatively Simple Data										
3												
4		Assume you have some simple system where you have multiple measurements for each independent variable.										
5												
6		y (measured)	x (specified)	y avg	y std							
7		20.3188	10	19.52583	0.8140085		Note, this data was generated from the following model:					
8		18.6923	10				$y = 2x + 0$					
9		19.5664	10				With Normal noise, std=1 added to the measurement.					
10		40.3426	20	42.23013	1.6839557							
11		43.5784	20				Now, get mean and STD for each value!					
12		42.7694	20									
13		58.6501	30	60.80347	2.1934422		Now collect data and plot with error bars!					
14		63.0349	30									
15		60.7254	30									
16												
17			X	Y avg	Y std							
18			10	19.52583	0.8140085							
19			20	42.23013	1.6839557							
20			30	60.80347	2.1934422							
21												
22												

Sheet1 Sheet2 Sheet3

Ready 100%

Microsoft Excel window titled "eche460demo". The ribbon includes Home, Insert, Page Layout, Formulas, Data, Review, View, and Aspen. The Insert ribbon is active, showing options for Tables, Illustrations, Charts, Links, and Text. The Scatter chart option is highlighted.

A tooltip for the Scatter chart is displayed, stating: "Insert a Scatter chart, also known as an XY chart. This type of chart compares pairs of values. Use it when the values being charted are not in X-axis order or when they represent separate measurements."

The spreadsheet contains the following data:

	A	B	C	D	E	F
1						
2		Relatively Simple Data				
3						
4		Assume you have some simple system where you have multiple independent variables.				
5						
6		y (measured)	x (specified)	y avg	y std	
7		20.3188	10	19.52583	0.8140085	
8		18.6923	10			
9		19.5664	10			
10		40.3426	20	42.23013	1.6839557	
11		43.5784	20			
12		42.7694	20			
13		58.6501	30	60.80347	2.1934422	
14		63.0349	30			
15		60.7254	30			
16						
17			X	Y avg	Y std	
18			10	19.52583	0.8140085	
19			20	42.23013	1.6839557	
20			30	60.80347	2.1934422	
21						
22						

Notes on the right side of the spreadsheet:

- Note, this data was generated from the following model:

$$y = 2x + 0$$
- With Normal noise, std=1 added to the measurement.
- Now, get mean and STD for each value!
- Now collect data and plot with error bars!

The status bar at the bottom shows: Ready, Average: 30.42657222, Count: 8, Sum: 182.5594333, 100% zoom.

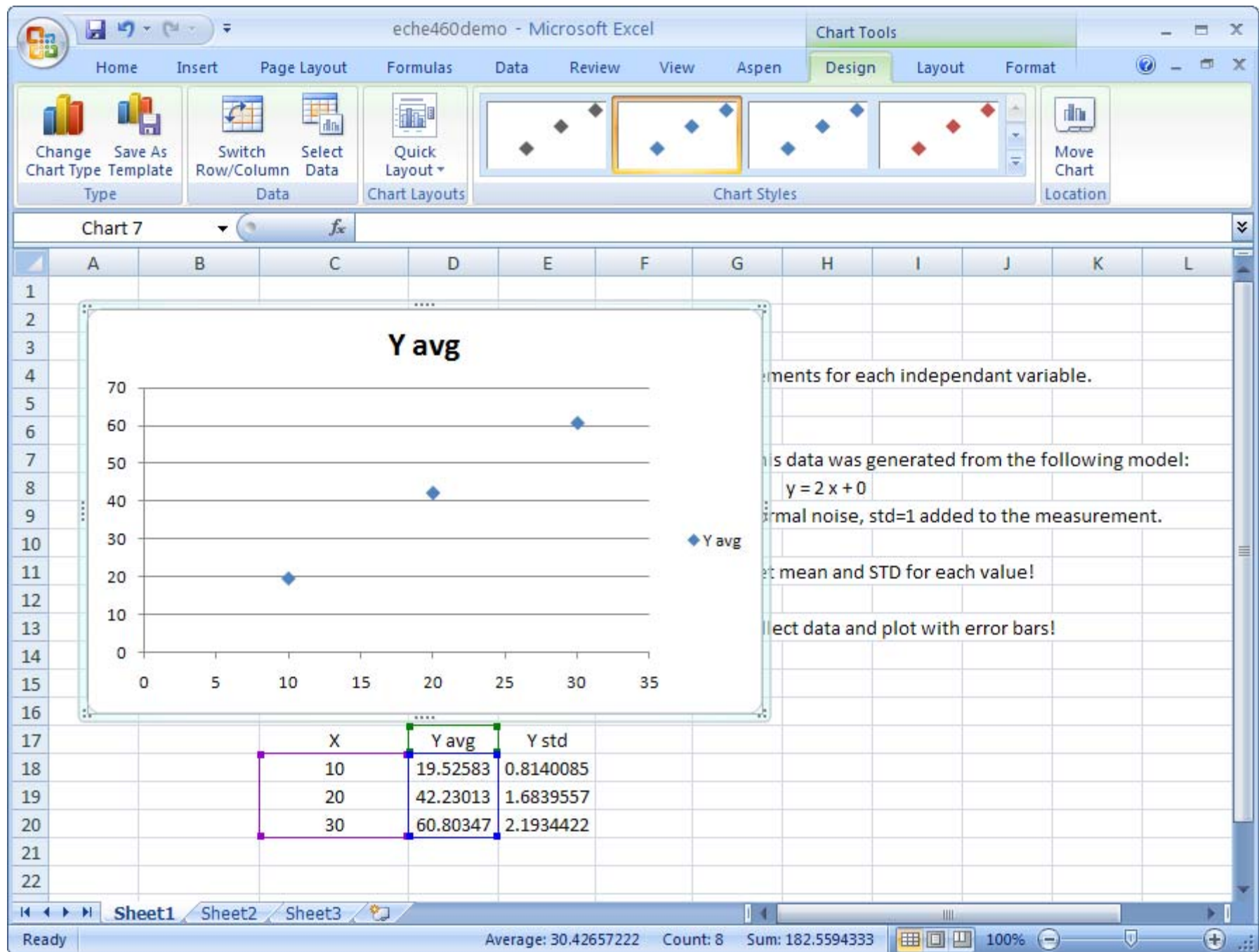
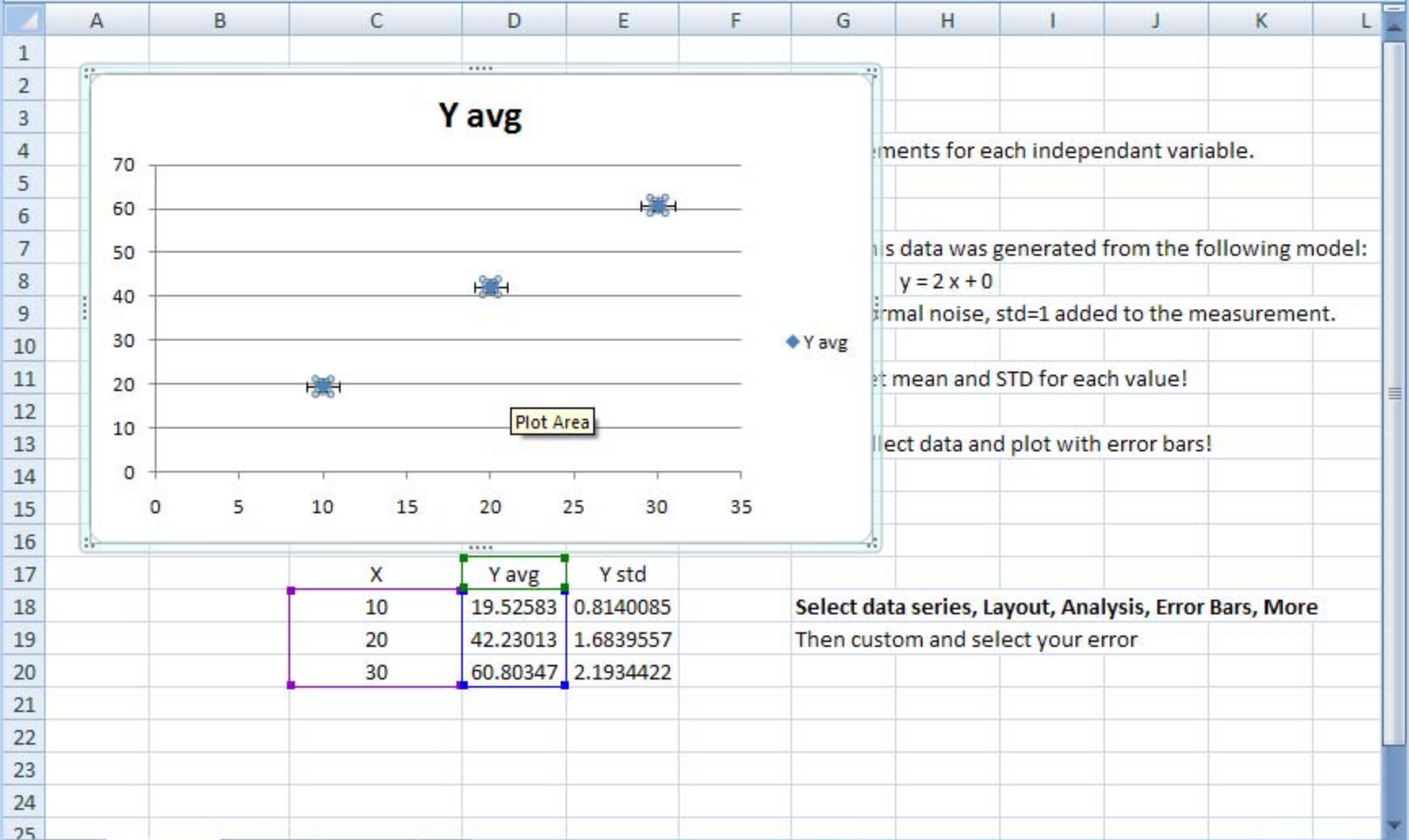


Chart 7 $\text{=SERIES}(\text{Sheet1!}\$D\$17,\text{Sheet1!}\$C\$18:\$C\$20,\text{Sheet1!}\$D\$18:\$D\$20,1)$



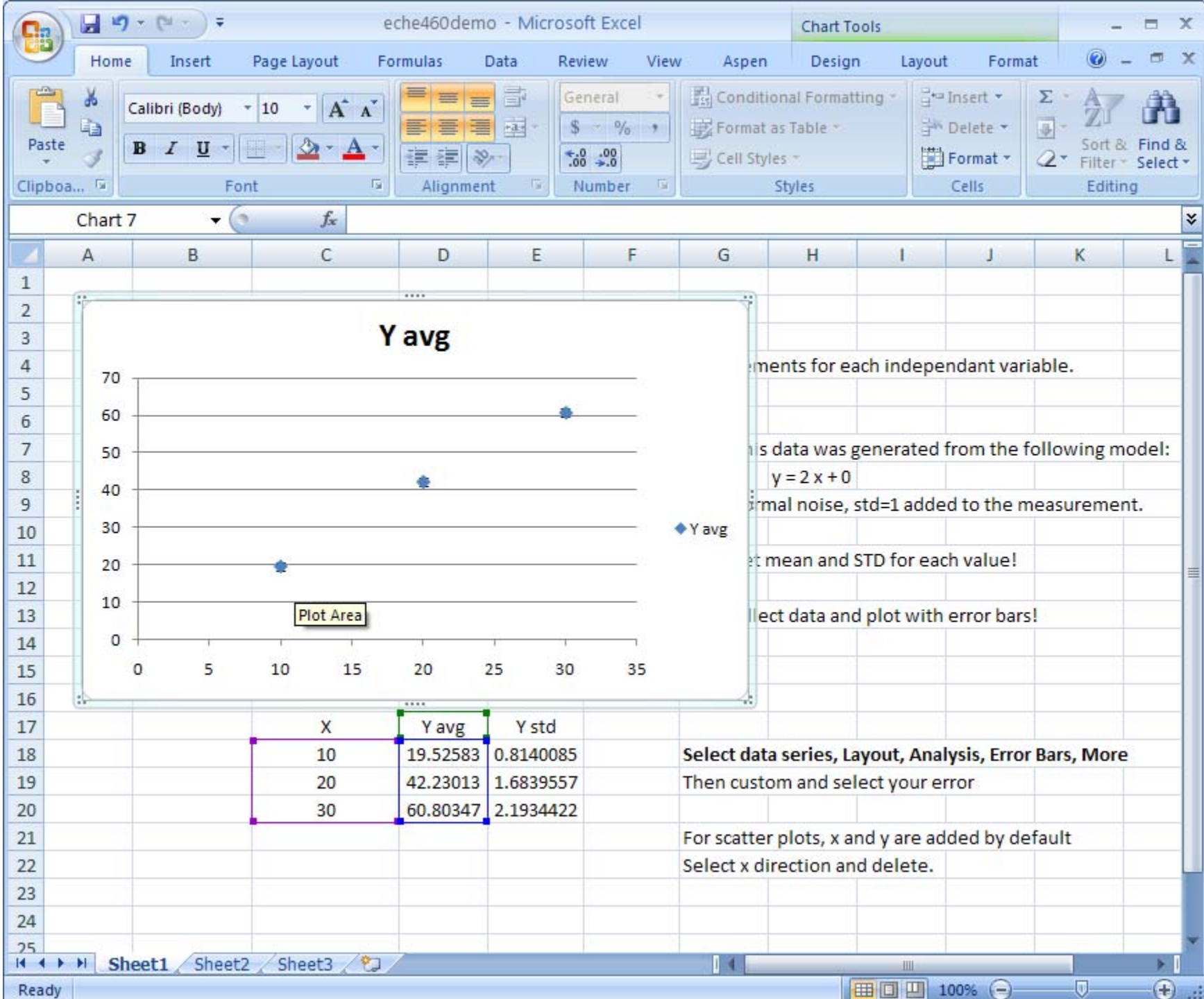
ements for each independant variable.

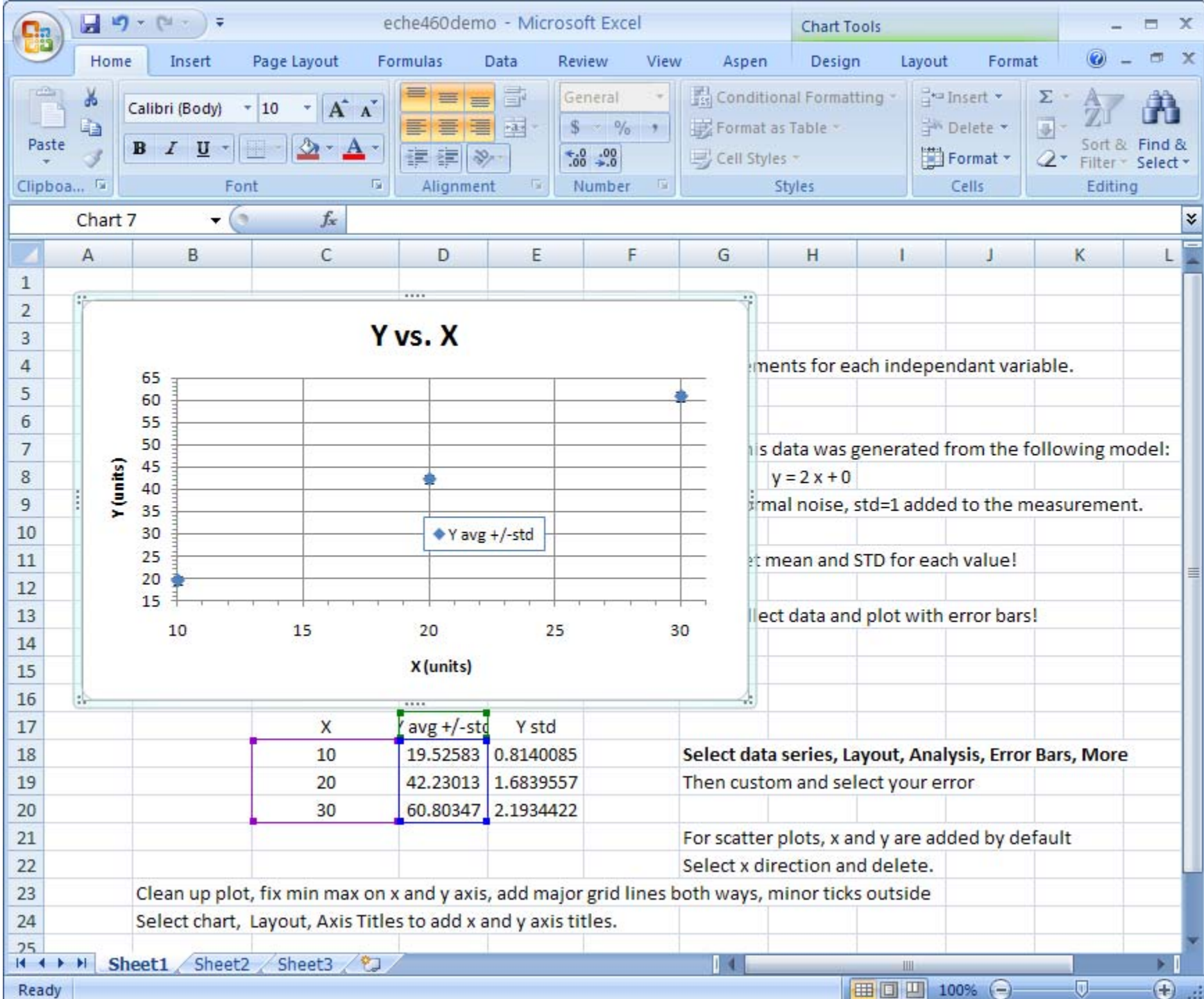
is data was generated from the following model:
 $y = 2x + 0$
 rmal noise, std=1 added to the measurement.

et mean and STD for each value!

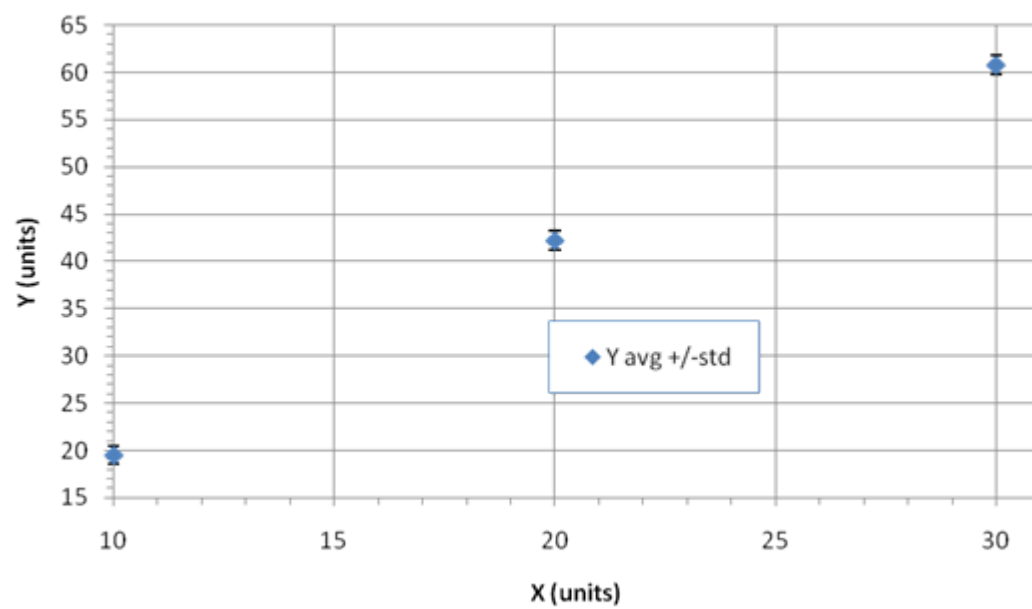
lect data and plot with error bars!

Select data series, Layout, Analysis, Error Bars, More
 Then custom and select your error





Y vs. X



Clipboard Paste

Font: Calibri, 11, Bold, Italic, Underline, Text Color, Background Color

Alignment: Left, Center, Right, Justify, Indent, Decrease Indent, Increase Indent

Number: General, Currency (\$), Percentage (%), Decimals (0.00), Fractions (1/2), Scientific (E12), Text (0000000000), Custom (0.0000000000)

Styles: Conditional Formatting, Format as Table, Cell Styles

Cells: Insert, Delete, Format

Editing: Sort & Filter, Find & Select

D6

Real data generated from model is:

	A	B	C	D	E	F	G	H	I	J	K	L	M
2													
3	t	y		Model in form : $y = a \exp(b t)$									
4	0	2.9993		Find a and b									
5	1	2.6095											
6	2	1.934		Real data generated from model is: $y = 3 \exp(-.2 t)$ with normal noise, $\text{std} = .1$									
7	3	1.6836											
8	4	1.3254											
9	5	1.2154											
10	6	0.7947											
11	7	0.743											
12	8	0.6609											
13	9	0.606											
14	10	0.5604											
15	11	0.341											
16	12	0.123											
17	13	0.1486											
18	14	0.0763											
19	15	0.3844											
20	16	0.0607											
21	17	0.1749											
22	18	0.0627											
23	19	0.156											
24	20	-0.0215											
25													
26													

Home Insert Page Layout Formulas Data Review View Aspen

Clipboard Font Alignment Number Styles Cells Editing

Calibri 11 A A

B I U

General \$ % ' .0 .00 .00

Conditional Formatting

Format as Table

Cell Styles

Insert Delete Format

Sort & Find & Filter Select

	A	B	C	D	E	F	G	H	I	J	K	L	M
2													
3	t	y		Model in form : $y = a \exp(b t)$									
4	0	2.9993		Find a and b									
5	1	2.6095											
6	2	1.934		Real data generated from model is:									
7	3	1.6836		$y = 3 \exp(-.2 t)$									
8	4	1.3254		with normal noise, std= .1									
9	5	1.2154											
10	6	0.7947		Variable transform (not linearization!!) gives you:									
11	7	0.743		$\ln(y) = \ln(a) + b t$									
12	8	0.6609		Plot $\ln(y)$ vs t, get slope and intercept									
13	9	0.606											
14	10	0.5604											
15	11	0.341											
16	12	0.123											
17	13	0.1486											
18	14	0.0763											
19	15	0.3844											
20	16	0.0607											
21	17	0.1749											
22	18	0.0627											
23	19	0.156											
24	20	-0.0215											
25													
26													

Home Insert Page Layout Formulas Data Review View Aspen

Clipboard Paste

Font Calibri 11 Bold Italic Underline Text Color Background Color

Alignment

Number General \$ % .00 .00

Styles Conditional Formatting Format as Table Cell Styles

Cells Insert Delete Format

Editing Sort & Filter Find & Select

	A	B	C	D	E	F	G	H	I	J	K	L	M
2													
3	t	y	ln(y)	Model in form : $y = a \exp(bt)$									
4	0	2.9993	1.098379	Find a and b									
5	1	2.6095	0.959159										
6	2	1.934	0.65959	Real data generated from model is:									
7	3	1.6836	0.520934	$y = 3 \exp(-.2t)$									
8	4	1.3254	0.281714	with normal noise, std=.1									
9	5	1.2154	0.195073										
10	6	0.7947	-0.22979	Variable transform (not linearization!!) gives you:									
11	7	0.743	-0.29706	$\ln(y) = \ln(a) + bt$									
12	8	0.6609	-0.41415	Plot ln(y) vs t, get slope and intercept									
13	9	0.606	-0.50088										
14	10	0.5604	-0.5791										
15	11	0.341	-1.07587										
16	12	0.123	-2.09557										
17	13	0.1486	-1.9065										
18	14	0.0763	-2.57308										
19	15	0.3844	-0.95607										
20	16	0.0607	-2.80181										
21	17	0.1749	-1.74354										
22	18	0.0627	-2.76939										
23	19	0.156	-1.8579										
24	20	-0.0215	#NUM!										
25													
26													

Get External Data	Refresh All	Connections	Sort & Filter	Filter	Clear Reapply Advanced	Text to Columns	Remove Duplicates	Group Ungroup Subtotal	Data Analysis Solver
	Connections								

D14

Does your data tab have Analysis showing? If not, do following...

	A	B	C	D	E	F	G	H	I	J	K	L	M
2													
3	t	y	ln(y)	Model in form : $y = a \exp(b t)$									
4	0	2.9993	1.098379	Find a and b									
5	1	2.6095	0.959159										
6	2	1.934	0.65959	Real data generated from model is:									
7	3	1.6836	0.520934	$y = 3 \exp(-.2 t)$									
8	4	1.3254	0.281714	with normal noise, std=.1									
9	5	1.2154	0.195073										
10	6	0.7947	-0.22979	Variable transform (not linearization!!) gives you:									
11	7	0.743	-0.29706	$\ln(y) = \ln(a) + b t$									
12	8	0.6609	-0.41415	Plot $\ln(y)$ vs t, get slope and intercept									
13	9	0.606	-0.50088										
14	10	0.5604	-0.5791	Does your data tab have Analysis showing? If not, do following...									
15	11	0.341	-1.07587										
16	12	0.123	-2.09557										
17	13	0.1486	-1.9065										
18	14	0.0763	-2.57308										
19	15	0.3844	-0.95607										
20	16	0.0607	-2.80181										
21	17	0.1749	-1.74354										
22	18	0.0627	-2.76939										
23	19	0.156	-1.8579										
24	20	0.0215	-3.8397										
25													
26													

Simple Data

Dynamic Data

Sheet3

Get External Data Refresh All Edit Links Connections

Sort & Filter Sort Filter Clear Reapply Advanced

Data Tools Text to Columns Remove Duplicates

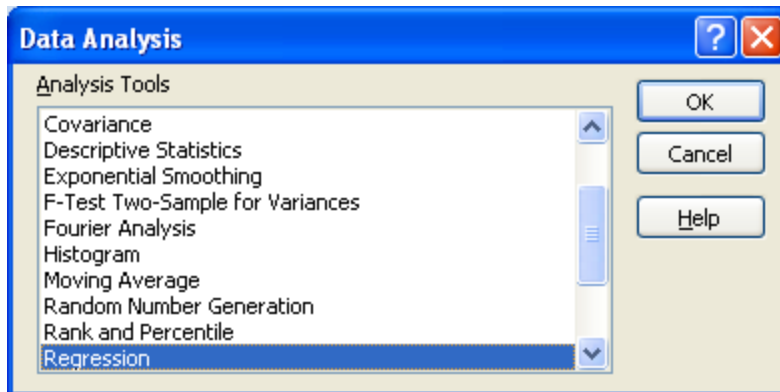
Outline Group Ungroup Subtotal

Analysis Data Analysis Solver

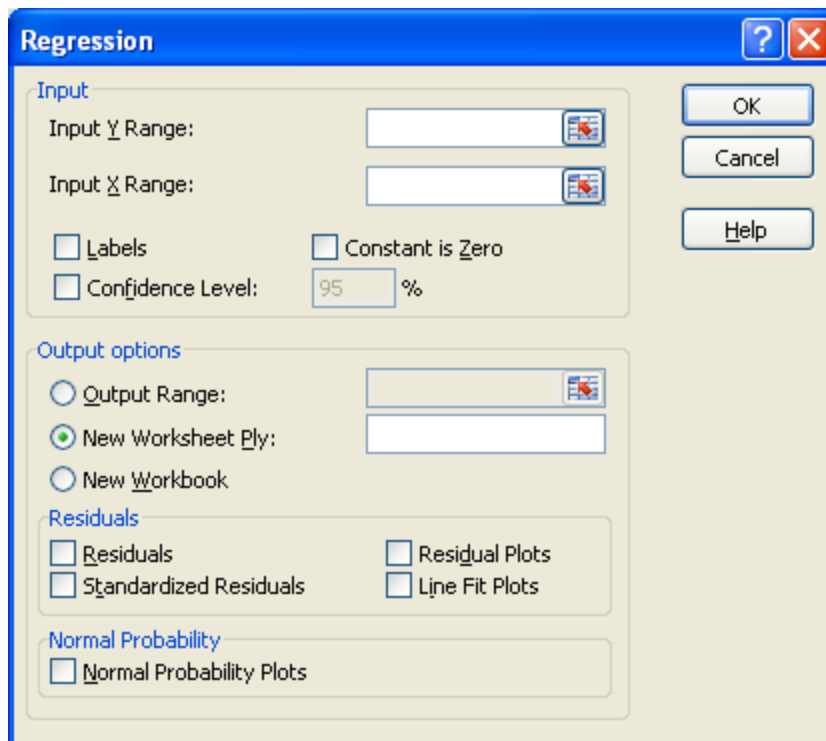
J18

fx

	A	B	C	D	E	F	G	H	I	J	K	L	M
2													
3	t	y	ln(y)	Model in form : $y = a \exp(b t)$									
4	0	2.9993	1.098379	Find a and b									
5	1	2.6095	0.959159										
6	2	1.934	0.65959	Real data generated from model is:									
7	3	1.6836	0.520934	$y = 3 \exp(-.2 t)$									
8	4	1.3254	0.281714	with normal noise, std=.1									
9	5	1.2154	0.195073										
10	6	0.7947	-0.22979	Variable transform (not linearization!!) gives you:									
11	7	0.743	-0.29706	$\ln(y) = \ln(a) + b t$									
12	8	0.6609	-0.41415	Plot $\ln(y)$ vs t, get slope and intercept									
13	9	0.606	-0.50088										
14	10	0.5604	-0.5791	Does your data tab have Analysis showing? If not, do following...									
15	11	0.341	-1.07587										
16	12	0.123	-2.09557	Top left Window button, Then "Excel Options" button									
17	13	0.1486	-1.9065	"Add-ins" tab, then next to "Manage add-ins" hit "Go"									
18	14	0.0763	-2.57308	Select Analysis and Solver checkboxes and Go									
19	15	0.3844	-0.95607										
20	16	0.0607	-2.80181										
21	17	0.1749	-1.74354										
22	18	0.0627	-2.76939										
23	19	0.156	-1.8579										
24	20	0.0215	-3.8397										
25													
26													



Data Tab
Analysis Section
Select “Data Analysis”



Select your x/y Ranges
Add labels
Confidence Level
Residuals
Standardized Residuals

?

×

Regression

Input

Input Y Range:

\$K\$4:\$K\$24

Input X Range:

\$J\$4:\$J\$24

☒ Labels

☐ Constant is Zero

☒ Confidence Level:

95

%

OK

Cancel

Help

Output options

☐ Output Range:

☒ New Worksheet Ply:

☐ New Workbook

Residuals

☒ Residuals

☐ Residual Plots

☒ Standardized Residuals

☐ Line Fit Plots

Normal Probability

☐ Normal Probability Plots

Get External Data Refresh All Edit Links Connections Sort & Filter Filter Sort Clear Reapply Advanced Data Tools Text to Columns Remove Duplicates Data Tools Group Ungroup Subtotal Outline Analysis Data Analysis Solver

C21

fx

	A	B	C	D	E	F	G	H	I
1	SUMMARY OUTPUT								
2									
3	Regression Statistics								
4	Multiple R	0.923653439							
5	R Square	0.853135675							
6	Adjusted R Square	0.844976546							
7	Standard Error	0.526817793							
8	Observations	20							
9									
10	ANOVA								
11		df	SS	MS	F	Significance F			
12	Regression	1	29.01984997	29.01984997	104.5621	6.33E-09			
13	Residual	18	4.995665764	0.277536987					
14	Total	19	34.01551573						
15									
16		Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
17	Intercept	1.142243802	0.244723436	4.667488406	0.000192	0.628099	1.656389	0.628099	1.656
18	0	-0.208899191	0.020429118	-10.22556107	6.33E-09	-0.25182	-0.16598	-0.25182	-0.16
19									
20									
21									
22	RESIDUAL OUTPUT								
23									
24	Observation	Predicted	1.098378928	10832	Residuals	Standard Residuals			

Home

Insert

Page Layout

Formulas

Data

Review

View

Aspen



Paste

Clipboard...

Calibri

11

A A

B I U

Font



Alignment

General

\$ %

0.00 0.00

Number

Conditional Formatting

Format as Table

Cell Styles

Styles

Insert

Delete

Format

Cells

Σ

A Z

Sort & Filter

Find & Select

Filter

Select

Editing

D9

fx

	A	B	C	D	E	F	G	H	I
1	SUMMARY OUTPUT								
2									
3	Regression Statistics								
4	Multiple R	0.923653439							
5	R Square	0.853135675							
6	Adjusted R Square	0.844976546							
7	Standard Error	0.526817793							
8	Observations	20							
9									
10	ANOVA								
11		df	SS	MS	F	gnificance F			
12	Regression	1	29.01984997	29.01984997	104.5621	6.33E-09			
13	Residual	18	4.995665764	0.277536987					
14	Total	19	34.01551573						
15									
16		Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	pper 9
17	Intercept	1.142243802	0.244723436	4.667488406	0.000192	0.628099	1.656389	0.628099	1.656
18	0	-0.208899191	0.020429118	-10.22556107	6.33E-09	-0.25182	-0.16598	-0.25182	-0.16
19									
20									
21									
22	RESIDUAL OUTPUT								
23									
24	Observation	Predicted 1.098378928	10832	Residuals	tandard Residuals				

Simple Data

Sheet5

Dynamic Data

Sheet3

Ready

100%

Clipboard

Font: Calibri, 11, Bold, Italic, Underline, Text Color, Background Color

Alignment: Left, Center, Right, Justify, Indent, Decrease Indent, Increase Indent, Wrap Text, Merge & Center, Unmerge Cells

Number: General, Currency (\$), Percentage (%), Decimals (0.00, 0.0, 0.000), Fractions (1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256, 1/512, 1/1024, 1/2048, 1/4096, 1/8192, 1/16384, 1/32768, 1/65536, 1/131072, 1/262144, 1/524288, 1/1048576, 1/2097152, 1/4194304, 1/8388608, 1/16777216, 1/33554432, 1/67108864, 1/134217728, 1/268435456, 1/536870912, 1/1073741824, 1/2147483648, 1/4294967296, 1/8589934592, 1/17179869184, 1/34359738368, 1/68719476736, 1/137438953472, 1/274877906944, 1/549755813888, 1/1099511627776, 1/2199023255552, 1/4398046511104, 1/8796093022208, 1/17592186044416, 1/35184372088832, 1/70368744177664, 1/140737488355328, 1/281474976710656, 1/562949953421312, 1/1125899906842624, 1/2251799813685248, 1/4503599627370496, 1/9007199254740992, 1/18014398509481984, 1/36028797018963968, 1/72057594037927936, 1/144115188075855872, 1/288230376151711744, 1/576460752303423488, 1/1152921504606846976, 1/2305843009213693952, 1/4611686018427387904, 1/9223372036854775808, 1/18446744073709551616, 1/36893488147419103232, 1/73786976294838206464, 1/147573952589676412928, 1/295147905179352825856, 1/590295810358705651712, 1/1180591620717411303424, 1/2361183241434822606848, 1/4722366482869645213696, 1/9444732965739290427392, 1/18889465931478580854784, 1/37778931862957161709568, 1/75557863725914323419136, 1/151115727451828646838272, 1/302231454903657293676544, 1/604462909807314587353088, 1/1208925819614629174706176, 1/2417851639229258349412352, 1/4835703278458516698824704, 1/9671406556917033397649408, 1/19342813113834066795298816, 1/38685626227668133590597632, 1/77371252455336267181195264, 1/154742504910672534362390528, 1/309485009821345068724781056, 1/618970019642690137449562112, 1/1237940039285380274899124224, 1/2475880078570760549798248448, 1/4951760157141521099596496896, 1/9903520314283042199192993792, 1/19807040628566084398385987584, 1/39614081257132168796771975168, 1/79228162514264337593543950336, 1/158456325028528675187087900672, 1/316912650057057350374175801344, 1/633825300114114700748351602688, 1/1267650600228229401496703205376, 1/2535301200456458802993406410752, 1/5070602400912917605986812821504, 1/10141204801825835211973625643008, 1/20282409603651670423947251286016, 1/40564819207303340847894502572032, 1/81129638414606681695789005144064, 1/162259276829213363391578010288128, 1/324518553658426726783156020576256, 1/649037107316853453566312041152512, 1/1298074214633706907132624082305024, 1/2596148429267413814265248164610048, 1/5192296858534827628530496329220096, 1/10384593717069655257060992658440192, 1/20769187434139310514121985316880384, 1/41538374868278621028243970633760768, 1/83076749736557242056487941267521536, 1/166153499473114484112975882535043072, 1/332306998946228968225951765070086144, 1/664613997892457936451903530140172288, 1/1329227995784915872903807060280344576, 1/2658455991569831745807614120560689152, 1/5316911983139663491615228241121378304, 1/10633823966279326983230456482242756608, 1/21267647932558653966460912964485513216, 1/42535295865117307932921825928971026432, 1/85070591730234615865843651857942052864, 1/170141183460469231731687303715884105728, 1/340282366920938463463374607431768211456, 1/680564733841876926926749214863536422912, 1/1361129467683753853853498429727072845824, 1/2722258935367507707706996859454145691648, 1/5444517870735015415413993718908291383296, 1/10889035741470030830827987437816582766592, 1/21778071482940061661655974875633165533184, 1/43556142965880123323311949751266331066368, 1/87112285931760246646623899502532662132736, 1/174224571863520493293247799005065324265472, 1/348449143727040986586495598010130648530944, 1/696898287454081973172991196020261297061888, 1/1393796574908163946345982392040522594123776, 1/2787593149816327892691964784081045188247552, 1/5575186299632655785383929568162090376495104, 1/11150372599265311570767859136324180752990208, 1/22300745198530623141535718272648361505980416, 1/44601490397061246283071436545296723011960832, 1/89202980794122492566142873090593446023921664, 1/178405961588244985132285746181186892047843328, 1/356811923176489970264571492362373784095686656, 1/713623846352979940529142984724747568191373312, 1/1427247692705959881058285969449495136382746624, 1/2854495385411919762116571938898990272765493248, 1/5708990770823839524233143877797980545530986496, 1/11417981541647679048466287755595961091061972992, 1/22835963083295358096932575511191922182123945984, 1/45671926166590716193865151022383844364247891968, 1/91343852333181432387730302044767688728495783936, 1/182687704666362864775460604089535377456991567872, 1/365375409332725729550921208179070754913983135744, 1/730750818665451459101842416358141509827966271488, 1/1461501637330902918203684832716283019655932542976, 1/2923003274661805836407369665432566039311865085952, 1/5846006549323611672814739330865132078623730171904, 1/11692013098647223345629478661730264157247460343808, 1/23384026197294446691258957323460528314494920687616, 1/46768052394588893382517914646921056628989841375232, 1/93536104789177786765035829293842113257979682750464, 1/187072209578355573530071658587684226515959365500928, 1/374144419156711147060143317175368453031918731001856, 1/748288838313422294120286634350736906063837462003712, 1/1496577676626844588240573268701473812127674924007424, 1/2993155353253689176481146537402947624255349848014848, 1/5986310706507378352962293074805895248510699696029696, 1/11972621413014756705924586149611790497021399392059392, 1/23945242826029513411849172299223580994042798784118784, 1/47890485652059026823698344598447161988085597568237568, 1/95780971304118053647396689196894323976171195136475136, 1/191561942608236107294793378393788647952342390272950272, 1/383123885216472214589586756787577295904684780545900544, 1/766247770432944429179173513575154591809369561091801088, 1/1532495540865888858358347027150309183618739122183602176, 1/3064991081731777716716694054300618367237478244367204352, 1/6129982163463555433433388108601236734474956488734408704, 1/12259964326927110866866776217202473468949912977468817408, 1/24519928653854221733733552434404946937899825954937634816, 1/49039857307708443467467104868809893875799651909875269632, 1/98079714615416886934934209737619787751599303819750539264, 1/196159429230833773869868419475239575503198607639501078528, 1/392318858461667547739736838950479151006397215279002157056, 1/784637716923335095479473677900958302012794430558004314112, 1/1569275433846670190958947355801916604025588861116008628224, 1/3138550867693340381917894711603833208051177722232017256448, 1/6277101735386680763835789423207666416102355444464034512896, 1/12554203470773361527671578846415332832204710888928069025792, 1/25108406941546723055343157692830665664409421777856138051584, 1/50216813883093446110686315385661331328818843555712276103168, 1/100433627766186892221372630771322662657637687111424552206336, 1/200867255532373784442745261542645325315275374222849104412672, 1/401734511064747568885490523085290650630550748445698208825344, 1/803469022129495137770981046170581301261101496891396417650688, 1/1606938044258990275541962092341162602522202993782792835301376, 1/3213876088517980551083924184682325205044405987565585670602752, 1/6427752177035961102167848369364650410088811975131171341205504, 1/12855504354071922204335696738729300820177623950262342682411008, 1/25711008708143844408671393477458601640355247900524685364822016, 1/51422017416287688817342786954917203280710495801049370729644032, 1/102844034832575377634685573909834406561420991602098741459288064, 1/205688069665150755269371147819668813122841983204197482918576128, 1/411376139330301510538742295639337626245683966408394965837152256, 1/822752278660603021077484591278675252491367932816789931674304512, 1/1645504557321206042154969182557350504982735865633579863348609024, 1/3291009114642412084309938365114701009965471731267159726697218048, 1/6582018229284824168619876730229402019930943462534319453394436096, 1/13164036458569648337239753460458804039861886925068638906788872192, 1/26328072917139296674479506920917608079723773850137277813577744384, 1/52656145834278593348959013841835216159447547700274555627155488768, 1/105312291668557186697918027683670432318895095400549111254310977536, 1/210624583337114373395836055367340864637790190801098222508621955072, 1/421249166674228746791672110734681729275580381602196445017243910144, 1/842498333348457493583344221469363458551160763204392890034487820288, 1/1684996666796914987166688442938726917102321526408785780068975640576, 1/3369993333593829974333376885877453834204643052817571560137951281152, 1/6739986667187659948666753771754907668409286105635143120275902562304, 1/13479973334375319897333507543509815336818572211270286240551805124608, 1/26959946668750639794667015087019630673637144422540572481103610249216, 1/53919893337501279589334030174039261347274288845081144962207220498432, 1/107839786675002559178668060348078522694548577690162289924414440996864, 1/215679573350005118357336120696157045389097155380324579848828881993728, 1/431359146700010236714672241392314090778194310760649159697657763987456, 1/862718293400020473429344482784628181556388621521298319395315527974912, 1/1725436586800040946858688965569256363112777243042596638790631055949824, 1/3450873173600081893717377931138512726225554486085193277581262111899648, 1/6901746347200163787434755862277025452451108972170386555162524223799296, 1/13803492694400327574869511724554050904902217944340773110325048447598592, 1/27606985388800655149739023449108101809804435888681546220650096895197184, 1/55213970777601310299478046898216203619608871777363092441300193790394368, 1/110427941555202620598956093796432407239217743554726184882600387580788736, 1/220855883110405241197912187592864814478435487109452369765200775161577472, 1/441711766220810482395824375185729628956870974218904739530401550323154944, 1/883423532441620964791648750371459257913741948437809479060803100646309888, 1/1766847064883241929583297500742918515827483896875618958121606201292619776, 1/3533694129766483859166595001485837031654967793751237916243212402585239552, 1/7067388259532967718333190002971674063309935587502475832486424805170479104, 1/14134776519065935436666380005943348126619871175004951664972849610340958208, 1/28269553038131870873332760011886696253239742350009903329945699220681916416, 1/56539106076263741746665520023773392506479484700019806659891398441363832832, 1/113078212152527483493331040047546785012958969400039613319782796882727665664, 1/226156424305054966986662080095093570025917938800079226639565593765455331328, 1/452312848610109933973324160190187140051835877600158453279131187530910662656, 1/904625697220219867946648320380374280103671755200316906558262375061821325312, 1/1809251394440439735893296640760748560207343510400633813116524750123642650624, 1/3618502788880879471786593281521497120414687020801267626233049500247285301248, 1/7237005577761758943573186563042994240829374041602535252466099000494570602496, 1/14474011155523517887146373126085988481658748083205070504932198000989141204992, 1/28948022311047035774292746252171976963317496166410141009864396001978282409984, 1/57896044622094071548585492504343953926634992332820282019728792003956564819968, 1/115792089244188143097170985008687907853269984665640564039457584007913129639936, 1/231584178488376286194341970017375815706539969331281128078915168015826259279872, 1/463168356976752572388683940034751631413079938662562256157830336031652518559744, 1/926336713953505144777367880069503262826159877325124512315660672063305037119488, 1/1852673427907010289554735760139006525652319754650249024631321344126610074238976, 1/3705346855814020579109471520278013051304639509300498049262642688253220148477952, 1/7410693711628041158218943040556026102609279018600996098525285376506440296955904, 1/14821387423256082316437886081112052205218558037201992197050570753012880593911808, 1/29642774846512164632875772162224104410437116074403984394101141506025761187823616, 1/59285549693024329265751544324448208820874232148807968788202283012051522375647232, 1/118571099386048658531503088648896417641748464297615937576404566024103044751294464, 1/237142198772097317063006177297792835283496928595231875152809132048206089502588928, 1/474284397544194634126012354595585670566993857190463750305618264096412179005177856, 1/948568795088389268252024709191171341133987714380927500611236528192824358010355712, 1/1897137590176778536

Home Insert Page Layout Formulas Data Review View Aspen

Clipboard Font Alignment Number Styles Cells Editing

Calibri 11 Bold Italic Underline Font Color Background Color

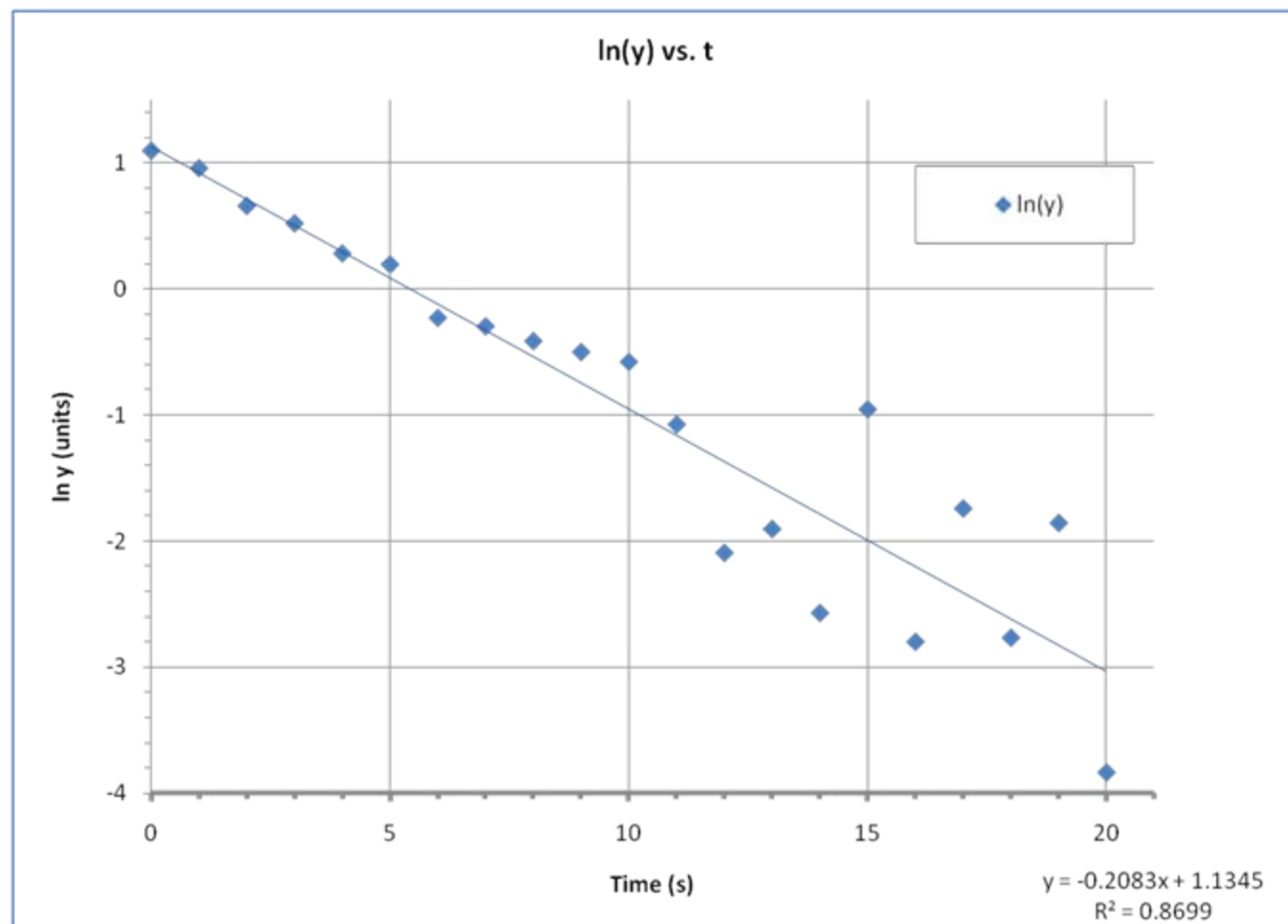
General Conditional Formatting Insert Delete Format

Format as Table Cell Styles

Sort & Find & Filter Select

G3 0.767

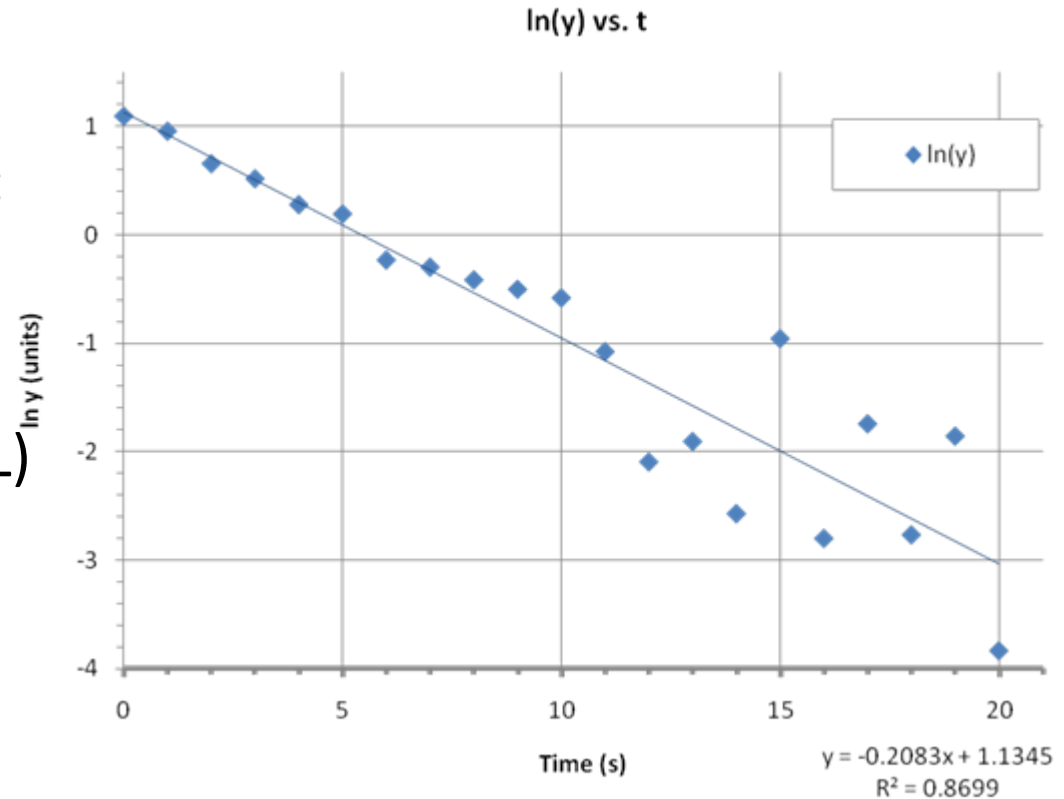
	A	B	C	D	E	F	G	H	I
1	SUMMARY OUTPUT			Regressed values are close to real values of 3 and -.2					
2							SE		
3	Regression Statistics			ln(a) = 1.142	a=	3.133792	0.767		
4	Multiple R	0.923653439			b=	-0.2089	0.020429		
5	R Square	0.853135675		ln(a) = 1.142 +/- 0.244					
6	Adjusted R Square	0.844976546		a = exp (1.142) +/- ???		a=f(z), z=avg+/- SE = 1.14 +/- 0.24			
7	Standard Error	0.526817793		a=exp(z)		df/dz=exp(z) = exp (1.14)			
8	Observations	20				(df/dz)^2= 9.820653			
9						dz^2 0.05989			
10	ANOVA			(da)^2=(df/dz)^2 (dz)^2=			0.588155	da=	0.766912
11		df	SS	MS	F	gnificance F			
12	Regression	1	29.01984997	29.01984997	104.5621	6.33E-09			
13	Residual	18	4.995665764	0.277536987					
14	Total	19	34.01551573						
15									
16		Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 9
17	Intercept	1.142243802	0.244723436	4.667488406	0.000192	0.628099	1.656389	0.628099	1.656
18	0	-0.208899191	0.020429118	-10.22556107	6.33E-09	-0.25182	-0.16598	-0.25182	-0.16
19									
20	Error here! I used Standard error to find my errors on slope and intercept								
21	95% confidence would be 2xStandard Error								
22	RESIDUAL OUTPUT								
23									
24	Observation	Predicted 1.09837892810832	Residuals	tandard Residuals					



Title Here, 32 Pt

Citation Here, 1988 24 Pt

- Some results here
 - α found from intercept:
 3.13 ± 0.77 (SE)
 - β found from slope:
 -0.209 ± 0.020 (95% CL)
- Why is this important?
 - This implies the experiment failed!
 - Take better data next time
 - Avoid breaking equipment



$$\ln(y) = (\beta)t + \ln(\alpha)$$
$$m = \beta \quad b = \ln(\alpha)$$

Potential areas for error Analysis

- Plate and Frame
 - Slope: α, R_f, k, n
- Pumps
 - Error bars on Cv, Head measurement. System Curve +/- 10% error in K
- VLE
 - Error bars on y_i and γ_i
 - Slope: α and β for Van Laar, A and B for Margules, Λ_{ij}
- Voltammetry
 - Slope: D
- Rheology
 - Slope: μ, m, n, A, B
- Heat Conduction
 - Slope: h, c_p, C_1, ζ_1
- Adsorption
 - Error bars on t_r, v_i, σ_i
 - Slope: $\Delta U, K_i^*, D_L$