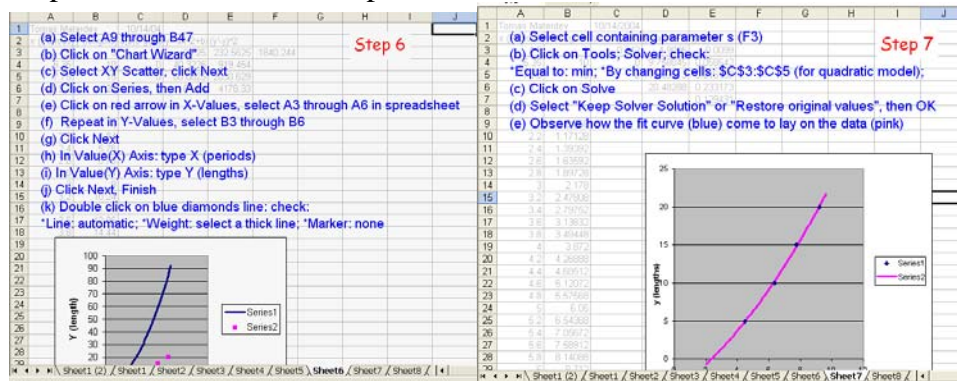


[back to e-syllabus](#)

CW3 (cont.)

Steps 6 and 7 in CW3 were performed.



FAQ:

1) 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.

2) 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.

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

Right click on the graph, click Select Data, then click Add, then enter 'Series X values' and 'Series Y values'.

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

Right click on the dots, then select Change Series Chart Type. Then select Line.

6) Where is Solver? If this is your first time using Solver, it may not be installed yet so click on the MS icon, then select Excel Options in the bottom:

The screenshot shows a Microsoft Excel window titled 'cw03sol2007.xls [Compatibility Mode] - Microsoft Excel'. The 'Recent Documents' list on the left includes:

- 1. cw03sol2007.xls
- 2. cw03sol.xls
- 3. E103GradesFa08_15.xls
- 4. list103f08.xls
- 5. studentlist.xls
- 6. Summer applicants 2007.xls

The main worksheet displays a table of data with columns for 'Periods', 'Lengths', and 'Guesses'. A chart titled 'Data Modeling for a Pendulum' is overlaid on the data. The chart shows 'Series1' (a blue line) and 'Series2' (red squares). The x-axis is labeled 'X(periods)' and ranges from 0 to 12. The y-axis is labeled 'Lengths' and ranges from 0 to 100. The chart shows a curve that starts at (0,0) and increases, with red squares representing data points. The status bar at the bottom indicates 'Ready' and '100%' zoom.

Then click on Add-ins on the left, and next to Manage, select Excel Add-ins, then click Go (see below)

Excel Options

Popular

Formulas

Proofing

Save

Advanced

Customize

Add-Ins

Trust Center

Resources

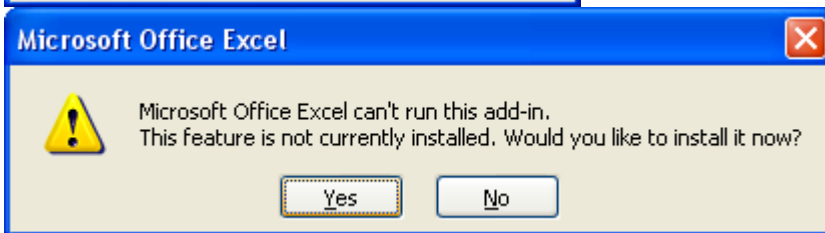
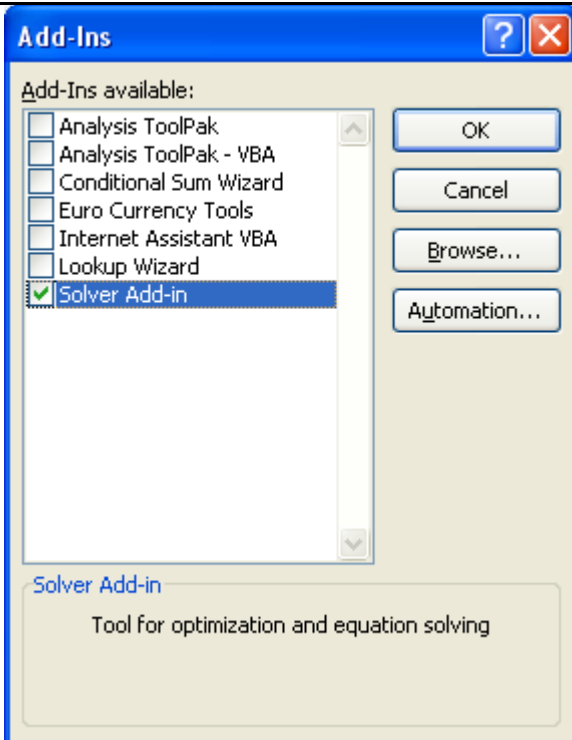
View and manage Microsoft Office add-ins.

Add-ins

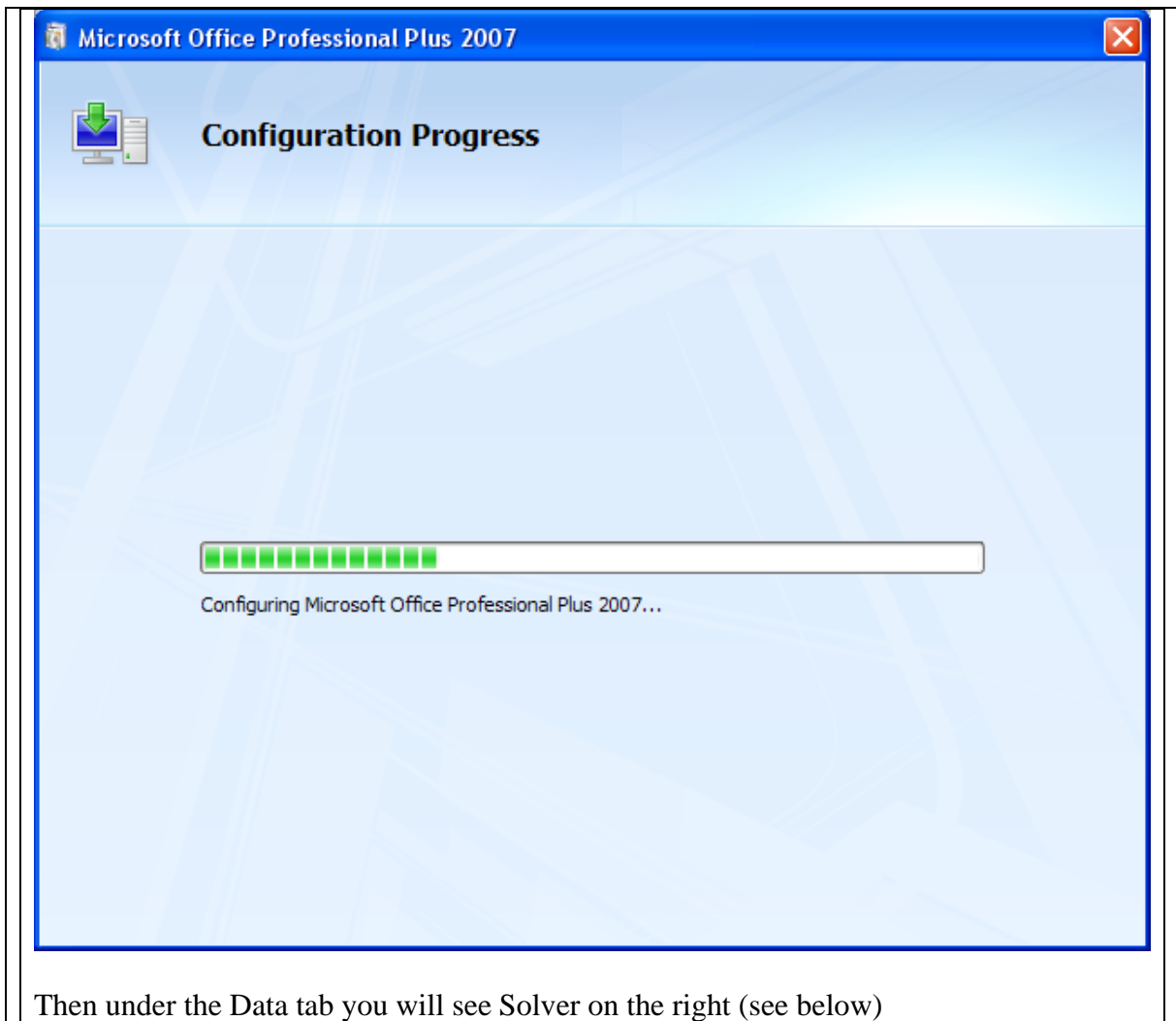
Name	Location	Type
Active Application Add-ins		
Acrobat PDFMaker Office COM Addin	C:\... 7.0\PDFMaker\Office\PDFMOfficeAddin.dll	COM Add-in
Convert with FlashPaper	C:\...romedia\FlashPaper 2\OfficePrintAddIn.dll	COM Add-in
Snagit Add-in	C:\...\TechSmith\Snagit 8\SnagitOfficeAddin.dll	COM Add-in
Inactive Application Add-ins		
Analysis ToolPak	analys32.xll	Excel Add-in
Analysis ToolPak - VBA	atpvbaen.xlam	Excel Add-in
Conditional Sum Wizard	sumif.xlam	Excel Add-in
Custom XML Data	C:\...iles\Microsoft Office\Office12\OFFRHD.DLL	Document Inspector
Date (Smart tag lists)	C:\...iles\Microsoft Shared\Smart Tag\MOFL.DLL	Smart Tag
Euro Currency Tools	eurotool.xlam	Excel Add-in
Financial Symbol (Smart tag lists)	C:\...iles\Microsoft Shared\Smart Tag\MOFL.DLL	Smart Tag
Headers and Footers	C:\...iles\Microsoft Office\Office12\OFFRHD.DLL	Document Inspector
Hidden Rows and Columns	C:\...iles\Microsoft Office\Office12\OFFRHD.DLL	Document Inspector
Hidden Worksheets	C:\...iles\Microsoft Office\Office12\OFFRHD.DLL	Document Inspector
Internet Assistant VBA	C:\...icrosoft Office\Office12\Library\HTML.XLAM	Excel Add-in
Invisible Content	C:\...iles\Microsoft Office\Office12\OFFRHD.DLL	Document Inspector
Lookup Wizard	lookup.xlam	Excel Add-in
Person Name (Outlook e-mail recipients)	C:\...es\Microsoft Shared\Smart Tag\FNAME.DLL	Smart Tag
Solver Add-in	solver.xlam	Excel Add-in
Document Related Add-ins		
Add-in:	Acrobat PDFMaker Office COM Addin	
Publisher:	Adobe Systems, Incorporated	
Location:	C:\Program Files\Adobe\Acrobat 7.0\PDFMaker\Office\PDFMOfficeAddin.dll	
Description:	Acrobat PDFMaker Office COM Addin	
Manage:	Excel Add-ins	Go...

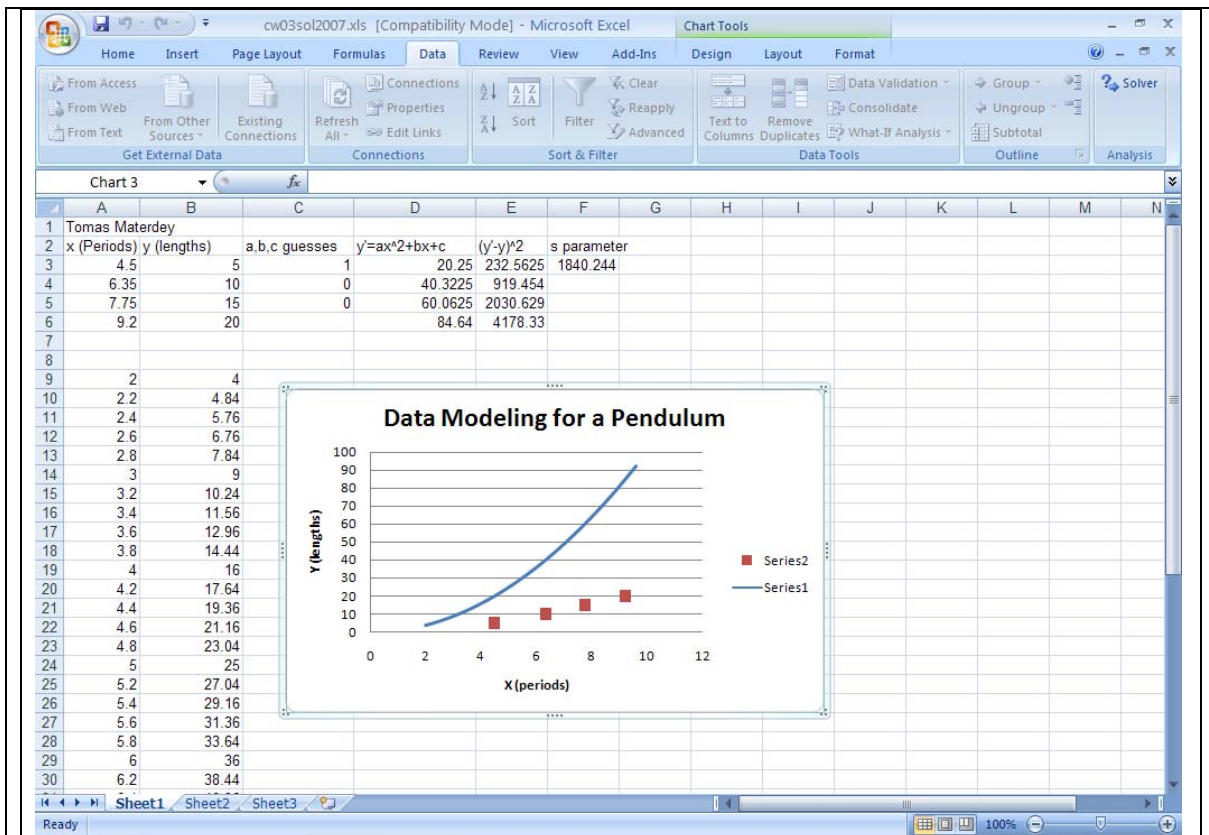
OK Cancel

Make sure Solver Add-in is checked in the next window. And click Yes to any error message



Excel will then install Solver, it takes a couple of minutes, be patience.





7) 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.**

8) 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.

Solver Parameters

Set Target Cell:

Equal To: ☐ Max ☒ Min ☐ Value of:

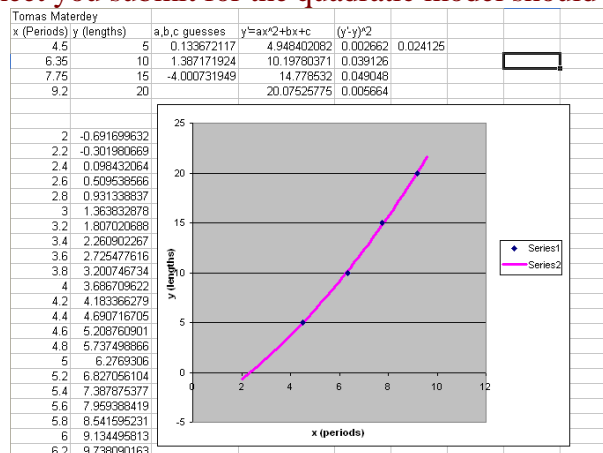
By Changing Cells:

Subject to the Constraints:

Buttons: Solve, Close, Options, Reset All, Help, Add, Change, Delete, Guess

8) What should I submit for CW3?

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




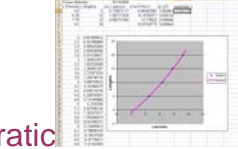
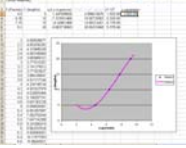
[back](#)

CW4

(a)

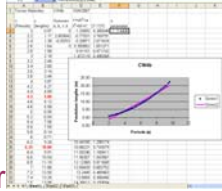
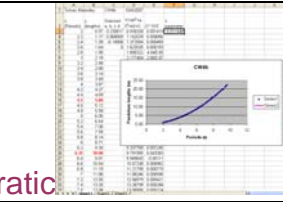

Save CW3 into a new file, then in Sheet #1 modify it to produce a linear and a cubic model for the same data set, insert snapshots of these worksheets into **Table 1** in a MS Word file. Make a table like the one below for the “s” values for the linear, quadratic, and cubic models, along with the coefficients 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=	

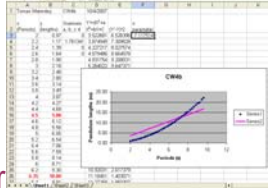
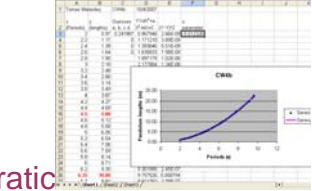
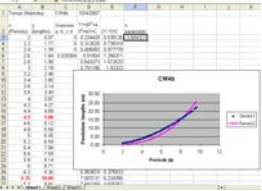
 <p>Quadratic</p>	A= B= C= D=	
 <p>Cubic</p>		
Table 1: All terms in polynomial models using same data set as in CW3		

(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
 <p>Linear</p>	A= B= C= D=	
 <p>Quadratic</p>	A= B= C= D=	
 <p>Cubic</p>	A= B= C= D=	
Table 2: All terms in polynomials models using new data set		

Model (only leading terms)	Coefficients	S parameter
----------------------------	--------------	-------------

 <p>Linear</p>	A= B= C= D=	
 <p>Quadratic</p>	A= B= C= D=	
 <p>Cubic</p>	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:

$$Y'=f(X)= D*X^3 + A*X^2 + B*X + C \text{ (has 4 coefficients: D, A, B, C)}$$

Quadratic polynomial:

$$Y'=f(X)= A*X^2 + B*X + C \text{ (has 3 coefficients: A, B, C)}$$

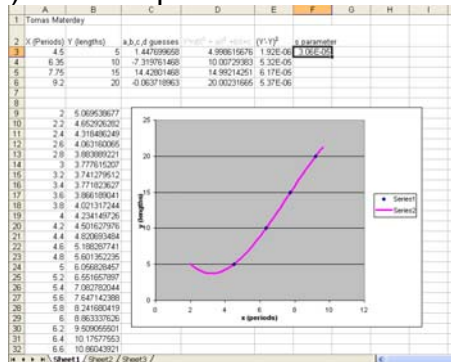
Linear polynomial:

$$Y'=f(X)= B*X + C \text{ (has 2 coefficients: B, C)}$$

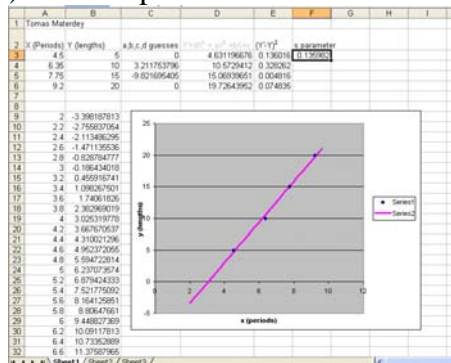
3) How can I get a snapshot of the worksheet?

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	Y			
10	data	data			
11					
12					
13					
14	We are trying to relate X to Y				
15	using $Y' = dX^3 + aX^2 + bX + c$				
16					
17					

	A	B	C	D	E	F
	X (Periods)	Y (lengths)	a,b,c,d guesses	In this column: $Y' = dX^3 + aX^2 + bX + c$	Step 2	
2				20.25	(b)	
3	4.5	5	1	40.3225	copy	
4	6.35	10	0	60.0625		
5	7.75	15	0	84.64		
6	9.2	20	0			
7						
8						
9						
10						
11						
12						
13						
14						
15						

(a) In this cell type

$=\$C\$6*A3^3 + \$C\$3*A3^2 + \$C\$4*A3 + \$C\5

This gives Y' when X is in A3 using a cubic polynomial

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						
7						
8						
9	2		4			
10	2.2		4.84			
11	2.4		5.76			
12	2.6		6.76			
13	2.8		7.84			
14	3		9			

(a) In A9 type 2

(b) In A10 type $=A9+0.2$

(c) Copy to A11-A47, until you get 9.6

(d) In B9 type $=\$C\$6*A9^3$

$+ \$C\$3*A9^2 + \$C\$4*A9 + \$C\5

(e) Copy to B10-B47

	A	B	C	D	E	F	G	H	I	J
1	Tomas Materley	10/14/2004								
2										
3										
4										
5										
6										
7										
8										
9	2	5.07054								
10	2.2	4.653826								
11	2.4	4.319292								
12	2.6	4.063881								
13	2.8	3.884531								
14	3	3.778186								
15	3.2	3.741786								
16	3.4	3.772271								
17	3.6	3.866584								
18	3.8	4.021665								
19	4	4.234456								
20	4.2	4.501897								
21	4.4	4.82093								
22	4.6	5.188496								
23	4.8	5.601536								
24	5	6.066991								
25	5.2	6.551802								
26	5.4	7.08291								

(a) Select cell containing parameter s (F3)

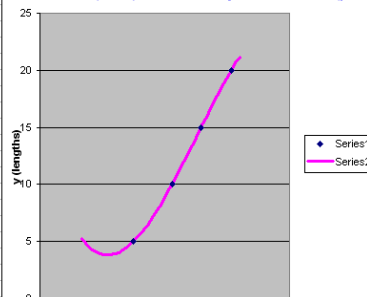
(b) Click on Tools; Solver; check: $(Y'-Y)^2$

*Equal to: min; *By changing cells: $\$C\$3:\$C\6 (for cubic model);

(c) Click on Solve

(d) Select "Keep Solver Solution" or "Restore original values", then OK

(e) Observe how the fit curve (blue) come to lay on the data (pink)



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?

[back](#)

[back](#)

[back](#)

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:

17) 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.

18) 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.

[back](#)