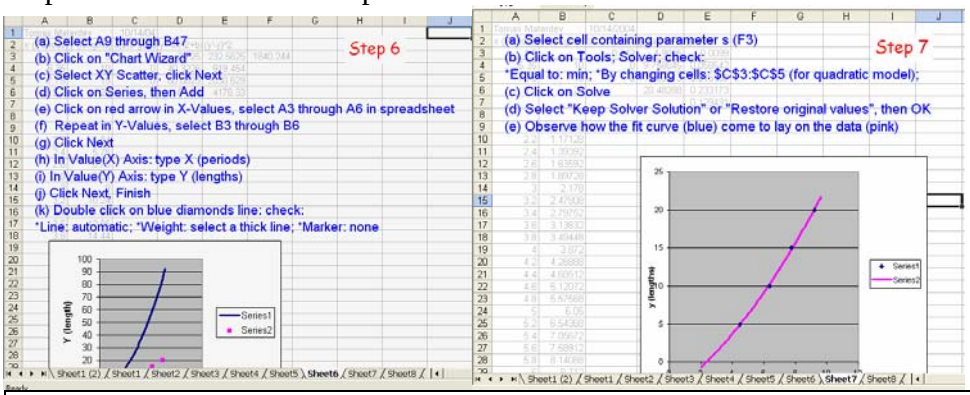
Engin 103 October 2, 2008 back to e-syllabus	Topics: CW3 (Cont.) CW4 Logbook questions

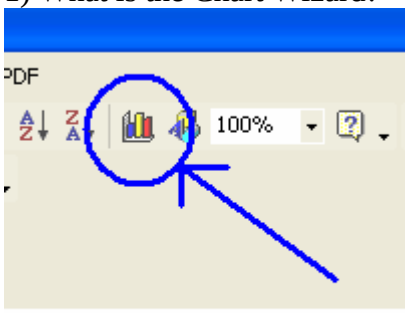
CW3 (cont.)

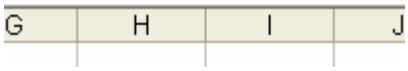
Steps 6 and 7 in CW3 were performed.



FAQ:

1) What is the Chart Wizard?





2) What are the series?

Each series consists of two sets of numbers, one for X and one for Y. The X values will be represented along the horizontal axis, the Y values along the vertical axis, so each pair (x,y) is a dot on the graph.

3) Why do we need two series?

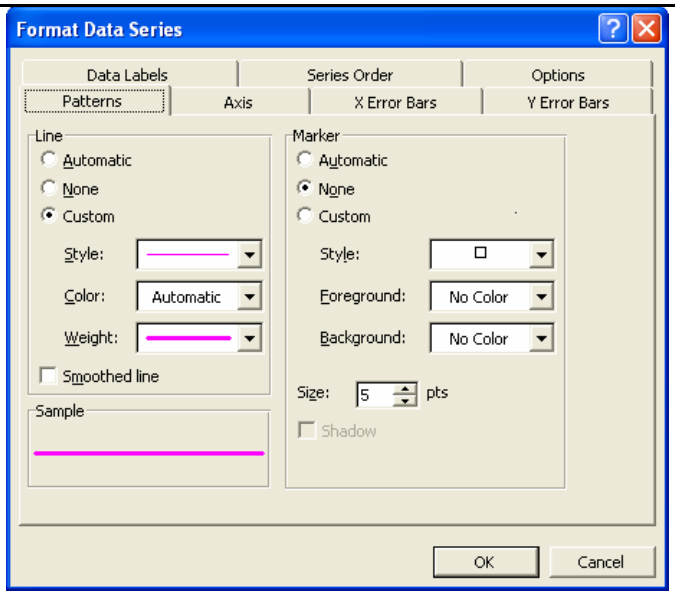
We use the data series to show the data points, and the calculated series to show the curve or mathematical model for the data.

4) How can I add a series to a graph?

Right click on the graph, select Data Source, Series, Add Series

5) How can I change the dots for the calculated series into a line?

Double click on the dots, then select Custom for Line and None for Marker (see example below)



6) What do we use Solver for?

This is the heart of the data modeling process, we use Solver to obtain the model for the measured data. **How to obtain a model?** The process consists of using Solver (get it under Tools/Add-ins if needed) to minimize a "standard deviation" parameter s by allowing the polynomial coefficients a, b, c to vary.

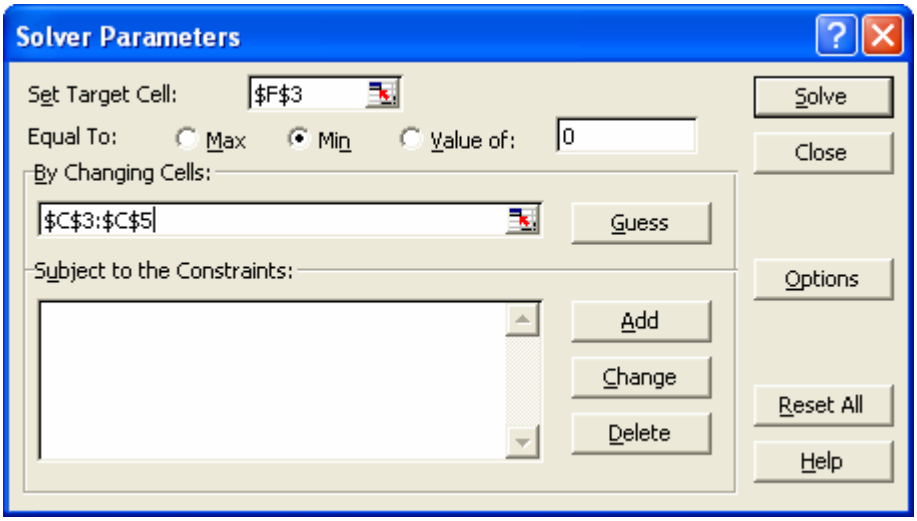
$Y' = aX^2 + bX + c$

Starting with your guesses, Solver varies a, b, c until the s parameter, contained in cell $F$3 and which is the average of the deviations $(Y-Y')^2$, is minimum. When this is achieved, the final values for a, b, c determine our polynomial (quadratic) model for the measured data.

In this CW3, to save time, we used only 4 pairs of data, however this is not sufficient to obtain a good model in practice, **for your Project 1, please use at least 10 pairs of data.**

7) Why my data points are far from the curve after using Solver?

Make sure you select the Minimize option and not the Maximize option. See below.



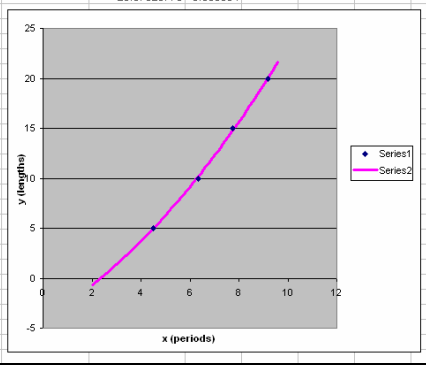
8) What should I submit for CW3?

The Spreadsheet you submit for the quadratic model should look like this

Tomas Materdey

x (Periods)	y (lengths)	a,b,c guesses	y'=ax^2+bx+c	(y'-y)^2	
4.5	5	0.133672117	4.948402082	0.002662	0.024125
6.35	10	1.387171924	10.19780371	0.039126	
7.75	15	-4.000731949	14.778532	0.049048	
9.2	20		20.07525775	0.005664	

2	-0.691699632
2.2	-0.301980669
2.4	0.098432064
2.6	0.509538566
2.8	0.931338837
3	1.363832878
3.2	1.807020688
3.4	2.260902267
3.6	2.725477616
3.8	3.200746734
4	3.686709622
4.2	4.183366279
4.4	4.690716705
4.6	5.208760901
4.8	5.737498866
5	6.2769306
5.2	6.827056104
5.4	7.387875377
5.6	7.959388419
5.8	8.541595231
6	9.134495813
6.2	9.738090163



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CW4

(a) Save CW3 into a new file, then in Sheet #1 modify it to produce a linear and a cubic model for the same data set, insert snapshots of these worksheets into **Table 1** in a MS Word file. Make a table like the one below for the "s" values for the linear, quadratic, and cubic models, along with the coefficients obtained for each model. Indicate which is the best model (linear, quadratic, or cubic) for our set of data, and explain why.

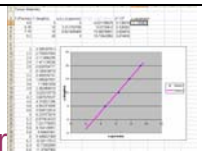
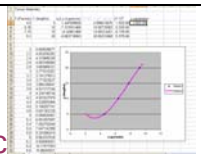
Model	Coefficients	S parameter
Linear 	A= B= C= D=	
Quadratic 	A= B= C= D=	
Cubic 	A= B= C= D=	

Table 1: All terms in polynomial models using same data set as in CW3

(b) Download this data set, repeat the table above for this new data set: (i) In Sheet#2 using all terms in each polynomial model. Insert spreadsheet snapshots, polynomial coefficients, and parameter s into **Table 2** in your MS Word file (ii) In Sheet #3 using only the highest order term in each polynomial model. Insert spreadsheet snapshots,

polynomial coefficients, and parameter s into **Table 3** in your MS Word file. Can you conclude what is the dominant relationship (linear, quadratic, or cubic) between the periods and the lengths of a pendulum?

(c)

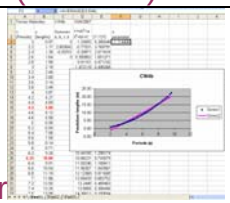
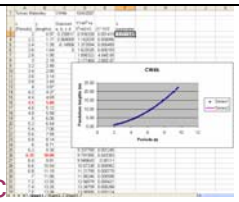
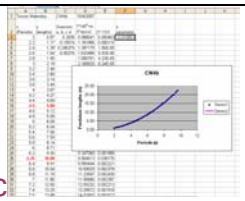
Model (all terms)	Coefficients	S parameter
Linear 	A= B= C= D=	
Quadratic 	A= B= C= D=	
Cubic 	A= B= C= D=	

Table 2: All terms in polynomials models using new data set

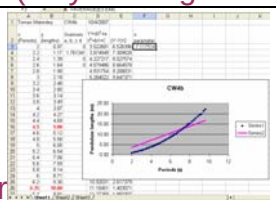
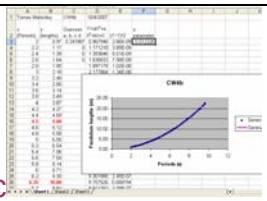
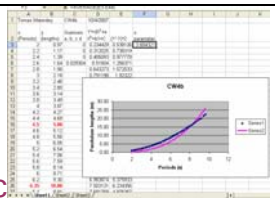
Model (only leading terms)	Coefficients	S parameter
Linear 	A= B= C= D=	
Quadratic 	A= B= C= D=	
Cubic 	A= B= C= D=	

Table 3: Only highest order term in polynomial models using new data set

In each team, students working together at a computer numbered between 1 and 10 will submit file cw4_XX_a.html and folder cw4_XX_a_files, students working at a computer numbered between 11 and 20 will submit file cw4_XX_b.html and folder cw4_XX_b_files, to the *files* folder in the server. Replace XX by 01 if team 1, etc. Include your names within the files.

Q&A

1) What is the purpose of CW4?

The purpose is to modify the Excel Spreadsheet we created for CW3 to apply a cubic and linear model to the same set of data. After assembling a table with the s parameters and coefficients for the three models, we will be able to determine the best model for a given set of data. This is something you should do for part II of Project 1.

2) How many coefficients are there in these different models?

Cubic polynomial:
$Y'=f(X)= D*X^3 + A*X^2 + B*X + C$ (has 4 coefficients: D, A, B, C)

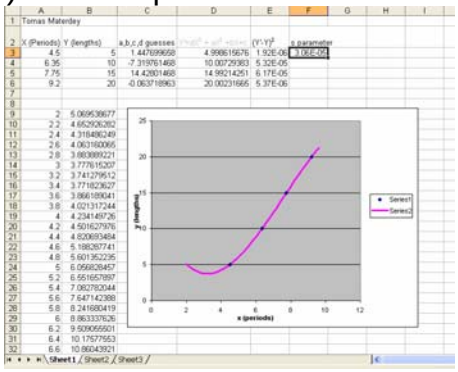
Quadratic polynomial:
$Y'=f(X)= A*X^2 + B*X + C$ (has 3 coefficients: A, B, C)

Linear polynomial:
$Y'=f(X)= B*X + C$ (has 2 coefficients: B, C)

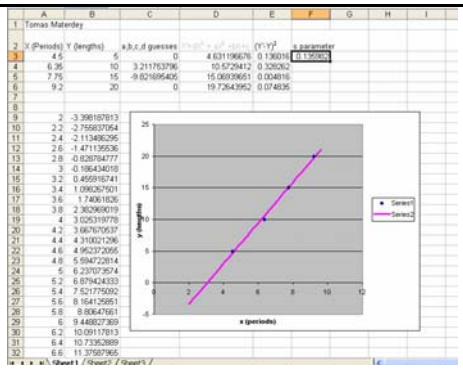
3) How can I get a snapshot of the worksheet?

Copy a snapshot of the Excel screen by doing ALT+PRINT SCREEN, then PASTE into a WORD file

4) What a spreadsheet for a cubic model would look like?



5) What a spreadsheet for a linear model would look like?



6) What changes should I make to the CW3 spreadsheet to produce a cubic model?

Here are the changes (in green) to make to the spreadsheet for CW3 to apply a cubic model for CW4a)

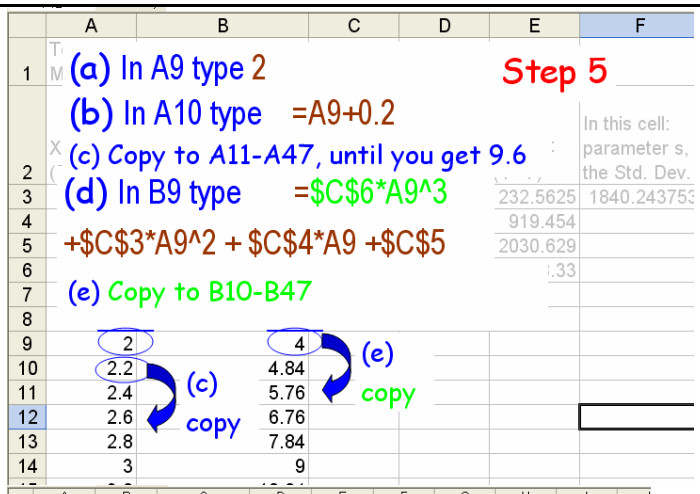
	A	B	C	D	E
1	Your name		10/19/2004		
2	X (Periods)	Y (lengths)	a,b,c, d guesses		
3	4.5	5	1	← a	
4	6.35	10	0	← b	
5	7.75	15	0	← c	
6	9.2	20	0	← extra cubic parameter 'd'	
7					
8					
9	↑ X data	↑ Y data			
10					
11					
12					
13					
14	We are trying to relate X to Y				
15					
16	using $Y' = dX^3 + aX^2 + bX + c$				
17					

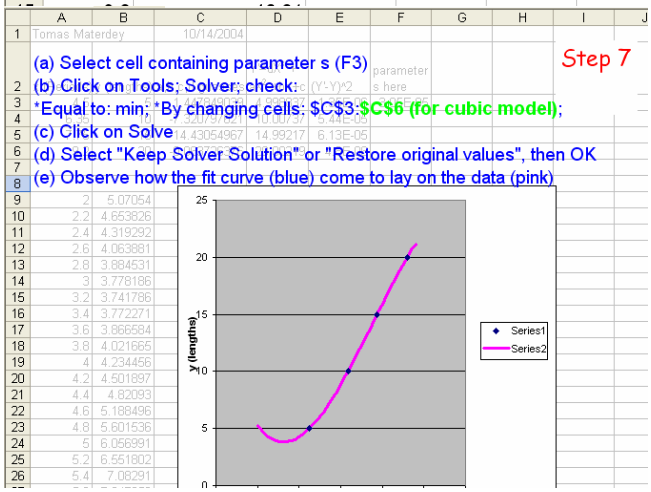
Step 1

	A	B	C	D	E	F
2	X (Periods)	Y (lengths)	a,b,c,d guesses	In this column: $Y' = dX^3 + aX^2 + bX + c$		
3	4.5	5	1	20.25		
4	6.35	10	0	40.3225		
5	7.75	15	0	60.0625		
6	9.2	20	0	84.64		
7						
8						
9	(a) In this cell type					
10	=$C$6*A3^3+$C$3*A3^2 + $C$4*A3 + $C$5					
11	This gives Y' when X is in A3 using a cubic					
12	polynomial					
13						
14						
15						

Step 2

(b) copy





6) **How to get a QUADRATIC model using the spreadsheet made for a CUBIC model?**

7) **How to get a Linear model using the spreadsheet made for a CUBIC model?**

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LOGBOOK: example of a logbook page

-Use a quadrille notebook; number all pages; date all entries
-Write your notes for all activities, thoughts, problems and solutions, and learning conclusions related to Engin 103. You should write down progress, outcomes, and conclusions on projects and teamwork; conclusions from class work (including LabVIEW) and homework.
-In addition you should answer in the logbook all questions listed in these notes in blue, as shown below:

13) Explain in your own words what did you do in each of the seven steps to do data modeling with Excel in CW3. Write Y'=f(X), being f the quadratic polynomial obtained after using Solver with values for the coefficients a,b,c substituted in. Also write down the final s parameter achieved with these coefficients. Attach a copy of your spreadsheet for CW3.

14) You have the spreadsheet to make a quadratic model for certain data set, such as the one used in CW3.
(a) Explain what changes you would do on the spreadsheet to make a linear model for the same data set. Use the most economical way that would not require changing the equations in cells D3 and B9 and copying them into the cells below.
(b) Explain what changes you would do on the spreadsheet to make a cubic model for the same data set.
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