PROBLEM 1

	A	B	C	D	E	F	G	H	I	J
1										
2	**Australian Wind Model: Program to estimate the value of design hourly wind speed distribution for a tall building**									
3	**Programmer**		R. Powers			**Formula**	Vz = (u/0.4) * ln(z/z0)			
4	**Date**		10/3/2013 18:21							
5						Design Environments			u	z0
6	Design Environment	Downtown areas	dim			Open water			1.204	0.002
7	z0	2	m			Open country			1.385	0.02
8	Start height	1.00	m			City suburbs			1.626	0.2
9	End height	500.00	m			Downtown areas			1.963	2
10	Height step size	5.00	m							
11	No. Iterations	100								
12										
13	Height Above Ground (m)	Wind Speed (m/s)								
14	5	4.50								
15	10	7.90								

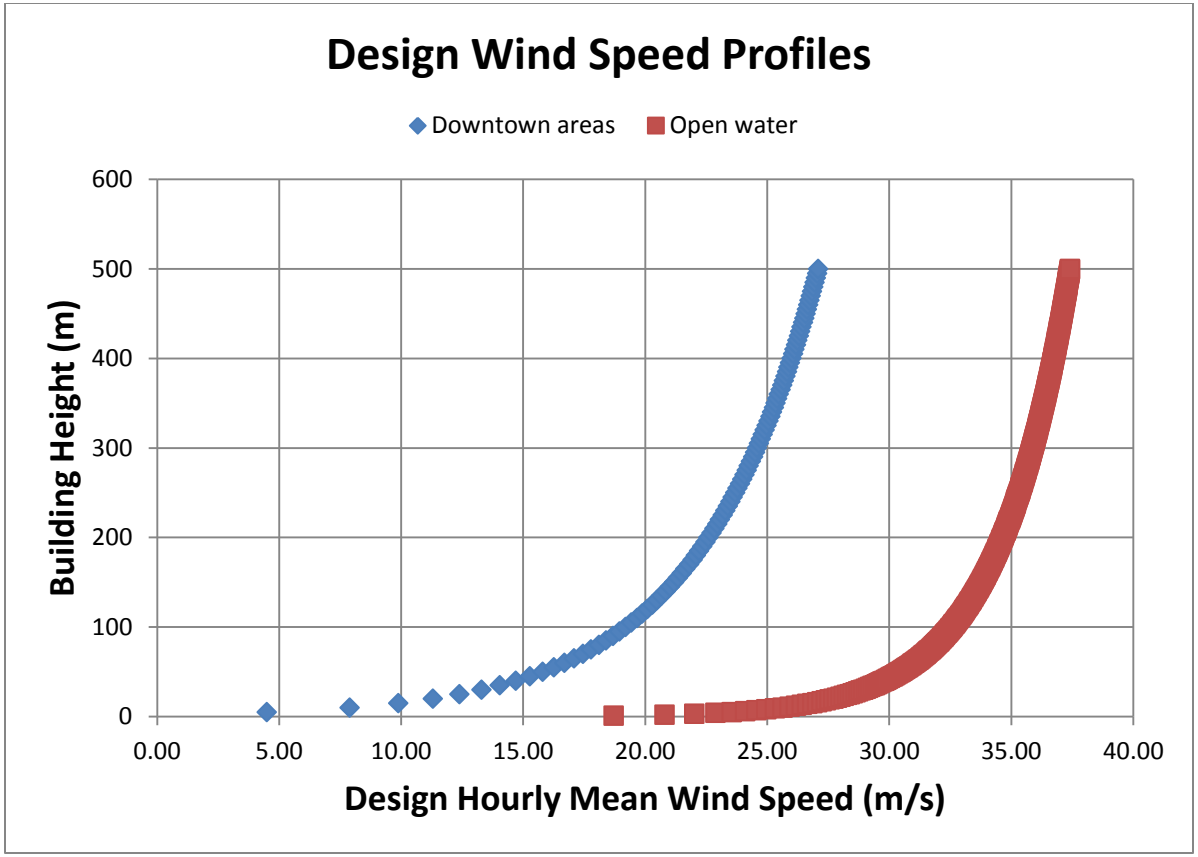
Calculate Design Hourly Mean Wind Speed Profile

(General) DesignWindSpeed

```
Sub DesignWindSpeed()

' sub-routine to calculate the design hourly mean wind speed
' profile for a tall building

' Programmer: R. Powers
' Date: 09/23/2013

' clear the appropriate cells
Range("A14:B1000").Clear
Range("B7").Clear
Range("B11").Clear

' retrieve the design environment that was chosen and assign
' values of friction velocity and roughness length accordingly.

Sheets("Problem1").Select

Range("B6").Select
designEnvironment = ActiveCell.Value

If designEnvironment = "Open water" Then
    u = 1.204
    z0 = 0.002
ElseIf designEnvironment = "Open country" Then
    u = 1.385
    z0 = 0.02
ElseIf designEnvironment = "City suburbs" Then
    u = 1.626
    z0 = 0.2
ElseIf designEnvironment = "Downtown areas" Then
    u = 1.963
    z0 = 2
Else
    MsgBox ("I could not find the values needed.")
End If
```

```
' write the value of roughness length back into the worksheet
ActiveWorkbook.Sheets("Problem1").Range("B7") = z0

' calculate the number of iterations
    'Read the value of start height
    Range("B8").Select
    startHeight = ActiveCell.Value

    'Read the value of end height
    Range("B9").Select
    endHeight = ActiveCell.Value

    ' Read the value of height increment
    Range("B10").Select
    deltaHeight = ActiveCell.Value

    ' calculate the number of iterations
    noiterations = WorksheetFunction.RoundDown(((endHeight - startHeight) / deltaHeight) + 1, 0)

    ' Write back to the spreadsheet the value of number of iterations
    ActiveWorkbook.Sheets("Problem1").Range("B11") = noiterations

' start the loop to compute design hourly mean wind speed for each repetition
For I = 1 To noiterations

    cellNumber = "A" & (I + 13)         ' assign the cell to write height values
    Range(cellNumber).Select            ' select cell assigned in previous step
    Z = I * deltaHeight                 ' establish height Z for current repetition
    ActiveCell.Value = Z                ' assign height Z to cells A+ (n+13)

    ' calculate the design hourly mean wind speed

    Vz = (u / 0.4) * Log(Z / z0)

    cellNumber = "B" & (I + 13)         ' assign the cell to write Vz values
    Range(cellNumber).Select            ' select cell
    ActiveCell.Value = Vz               ' write value of Vz
    ActiveCell.NumberFormat = "0.00"    ' format numbers

Next I                                  ' next value of i

End Sub
```

TASK 2 (Open water)			TASK 3 (Downtown areas)	
Height Above Ground (m)	Wind Speed (m/s)		Height Above Ground (m)	Wind Speed (m/s)
1	18.71		5	4.50
2	20.79		10	7.90
3	22.01		15	9.89
4	22.88		20	11.30
5	23.55		25	12.40
6	24.10		30	13.29
7	24.56		35	14.05
8	24.97		40	14.70
9	25.32		45	15.28
10	25.64		50	15.80
490	37.35		450	26.58
491	37.36		455	26.63
492	37.36		460	26.69
493	37.37		465	26.74
494	37.38		470	26.79
495	37.38		475	26.84
496	37.39		480	26.90
497	37.39		485	26.95
498	37.40		490	27.00
499	37.41		495	27.05
500	37.41		500	27.10


Design Wind Speed Profiles
Downtown areas
Open water
Building Height (m)
600
500
400
300
200
100
0
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Design Hourly Mean Wind Speed (m/s)

PROBLEM 2

In the grading of this problem, both positive and negative values for stress and deflection were accepted.

	A	B	C	D	E	F	G	H	I
1									
2	**Beam deflection and stress calculation**								
3	**Programmer**		R. Powers			**Formulas**	s = (W / 2Z*l*) * (*l* - x)^2		
4	**Date**		10/3/2013 18:21				y = (Wx^2/24E*I*) * (2*l*^2 + (2*l* - x)^2)		
5									
6	W	1100	lb						
7	E	13000000	lb/sq-in						
8	I	128	in^4						
9	dN	10	in						
10	*l*	350	in						
11									
12	delta x	5	in						

Calculate Stress and Deflection Profiles

(General) StressAndDeflection

```
Sub StressAndDeflection()

' sub-routine to calculate the stress and deflection
' along a cantilever beam supported at one end

' Programmer: R. Powers
' Date: 09/24/2013

' clear the appropriate cells
Range("A15:C1000").Clear

' retrieve the values

Sheets("Problem2").Select

Range("B6").Select
W = ActiveCell.Value

Range("B7").Select
E = ActiveCell.Value

Range("B8").Select
I = ActiveCell.Value

Range("B9").Select
dN = ActiveCell.Value

Range("B10").Select
Length = ActiveCell.Value
```

```
' calculate Z

Z = I / dN

' calculate the number of iterations
    'Read the value of delta x
    Range("B12").Select
    deltaLength = ActiveCell.Value

    ' calculate the number of iterations
    noiterations = WorksheetFunction.RoundDown((Length / deltaLength), 0)

' start the loops to compute stress and deflection for each iteration
For J = 0 To noiterations

    cellNumber = "A" & (J + 15)         ' assign the cell to write x values
    Range(cellNumber).Select            ' select cell assigned in previous step
    x = J * deltaLength                 ' establish x for current repetition
    ActiveCell.Value = x                ' assign x to cells A+ (n+15)
    ActiveCell.NumberFormat = "0.000"    ' format numbers

    ' calculate the stress s
    s = (W / (2 * Z * Length)) * ((Length - x) ^ 2)

    cellNumber = "B" & (J + 15)         ' assign the cell to write s values
    Range(cellNumber).Select            ' select cell
    ActiveCell.Value = s               ' write value of s
    ActiveCell.NumberFormat = "0.000"    ' format numbers

    ' calculate the deflection y
    y = ((W * x ^ (2)) / (24 * E * I * Length)) * ((2 * Length ^ (2)) + (2 * Length - x) ^ (2))

    cellNumber = "C" & (J + 15)         ' assign the cell to write y values
    Range(cellNumber).Select            ' select cell
    ActiveCell.Value = y               ' write value of y
    ActiveCell.NumberFormat = "0.000"    ' format numbers
Next J                                  ' next value of j

End Sub
```

TASK 1 (Figure 3 Values)		
x (in)	s (lb/sq-in)	y (in)
0.000	15000.000	0.000
5.000	14504.167	0.001
10.000	14016.667	0.002
15.000	13537.500	0.005
20.000	13066.667	0.008
25.000	12604.167	0.012
30.000	12150.000	0.018
35.000	11704.167	0.024
40.000	11266.667	0.030
45.000	10837.500	0.038
50.000	10416.667	0.047
55.000	10004.167	0.056
60.000	9600.000	0.066
65.000	9204.167	0.076
70.000	8816.667	0.087
75.000	8437.500	0.099
80.000	8066.667	0.111
85.000	7704.167	0.124
90.000	7350.000	0.138
95.000	7004.167	0.151
100.000	6666.667	0.166
105.000	6337.500	0.181
110.000	6016.667	0.196
115.000	5704.167	0.212
120.000	5400.000	0.228
125.000	5104.167	0.245
130.000	4816.667	0.261
135.000	4537.500	0.279

TASK 2 (Soft Steel)		
x (in)	s (lb/sq-in)	y (in)
0.000	15039.063	0.000
5.000	14612.444	0.001
10.000	14191.964	0.003
15.000	13777.623	0.006
20.000	13369.420	0.010
25.000	12967.355	0.016
30.000	12571.429	0.023
35.000	12181.641	0.031
40.000	11797.991	0.040
45.000	11420.480	0.050
50.000	11049.107	0.061
55.000	10683.873	0.073
60.000	10324.777	0.086
65.000	9971.819	0.100
70.000	9625.000	0.115
75.000	9284.319	0.131
80.000	8949.777	0.147
85.000	8621.373	0.165
90.000	8299.107	0.183
95.000	7982.980	0.201
100.000	7672.991	0.221
105.000	7369.141	0.241
110.000	7071.429	0.262
115.000	6779.855	0.284
120.000	6494.420	0.306
125.000	6215.123	0.329
130.000	5941.964	0.352
135.000	5674.944	0.376

TASK 3 (Al-Li)		
x (in)	s (lb/sq-in)	y (in)
0.000	15039.063	0.000
5.000	14612.444	0.001
10.000	14191.964	0.006
15.000	13777.623	0.013
20.000	13369.420	0.022
25.000	12967.355	0.034
30.000	12571.429	0.049
35.000	12181.641	0.066
40.000	11797.991	0.086
45.000	11420.480	0.107
50.000	11049.107	0.131
55.000	10683.873	0.157
60.000	10324.777	0.185
65.000	9971.819	0.216
70.000	9625.000	0.248
75.000	9284.319	0.281
80.000	8949.777	0.317
85.000	8621.373	0.354
90.000	8299.107	0.393
95.000	7982.980	0.434
100.000	7672.991	0.476
105.000	7369.141	0.520
110.000	7071.429	0.565
115.000	6779.855	0.611
120.000	6494.420	0.659
125.000	6215.123	0.708
130.000	5941.964	0.758
135.000	5674.944	0.809

140.000	4266.667	0.296
145.000	4004.167	0.314
150.000	3750.000	0.332
155.000	3504.167	0.350
160.000	3266.667	0.369
165.000	3037.500	0.388
170.000	2816.667	0.407
175.000	2604.167	0.426
180.000	2400.000	0.446
185.000	2204.167	0.465
190.000	2016.667	0.485
195.000	1837.500	0.505
200.000	1666.667	0.525
205.000	1504.167	0.545
210.000	1350.000	0.565
215.000	1204.167	0.585
220.000	1066.667	0.606
225.000	937.500	0.626
230.000	816.667	0.647
235.000	704.167	0.667
240.000	600.000	0.688
245.000	504.167	0.709
250.000	416.667	0.729
255.000	337.500	0.750
260.000	266.667	0.771
265.000	204.167	0.792
270.000	150.000	0.813
275.000	104.167	0.833
280.000	66.667	0.854
285.000	37.500	0.875

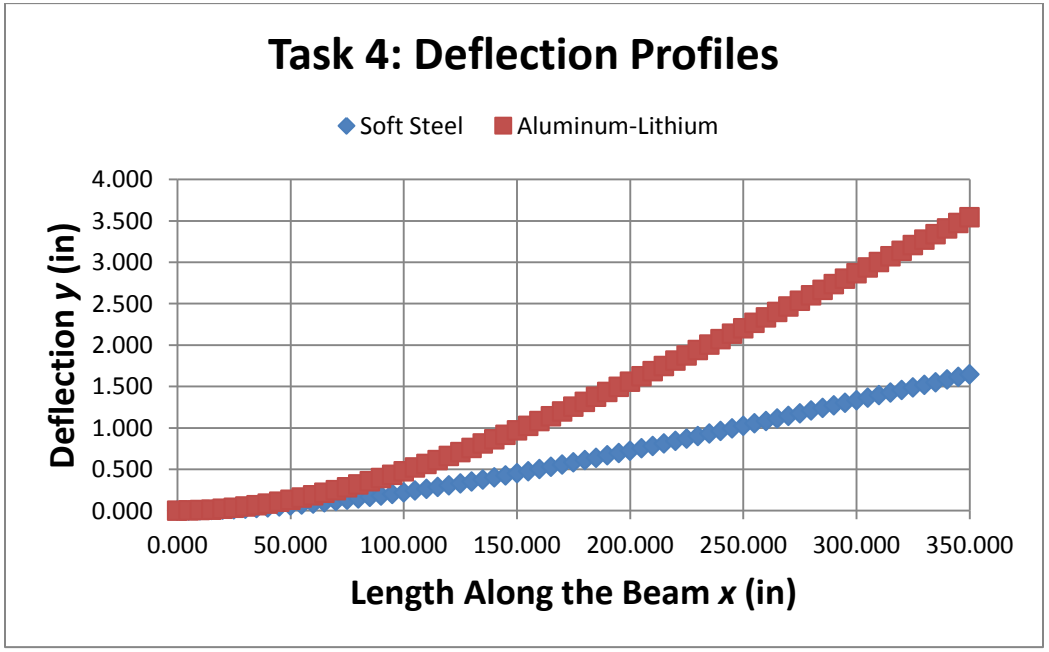
140.000	5414.063	0.400
145.000	5159.319	0.425
150.000	4910.714	0.450
155.000	4668.248	0.476
160.000	4431.920	0.502
165.000	4201.730	0.528
170.000	3977.679	0.555
175.000	3759.766	0.583
180.000	3547.991	0.610
185.000	3342.355	0.638
190.000	3142.857	0.666
195.000	2949.498	0.695
200.000	2762.277	0.723
205.000	2581.194	0.752
210.000	2406.250	0.782
215.000	2237.444	0.811
220.000	2074.777	0.841
225.000	1918.248	0.871
230.000	1767.857	0.901
235.000	1623.605	0.931
240.000	1485.491	0.961
245.000	1353.516	0.991
250.000	1227.679	1.022
255.000	1107.980	1.053
260.000	994.420	1.083
265.000	886.998	1.114
270.000	785.714	1.145
275.000	690.569	1.176
280.000	601.563	1.207
285.000	518.694	1.238

140.000	5414.063	0.862
145.000	5159.319	0.915
150.000	4910.714	0.969
155.000	4668.248	1.025
160.000	4431.920	1.081
165.000	4201.730	1.138
170.000	3977.679	1.196
175.000	3759.766	1.255
180.000	3547.991	1.314
185.000	3342.355	1.374
190.000	3142.857	1.435
195.000	2949.498	1.496
200.000	2762.277	1.558
205.000	2581.194	1.621
210.000	2406.250	1.684
215.000	2237.444	1.747
220.000	2074.777	1.811
225.000	1918.248	1.875
230.000	1767.857	1.940
235.000	1623.605	2.005
240.000	1485.491	2.070
245.000	1353.516	2.135
250.000	1227.679	2.201
255.000	1107.980	2.267
260.000	994.420	2.333
265.000	886.998	2.400
270.000	785.714	2.466
275.000	690.569	2.533
280.000	601.563	2.600
285.000	518.694	2.667

290.000	16.667	0.896
295.000	4.167	0.917
300.000	0.000	0.938

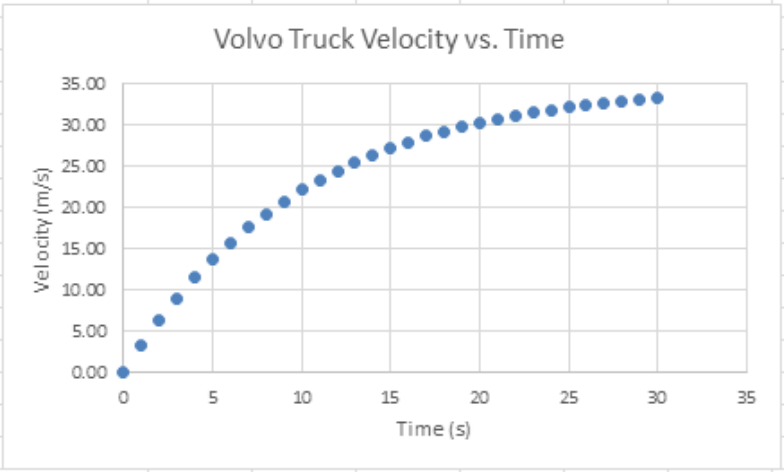
290.000	441.964	1.269
295.000	371.373	1.301
300.000	306.920	1.332
305.000	248.605	1.363
310.000	196.429	1.394
315.000	150.391	1.426
320.000	110.491	1.457
325.000	76.730	1.488
330.000	49.107	1.520
335.000	27.623	1.551
340.000	12.277	1.582
345.000	3.069	1.614
350.000	0.000	1.645

290.000	441.964	2.734
295.000	371.373	2.801
300.000	306.920	2.869
305.000	248.605	2.936
310.000	196.429	3.003
315.000	150.391	3.071
320.000	110.491	3.138
325.000	76.730	3.205
330.000	49.107	3.273
335.000	27.623	3.340
340.000	12.277	3.408
345.000	3.069	3.475
350.000	0.000	3.543



	A	B	C	D	E	F	G	H	I
1									
2	**Volvo Velocity Profiles**								
3	**Programmer**		R. Powers			**Formula**	Vt = Vmax + (V0 - Vmax)e^-kt		
4	**Date**		10/3/2013 18:50						
5									
6	Vmax	35	m/s						
7	V0	0	m/s				Dummy cell		
8	k	0.1	1/s				10		
9	tmax	30.00	s						
10									
11	t (s)	Vt (m/s)							
12	0	0.00							
13	1	3.33							
14	2	6.34							
15	3	9.07							
16	4	11.54							
17	5	13.77							
18	6	15.79							
19	7	17.62							
20	8	19.27							
21	9	20.77							
22	10	22.12							
23	11	23.35							
24	12	24.46							
25	13	25.46							
26	14	26.37							
27	15	27.19							
28	16	27.93							
29	17	28.61							
30	18	29.21							
31	19	29.77							
32	20	30.26							
33	21	30.71							
34	22	31.12							
35	23	31.49							
36	24	31.82							
37	25	32.13							
38	26	32.40							
39	27	32.65							
40	28	32.87							
41	29	33.07							
42	30	33.26							
43									

Calculate Velocity Profile



(General) VelocityProfile

```
Sub VelocityProfile()

' sub-routine to calculate the velocity profile of a Volvo truck

' Programmer : R. Powers
' Date: 09/23/2013

' retrieve values of constant parameters from cells B6, B7, B8, and B9

Sheets("Problem3").Select

Range("B6").Select
Vmax = ActiveCell.Value

Range("B7").Select
V0 = ActiveCell.Value

Range("B8").Select
k = ActiveCell.Value

Range("B9").Select
tmax = ActiveCell.Value

' start the loop to compute Vt for each repetition

For I = 0 To tmax

    cellNumber = "A" & (I + 12)         ' assign the cell to write t values
    Range(cellNumber).Select            ' select cell assigned in previous step
    t = I                               ' establish the t value
    ActiveCell.Value = t                ' assign t to cells A+ (n+12)

    ' calculate Vt

    Vt = Vmax + (V0 - Vmax) * Exp(-k * t)

    cellNumber = "B" & (I + 12)                     ' assign the cell to write Vt values
    Range(cellNumber).Select                        ' select cell
    ActiveCell.Value = Vt                   ' write value of Vt
    ActiveCell.NumberFormat = "0.00"        ' format numbers

Next I                                                      ' next value of i

End Sub
```