Engin 103	Topics:
March 2, 2010	<u>CW5</u>
	Introduction to LabVIEW
back to e-syllabus	<u>CW6</u>
	Circuit Analysis with LabVIEW I
	Circuit Analysis with LabVIEW II
	Project 1 Progress Reports
	Logbook questions
Engineering 1	03 –UMass Boston
	CW 5
(In-Cla	ass-Work 5)

1.- Import the data (metal distance and ultrasonic response) from <u>http://www.itl.nist.gov/div898/handbook/pmd/section6/pmd631.htm</u> into Excel (it helps to save them into a text file and then use 'Data/Get External Data/Import text file' with the 'fixed width' option). Produce a non-linear fit of the ultrasonic response Y' as a function of the metal distance X, with model Y'=exp(-b1\*X)/(b2+b3\*X). When importing data, note that in that website, the ultrasonic response (Y) appears in the first column, and the metal distance (X) in the second column. Plot the data and best fit on a same plot. Then copy the plot into a Word file. Also provide b1, b2, b3, and the final 'standard' deviation coefficient.

2.- Answer the following questions about data modeling

a) Using more coefficients in a model for a given data set will lead to a lower parameter s. True or false and why?

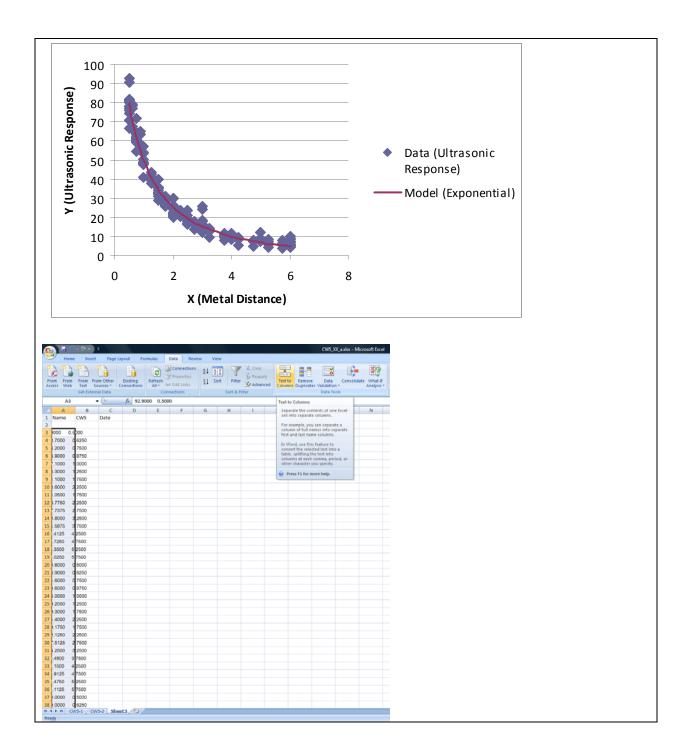
b) In studying a phenomenon, when doing data modeling, would scientists use more or less coefficients in their models, why? What would engineers do?

c) Does the way you build your physical system affect the quality of the mathematical model you can construct? Yes or no and why?

In each team, students working together at a computer numbered between 1 and 10 will submit file cw5\_XX\_a.xlsx, students working at a computer numbered between 11 and 20 will submit file cw5\_XX\_b.xlsx, to the *files* folder in the server. Replace XX by 01 if team 1, etc. Include your name within the files.

\*Remember that this is an individual work (turn it in, as instructed, with your name and date). Home-works and class-works count 20% toward the course grade. Class-works are done in class.

Your Excel graph should look like:

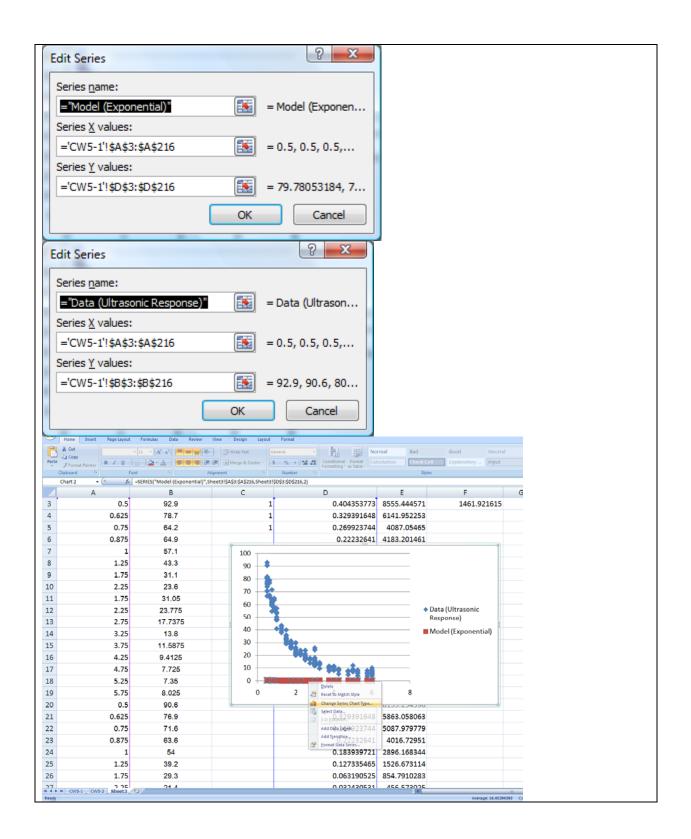


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5	64.2	0.75						
6	64.9	0.875						
7	57.1	1 25						
8 9	43.3 31.1	1.25						
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15	11.5875	3.75	3					
16	9.4125	4.25						
17	7.725	4.75						
18	7.35	5.25						
19	8.025	5.75						
20 21	90.6 76.9	0.5						
21	76.9	0.625						
22	63.6	0.875						
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			•	Y'=exp(-b1*X)/(b2+b3*X).			
3	0.5	92.9	1	0.404353773	=(D3-B3)^2		
4	0.625	78.7	1	0.329391648			
5	0.75	64.2	1	0.269923744			
6	0.875	64.9		0.22232641			
7	1	57.1		0.183939721			
8	1.25	43.3		0.127335465			
9	1.75	31.1		0.063190525			
10	2.25	23.6		0.032430531			
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24 25 1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	A         A           CW5-1         CW5-2         Sheet3           Henre         Invert         Page Lano           Page Rys Break         CW5-2         A           CW5         A         CW5           CW5         CW5         CW5           X (Metal Distance)         0.5         0.625           0.75         0.875         1.255           1.75         2.255         1.755           2.25         3.75         3.255           3.75         3.255         3.755           4.255         4.255         4.255           5.75         5.75         5.75	30.2           Fermulas         Data         Review           Interr         Fermulas         Ear           Interr         Structure         Ear <t< td=""><td>Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Date 10 Guesses b1,b2,b3 1 1</td><td>0 127235465 CVU X adar = Microsoft CVU X adar = Microsoft CVU X adar = Microsoft CVU X adar = Microsoft CVU X adar CVU X adar CVU X adar CVU X adar CVU X adar CVU X adar Videou</td><td>E (Y'-Y)^2 8555.444571 6141.952253 4087.05465 4183.201461 3239.437918 1863.878963 963.2835424 555.430307 960.1823614 555.430307 960.1823614 554.430365 314.0144393 190.188279 134.1554389 88.54401616 59.65238054 54.01015854 64.39305728</td><td>Parameter s =AVERAGE(E</td><td>B:E216)</td></t<>	Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Date 10 Guesses b1,b2,b3 1 1	0 127235465 CVU X adar = Microsoft CVU X adar = Microsoft CVU X adar = Microsoft CVU X adar = Microsoft CVU X adar CVU X adar CVU X adar CVU X adar CVU X adar CVU X adar Videou	E (Y'-Y)^2 8555.444571 6141.952253 4087.05465 4183.201461 3239.437918 1863.878963 963.2835424 555.430307 960.1823614 555.430307 960.1823614 554.430365 314.0144393 190.188279 134.1554389 88.54401616 59.65238054 54.01015854 64.39305728	Parameter s =AVERAGE(E	B:E216)
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24 25 1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	N         CVD-1         CVD-2         Sheet2           Home         Dourt         Page Earch         Current         Full           Page Trans         Current         Full         Full         Full         Full           Page Trans         Current         Full         F	30.2           Armulas         Data         Review           Image: Stress St	Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Date 10 Guesses b1,b2,b3 1 1	0 127235465 CW5.0C actor = Microsoft CW5.0C actor = Microsoft CW5.	E (Y'-Y)^2 8555.444571 6141.952233 4087.05465 4183.201461 3239.437918 1863.878963 963.2835424 555.430307 960.1823614 563.709605 314.0144393 190.188279 134.1554389 88.54401616 59.65238054 54.39305728 8135.254598 5863.058063	Parameter s =AVERAGE(E)	B:E216)
24 25 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	N         CVD-1         CVD-2         Sheet2           Home         Invert         Page Lano.           Page Page Briefs         Cuttor         Variation           Digget Page Briefs         Cuttor         Variation           SM         -         X           CW5         X         (Metal Distance)           0.5         0.625         0.75           0.875         1         1           1.25         1.75         2.255           2.75         2.255         3.255           3.75         4.255         3.75           4.25         5.75         5.75           0.625         0.625         0.575	30.2           A         Farmulas         Data         Review           I         Patrix         Formulas         Exclusion           I         Patrix         Formulas         Exclusion           I         Exclusion         Exclusion         Exclusion           I         AveBAACE(E1216)         B         Image: Comparison of the compa	Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Date 10 Guesses b1,b2,b3 1 1	0 127235465 CW5 DC Joke - Microsoft CW5 DC Joke - Microsoft CW5 DC Joke - Microsoft I Structures Woodsw CD Y'=exp(-b1*X)/(b2+b3*X), 0.404353773 0.329391648 0.269923744 0.22232641 0.183939721 0.127335465 0.063190525 0.032430531 0.01704743 0.009123343 0.001704743 0.0004951104 0.002716997 0.001504643 0.000839603 0.0004353773 0.329391648 0.269923744	E (Y'-Y)^2 8555.444571 6141.952253 4087.05465 4183.201461 3239.437918 1863.878963 963.2835424 563.709605 314.01283614 563.709605 314.0144393 190.188279 134.1554389 88.54401616 59.65238054 54.01015854 54.01015854 54.01015854 54.01015854 54.01015854 54.01015854 54.01015854	Parameter s =AVERAGE(E)	B:E216)
24 25 1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	N         CVIS-1         CVIS-2         Sheet3           Henre         Invert         Page Trans         CVIS-2         Sheet3           Page Trans         Invert         Page Trans         CVIS-2         Sheet3           Page Trans         Invert         Page Trans         CVIS-2         Sheet3           Page Trans         Invert         Page Trans         CVIS-2         Sheet3           SM         -         X         Invert         Sheet3         Sheet3           SM         -         X         Invert         Sheet3         Shee3         Sheet3         Sheet3	30.2           A         Farmulas         Data         Review           I         Patrier         Farmulas         Patrier           I         Patrier         Farmulas         Patrier           I         Marce         Farmulas         Patrier           I         Marce         Farmulas         Patrier           I         Marce         Farmulas         Patrier           Y         (Ultrasonic Response         92.9           78.7         64.2         64.9           57.1         43.3         31.1           23.6         31.05         23.775           17.7375         13.8         11.5875           9.4125         7.725         7.35           8.025         90.6         76.9           71.6         63.6         76.9	Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Date 10 Guesses b1,b2,b3 1 1	0 127235465 CW5 DC adde = Microsoft CW5 DC adde = Microsoft CW5 DC adde = Microsoft CW5 DC adde = Microsoft I Synthesis Window Window CD Y'=exp(-b1*X)/(b2+b3*X), 0.404353773 0.329391648 0.269923744 0.22232641 0.183939721 0.127335465 0.063190525 0.032430531 0.001704743 0.001704743 0.001704743 0.001704743 0.001704743 0.0002716997 0.001504643 0.000839603 0.000471523 0.000839603 0.000471523 0.000471523 0.000839613 0.000471523 0.00083963 0.000471523 0.00083963 0.000471523 0.00083963 0.000471523 0.00083963 0.000471523 0.00083963 0.000471523 0.00083963 0.000471523 0.00083963 0.000471523 0.00083963 0.000471523 0.00083963 0.00083963 0.000471523 0.00083963 0.00083653 0.00083963 0.00083653 0.00085555 0.0008	E (Y'-Y)^2 8555.444571 6541.952253 4087.05465 4183.201461 3239.437918 1863.878963 963.2835424 555.403307 960.1823614 563.709605 314.0144393 190.182379 134.1554389 88.54401616 59.65238054 54.01015854 64.39305728 8135.254598 5863.058063 5087.979779 4016.72951	Parameter s =AVERAGE(E)	3:E216)
24 25 1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	N         CVIS-1         CVIS-2         Sheet3           Henre         Invert         Page Trans         CVIS-2         Sheet3           Page Trans         Invert         Page Trans         CVIS-2         Sheet3           Page Trans         Invert         Page Trans         CVIS-2         Sheet3           Page Trans         Invert         Page Trans         CVIS-2         Sheet3           SM         -         X         Invert         Sheet3         Sheet3           SM         -         X         Invert         Sheet3         Shee3         Sheet3         Sheet3	30.2           Fermulas         Data         Review           Image: Strength Strengt Strength Strengt Strength Strengt Strengt Strengt	Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Zeem 10% Zeem 10 M Date 10 Guesses b1,b2,b3 1 1	0 127235465 CW5 DC Joke - Microsoft CW5 DC Joke - Microsoft CW5 DC Joke - Microsoft I Structures Woodsw CD Y'=exp(-b1*X)/(b2+b3*X), 0.404353773 0.329391648 0.269923744 0.22232641 0.183939721 0.127335465 0.063190525 0.032430531 0.01704743 0.009123343 0.001704743 0.0004951104 0.002716997 0.001504643 0.000839603 0.0004353773 0.329391648 0.269923744	E           (Y'-Y)^2           8555.444571           6141.952253           4087.05465           4183.201461           3239.437918           1863.878963           963.2835424           555.440571           960.1823614           563.709605           314.0144393           190.188279           134.1554389           88.54401616           59.65238054           54.01015854           64.39305728           8135.254598           5087.979779           4016.72551           2896.168344	Parameter s =AVERAGE(E	B:E216)

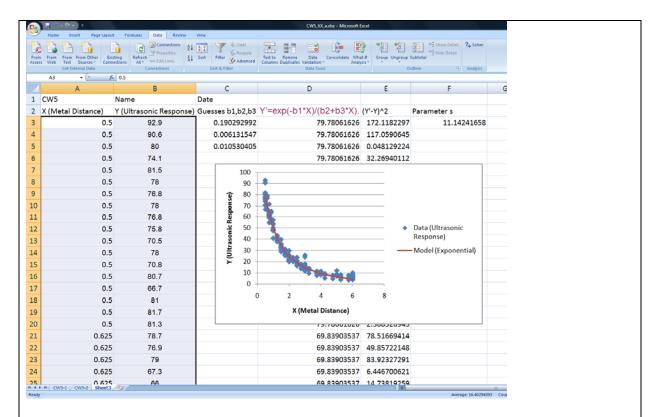
4       0.625       78.7       0.329391648       6141.952253         5       0.75       64.2       1       0.269923744       4087.05465         6       0.875       64.9       0.22232641       4183.201461         7       1       57.1       0.1283939211       3239.437918         8       1.25       43.3       0.0127335465       1683.878963         9       1.75       31.1       0.063190525       963.2835424         10       2.25       23.6       0.032430531       555.4303307         11       1.75       31.05       0.032430531       563.709605         13       2.75       17.7375       0.032430531       563.709605         14       3.25       13.8       0.00912343       190.18279         15       3.75       11.5875       0.001704743       314.0144393         14       3.25       7.35       0.000271697       88.5401616         17       4.75       7.725       0.001504643       59.6528054         18       5.25       7.35       0.000271697       88.5401616         19       5.75       8.025       0.000435173       313.5.25498         21       0.625	1.921615
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3       0.5       92.9       0.404353773       \$555.444571       1461.921         4       0.625       78.7       0.329391648       6141.952233         5       0.75       64.2       1       0.269923744       4087.05465         6       0.875       64.9       0.2232641       4183.201461         7       1       57.1       0.133939721       3239.437918         8       1.25       43.3       0.127335465       1863.878963         9       1.75       31.1       0.063190525       963.2835424         10       2.25       23.6       0.032430531       555.4303307         11       1.75       31.05       0.063190525       960.1823614         12       2.25       23.75       17.7375       0.01704743       314.0144393         14       3.25       13.8       0.009123343       190.188279         15       3.75       11.5875       0.001704743       314.014393         16       4.25       9.4125       0.002716997       8.54401616         17       4.75       7.725       0.001504643       59.6528054         18       5.25       7.05       0.002716997       8.54401616	1.921615
4       0.625       78.7       0.329391648       6141.952253         5       0.75       64.2       1       0.269923744       4087.05465         6       0.875       64.9       0.2232641       4183.201461         7       1       57.1       0.183939721       3239.437918         8       1.25       43.3       0.127335465       1863.878963         9       1.75       31.1       0.063190525       963.2835424         10       2.25       23.6       0.032430531       555.430307         11       1.75       31.05       0.063190525       960.1823614         12       2.25       23.76       0.032430531       563.709605         13       2.75       17.7375       0.01704743       314.0144393         14       3.25       13.8       0.009123343       190.188279         15       3.75       11.5875       0.001504643       59.6528054         18       5.25       7.35       0.00071523       64.3905728         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.3229391648       5863.058063         22       0.75       71.	
6       0.875       64.9       0.22232641       4183.201461         7       1       57.1       0.183939721       3239.437918         8       1.25       43.3       0.127335465       1863.878963         9       1.75       31.1       0.063190525       963.283544         10       2.25       23.6       0.032430531       555.4303307         11       1.75       31.05       0.063190525       960.1823614         12       2.25       23.775       0.032430531       553.709605         13       2.75       17.7375       0.01704743       314.0144393         14       3.25       13.8       0.009123343       190.188279         15       3.75       11.5875       0.001704743       314.0144393         16       4.25       9.4125       0.002716997       88.54401616         17       4.75       7.726       0.001504643       59.65238054         18       5.25       7.35       0.000839063       54.01015854         19       5.75       8.025       0.000083773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6	
7       1       57.1       0.183939721       3239.437918         8       1.25       43.3       0.127335465       1863.878963         9       1.75       31.1       0.063190525       963.2835424         10       2.25       23.6       0.032430531       555.430307         11       1.75       31.05       0.063190525       960.1823614         12       2.25       23.775       0.001704743       314.0144393         14       3.25       13.8       0.009123343       190.188279         15       3.75       11.5875       0.001704743       314.0144393         16       4.25       9.4125       0.002716997       88.54401616         17       4.75       7.725       0.001504643       59.6528054         18       5.25       7.35       0.000839603       54.01015854         19       5.75       8.025       0.0000839603       54.01015854         20       0.5       90.6       0.42933773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.269923744       5087.979779         23       0.875       63.6	
8       1.25       43.3       0.127335465       1863.878963         9       1.75       31.1       0.063190525       963.2835424         10       2.25       23.6       0.032430531       555.430307         11       1.75       31.05       0.063190525       960.1823614         12       2.25       23.75       0.001704743       314.0144393         14       3.25       13.8       0.009123343       190.188279         15       3.75       11.5875       0.001704743       314.0144393         16       4.25       9.4125       0.002716997       88.54401616         17       4.75       7.725       0.001504643       59.6528054         18       5.25       7.35       0.000839603       54.01015854         19       5.75       8.025       0.00071523       64.39305728         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.269923744       5087.979779         23       0.875       63.6       0.2232641       4016.72951         24       1       54	
9       1.75       31.1       0.063190525       963.2835424         10       2.25       23.6       0.032430531       555.4303307         11       1.75       31.05       0.063190525       960.1823614         12       2.25       23.775       0.032430531       555.4303307         13       2.75       17.7375       0.032430531       563.709605         14       3.25       13.8       0.009123343       190.188279         15       3.75       11.5875       0.004951104       134.1554389         16       4.25       9.4125       0.002716997       88.54401616         17       4.75       7.725       0.001504643       9.65238054         18       5.25       7.35       0.000839603       54.01015844         19       5.75       8.025       0.00047123       64.39305728         20       0.5       90.6       0.404353773       813.5254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.22932144       5087.979779         23       0.875       63.6       0.2232641       4016.72951         24       1       54	
10       2.25       23.6       0.032430531       555.4303307         11       1.75       31.05       0.063190525       960.1823614         12       2.25       23.775       0.032430531       563.709605         13       2.75       17.7375       0.01704743       314.0144393         14       3.25       13.8       0.009123343       190.188279         15       3.75       11.5875       0.001704743       314.0144393         16       4.25       9.4125       0.002716997       88.54401616         17       4.75       7.725       0.001504643       59.65238054         18       5.25       7.35       0.000495104       59.65238054         19       5.75       8.025       0.000471523       64.39305728         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.26923744       5087.979779         23       0.875       63.6       0.22232641       4016.72951         24       1       54       0.1383939721       2896.168344         14       54       0.12733546	
11       1.75       31.05       0.063190525       960.1823614         12       2.25       23.775       0.032430531       563.709605         13       2.75       17.7375       0.01704743       314.0144393         14       3.25       13.8       0.009123343       190.188279         15       3.75       11.5875       0.004951104       134.1554389         16       4.25       9.4125       0.000271697       88.54401616         17       4.75       7.725       0.001504643       59.65238054         18       5.25       7.35       0.0004915123       64.39305728         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.22923241       4016.72951         23       0.875       83.8       0.2223241       4016.72951         24       1       54       0.1383939721       2896.168844         1       54       0.1383939721       2896.16844         1       54       0.1383939721       2896.16844         1       54       0.127335465       152.6 573114	
12       2.25       23.775       0.032430531       563.709605         13       2.75       17.7375       0.01704743       314.0144393         14       3.25       13.8       0.009123343       190.188279         15       3.75       11.5875       0.004951104       134.1554389         16       4.25       9.4125       0.002716997       88.54401616         17       4.75       7.725       0.001504643       59.65238054         18       5.25       7.35       0.000839603       54.01015854         19       5.75       8.025       0.000471523       64.39305728         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.22923744       5087.979779         23       0.875       63.8       0.22232641       4016.72951         24       1       54       0.133939721       286.168344         0.127335465       152.6 673144       0.127335465       152.6 673144         Kit Mark Mark Mark Mark Mark Mark Mark Mark	
14       3.25       13.8       0.009123343       190.188279         15       3.75       11.5875       0.004951104       134.1554389         16       4.25       9.4125       0.002716997       88.54401616         17       4.75       7.725       0.001504643       59.65238054         18       5.25       7.35       0.000839603       54.01015854         19       5.75       8.025       0.0004353773       8135.254598         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.2293291648       5863.058063         24       1       54       0.138939721       286.168344         10       53.93       30.2       0.12733545       152.6 67314         Kerrage 10	
15       3.75       11.5875       0.004951104       134.1554389         16       4.25       9.4125       0.002716997       88.54401616         17       4.75       7.725       0.001504643       59.65238054         18       5.25       7.35       0.000839603       54.01015854         19       5.75       8.025       0.000471523       64.39305728         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.269923744       5087.979779         23       0.875       63.6       0.2232641       4016.72951         24       1       54       0.138939721       2896.168344         0.127335465       1526.673114       506.73114       506.73114         Kereage 16	
16       4.25       9.4125       0.002716997       88.54401616         17       4.75       7.725       0.001504643       59.65238054         18       5.25       7.35       0.000839603       54.01015854         19       5.75       8.025       0.000471523       64.39305728         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.269923744       5087.97979         23       0.875       63.6       0.22232641       4016.72951         24       1       54       0.183939721       2896.168344         24       1       54       0.127333465       152.6.673114         Kerker Kerker Verw Drigg Layout Format	
17       4.75       7.725       0.001504643       59.65238054         18       5.25       7.35       0.000839603       54.01015854         19       5.75       8.025       0.000471523       64.39305728         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.269923744       5087.97979         23       0.875       63.6       0.22232641       4016.72951         24       1       54       0.183939721       2896.168344         24       1       54       0.127333645       152.6.673114         Key First Page Lagost Farmulas         CMM 1000         Key First Page Lagost Farmulas	
18       5.25       7.35       0.000839603       54.01015854         19       5.75       8.025       0.000471523       64.39305728         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.269923744       5087.979779         23       0.875       63.6       0.22232641       4016.72951         24       1       54       0.183939721       2896.168344         25       9.2       0.127335465       1526.673114       Arrage 10	
19       5.75       8.025       0.000471523       64.39305728         20       0.5       90.6       0.404353773       8135.254598         21       0.625       76.9       0.329391648       5863.058063         22       0.75       71.6       0.269923744       5087.979779         23       0.875       83.6       0.22232641       4016.72951         24       1       54       0.183939721       2896.168344         24       1.25       30.2       0.177335465       1526.673114         Kerrage 10         Constants	
20         0.5         90.6         0.404353773         8135.254598           21         0.625         76.9         0.329391648         5863.058063           22         0.75         71.6         0.269923744         5087.979779           23         0.875         63.6         0.22232641         4016.72951           24         1         54         0.183939721         2866.168344           75         1.9         30.2         0.177335465         1576.673114	
21         0.625         76.9         0.329391648         5863.058063           22         0.75         71.6         0.269923744         5087.979779           23         0.875         63.6         0.22232641         4016.72951           24         1         54         0.138939721         2896.168344           25         1.36         30.2         0.177335465         1526.673114	
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23         0.875         63.6         0.2232641         4016.72951           24         1         54         0.183939721         2896.168344           25         1.25         30.2         0.127335465         1526.673114           Arrange 16           CMM Tools         CMM Tools	
24         1         54         0.183939721         2896.168344           25         1.25         39.2         0.127335645         1526.673114           Ket Tools         CW5.2 Sheet Size           Toolspan="2">Chart Tools         CW3.X.s.dix - Microsoft Locd           Toolspan="2">CW3.X.s.dix - Microsoft Locd	
25     125     39.2     0.127335645     1526.673114       Red     Arrenge 16       CVD_V2_Sheet3     CVD_V2_sheet3       Arrenge 16       CVD_V2_sheet3     Arrenge 16       CVD_V2_sheet3     Arrenge 16       CVD_V2_sheet3     Arrenge 16	



Format Selection	- 🔄 🖓 🛆				Later Links	chi da chi	wt 2	
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22	0.75	71.6		0.	269923744	5087.979779		
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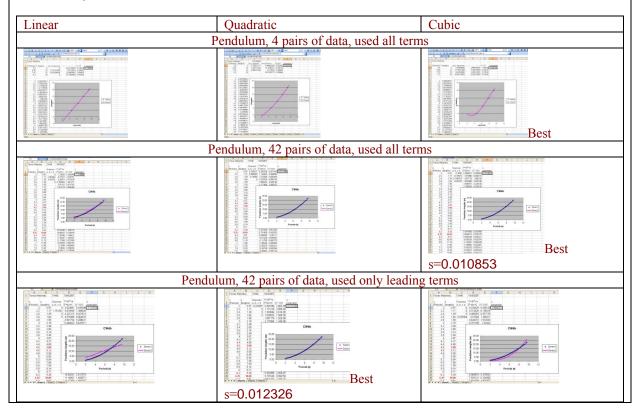
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## Data Modeling and Science vs. Engineering

The summary of CW4 results is shown in the table below.



When only the leading term was used, the quadratic model showed the lowest s parameter. This means our data behave more in line with a quadratic term rather than a cubic or a linear term. In deed, based on Newton's Laws and the Universal Law of Gravitation, the period of an ideal pendulum (mass of string is negligible, bob is not so large, and friction is ignored) is given by

$$T = 2\pi \sqrt{\frac{L}{g}}$$
 or  $L = \frac{gT^2}{4\pi^2}$ 

where T is the period, L is the length, and g is the acceleration of gravity.

From the value of the coefficient A, you can derive the constant acceleration of gravity g. In fact a method to measure this constant at different latitudes and longitudes is to measure the periods of a pendulum of different lengths, then extract g from the coefficient of the quadratic term.

-While doing data modeling, can we distinguish between an engineer and a scientist approach?

Engineers tend to make a more precise model of a system (getting lower s parameter) by including additional terms. Scientists tend to idealize a system in quest of a universal model that is simpler, but also less accurate when applied to a real system. Precision and universality satisfy a complementary relation similar to that of the uncertainty principle in quantum mechanics.

## Data Modeling and System Design



A good design will affect the quality of X,Y data, which will affect the quality of a mathematical model. In the two systems above, which one will allow better data, and so model, and why?

## back

## **Introduction to LabVIEW**

-LabVIEW: background for HW1 questions 4 and 5. How to locate different functions within the Front Panel (user interface: inputs and outputs quantities) and within the Block Diagram (programmer interface: operations, analysis).

-Things belonging to the Front Panel will be found under **Controls palette**, abbreviation is C, which can be brought up by 'right-clicking' (click on the mouse's right button) on the Front Panel.

-Things belonging to the Block Diagram will be found under **Functions palette**, abbreviation is F, which can be brought up by 'right-clicking' on the Block Diagram.

-Things to operate VI (Virtual Instruments) will be found under **Tools palette**, abbreviation is T, which can be brought up by clicking on Window, then select 'Show Tools Palette'

For example, where to locate 'Array'?. We start by guessing whether this is an input/output or

an operation, it is more of a numeric input utility, so right-click on the Front Panel to bring up the Controls palette (C), then select sub-palette All Controls, then select sub-palette Array and Cluster, to find Array in the first button. So the complete location for Array reads C/All Controls/Array and Cluster.

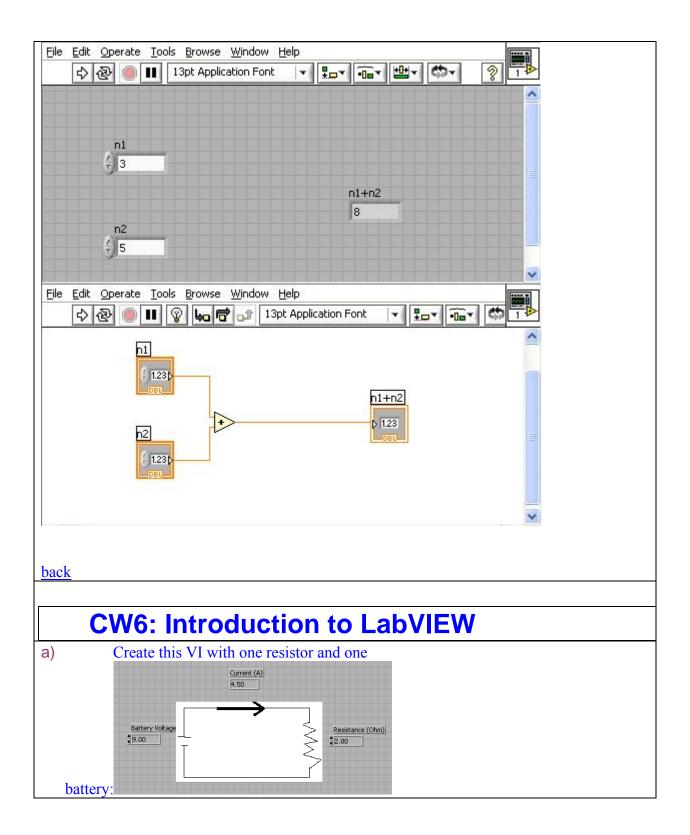
For example where to locate 'Reciprocal'?. This is more of an operation (getting the reciprocal of x is doing 1/x). So right-click on the Block Diagram to bring up the Functions palette (F), then select All Functions, then Numeric, and find Reciprocal under button 1/x. So the location for Reciprocal is F/All Functions/Numeric

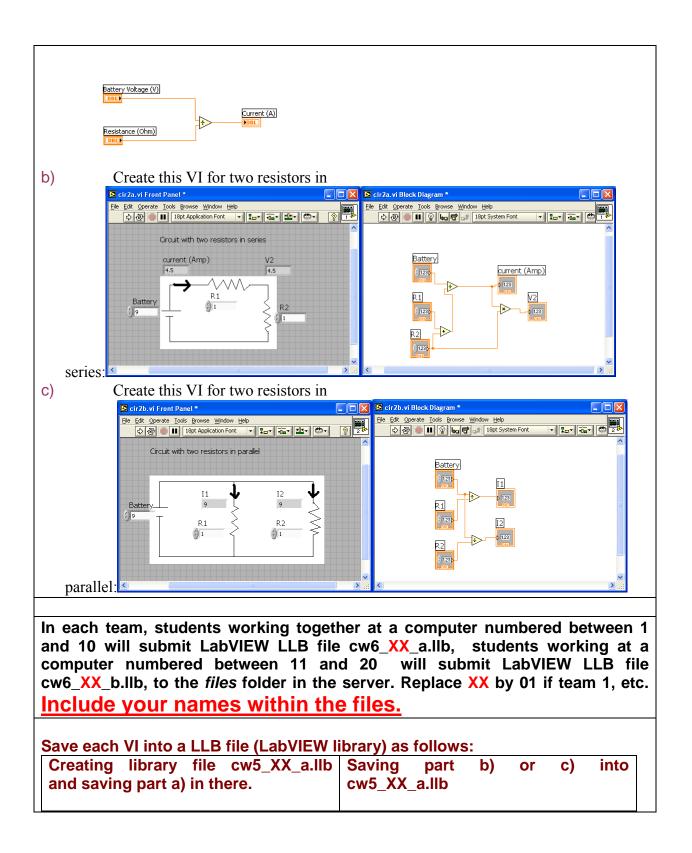
-As a background to changing values on a Numeric Control, we make a simple addition VI. We will need two inputs (Numeric Controls) and one output (Numeric Indicator) in the Front Panel, where the user will input the numbers she/he would like to add, where she/he will read the result, respectively. We should label the inputs as n1 and n2, and the output as n1+n2. This is necessary to identify identical elements on the Block Diagram, and as part of the user interface. **Label** can be entered by typing into the blank box that is shown when an element is placed in the Front Panel. The blank box can be brought up by right-click on the element and select '**Show Label**'. To edit labels, select the Text tool, under Tools Palette, then click on the label.

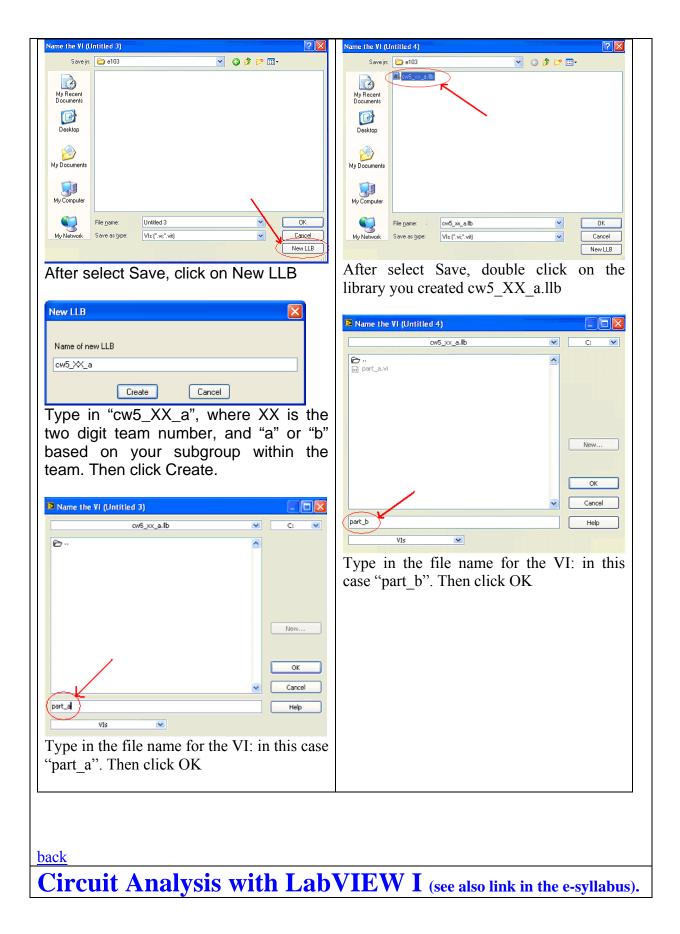
To tell LabVIEW how to produce the output from these inputs, the programmer goes to the Block Diagram to place the addition operation (F/All Functions/Numeric), then wire the inputs n1 and n2 into the left terminals of the addition by selecting the **wiring tool** (under T), click to start, click to end, double-click to finish a wiring. Note that since the addition is commutative, n1 and n2 can be individually connected to either the left upper terminal or the left lower terminal of the addition operator. Should we have a division, the upper terminal is divided by the lower terminal, or the left terminals are different. In a subtraction, the upper terminal is subtracted by the lower one.

If we need to remove any piece of wire, use the **Select tool** (arrow under T) to select that piece, then hit 'backspace' on the keyboard.

Then it comes to put in values into the Numeric Controls to test our addition VI: using the **Operate Value tool** (finger, under T) and click on the left handles to increase or decrease by an integer unit. To run the VI, click on the **Run button** (right arrow in the upper left corner), the results should show as expected. If we would like to scan through different inputs and outputs without having to hit the Run button every time we change the inputs, then use **Run Continuously** (found to the right of the Run button). Under this mode, the VI should be stopped before any modification can be made.







Example: a VI that solves a simple electrical circuit with one battery and one resistance:

Developing a Virtual Instrument consists of the following steps:

1) Define the problem you want to solve, specify what will be the inputs and the outputs. The inputs are the battery voltage V (in Volts) and the resistance of the light bulb R in (in Ohms). The output is the current flowing in the circuit I (in Amps)

2) Determine the equations or operations needed to produce the outputs from the inputs We need an equation that gives I in terms of V and R. It is Ohm's law: I=V/R

3) Implement the controls and indicators and graphs in the Control Panel and the operations in the Block Diagram

Control panel: enter a numeric control for V, another one for R; a numeric indicator (without handle on the left side) for the current I

Block Diagram: enter the "divide" operation, then wire V and R to this operator, and the output to I

4) Fix any error and implement modifications as needed

If there is a broken wire, that needs to be fixed If there is no error, the arrow on the upper left corner ("Run") is not broken

5) Test the final results against expected theoretical values. Enter V=9V; R=2 Ohm, I should read 4.5 A In circuits with more than one resistor, if the output does not agree with our calculation, the Block Diagram needs to be revised.

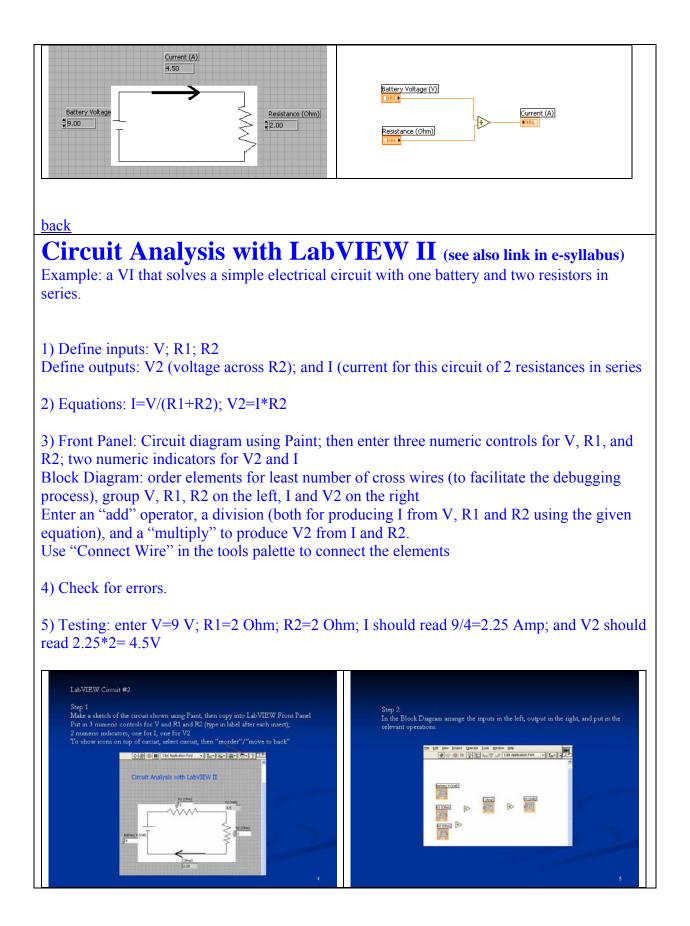
Insert a text box by clicking on "A" (Edit Text) in the tool palette Insert a circuit diagram made in Paint by selecting (using the dotted rectangle in Paint left menu), then Edit/Copy; then in the Front Panel of LabVIEW, Edit/Paste

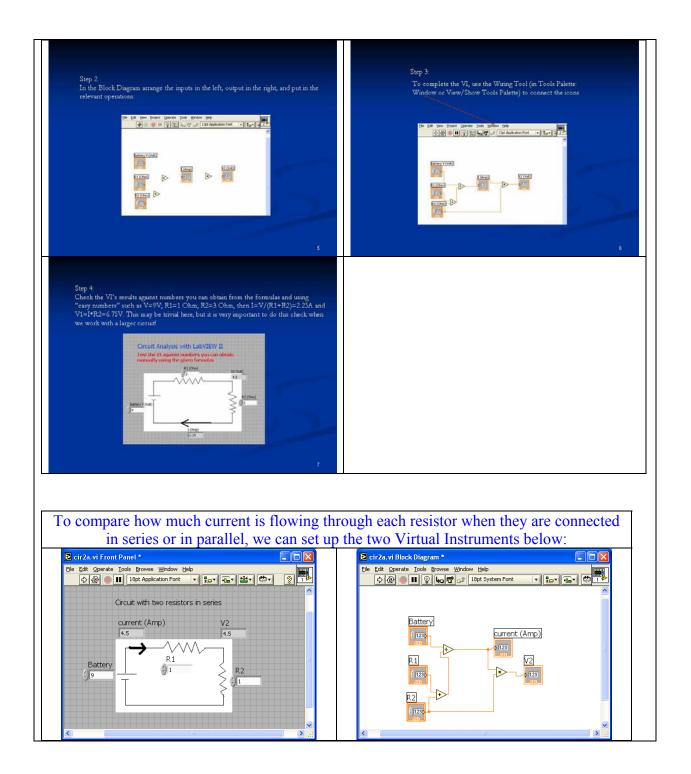
Front Panel: enter two numeric controls, label them as V and R; enter one numeric indicator, label it as I

Block Diagram: enter the "Divide" operator from Arith/Compare/Numeric Group V and R together with the "Divide" on the left side of the Block Diagram, and the I on the right.

Check if the "Run" button is continuous

Enter values in the Numeric Controls V and R boxes and check the result at the numeric indicator I box after clicking on the "Run" button.





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Team #	(9:30AM) Leader (first and last)	a) Describe what system your team is building b) What input X and output Y you will use to test the predictability?	c) In what units (cm, in, s, etc.) will you measure X and Y? d) What instrument will you	Assign a grade on communication in your team in this project: 4 -members always

Team #	Leader (first and last)	<ul> <li>a) Describe what system your team is building</li> <li>b) What input X and output Y you will use to test the predictability?</li> </ul>	<ul> <li>c) In what units (cm, in, s, etc.) will you measure X and Y?</li> <li>d) What instrument will you use to measure X and Y (rulers, stop watch, etc.)</li> <li>e) What will be the range for X? (Note the range needs to allow for at least 10 distinctive values for X)</li> </ul>	Assign a grade on communication in your team in this project: 4 –members always communicate how they ard doing on their part 3 – members sometimes communicate how they ard doing on their part 2- some member does not reply emails or phone call: 1 – members show no interest in participating
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Section 1				
<b>7</b> Section 1				
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Section 1				
<u>10</u> Section 1				

Section 2 (	$(2.00^{\circ} \text{WI})$			
Team #	Leader (first	a) Describe what system your team is	c) In what units (cm, in, s,	Assign a grade on
	and last)	building	etc.) will you measure X and	communication in your
		b) What input X and output Y you will	Y?	team in this project:
		use to test the predictability?	d) What instrument will you	4 –members always

		use to measure X and Y (rulers, stop watch, etc.) e) What will be the range for X? (Note the range needs to allow for at least 10 distinctive values for X)	communicate how they are doing on their part 3 – members sometimes communicate how they are doing on their part 2- some member does not reply emails or phone calls 1 – members show no interest in participating
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<u>5</u> Section 2	A.)	B.)	
6 Section 2	a)	b)	
<b>7</b> Section 2			
Section 2			
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<u>back</u>			
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LOGBOOK: example of a logbook page			
<ul> <li>-Use a quadrille notebook; number all pages; date all entries</li> <li>-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.</li> <li>-In addition you should answer in the logbook all questions listed in these notes in blue, as shown below:</li> </ul>			
<ul> <li>21) Insert the three tables shown in CW4 with values of the polynomial coefficients and s parameters in the logbook. Describe the differences in the graphs of the three tables in CW4.</li> <li>22) Calculate the constant acceleration of gravity g (in m/s<sup>2</sup>) using the quadratic coefficient A from your table #3 of CW4 using the formula provided above; show the</li> </ul>			
calculations and the final result in your logbook			

back