ME 1020 Engineering Programming with MATLAB

Problem 6.15:

15. The solubility of oxygen in water is a function of the water temperature. Let S represent the solubility of O_2 as millimoles of O_2 per liter of water. Let T be temperature in °C. Use the following data to obtain a curve fit for S as a function of T. Use the fit to estimate S when $T = 8$°C and $T = 50$°C.

T (°C)	S (mmol O_2 /L H_2O)
5	1.95
10	1.7
15	1.55
20	1.40
25	1.30
30	1.15
35	1.05
40	1.00
45	0.95

```
% Problem 6.15
clear
clc
disp('Problem 6.15: Scott Thomas')

format shortEng

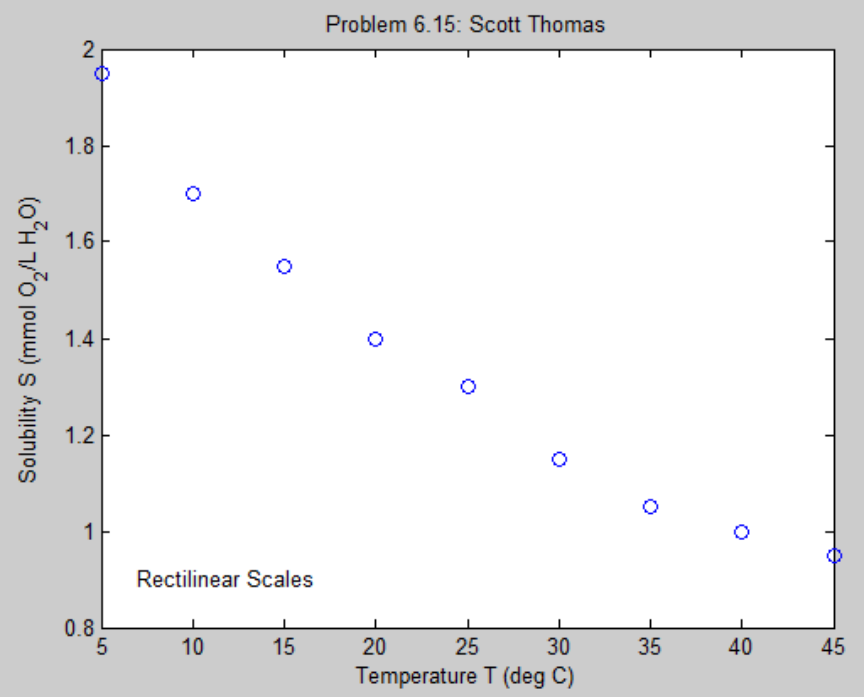
temperature = 5:5:45;
temperatureplot = 5:1:45;
solubility = [1.95 1.7 1.55 1.4 1.3 1.15 1.05 1 0.95];% torr

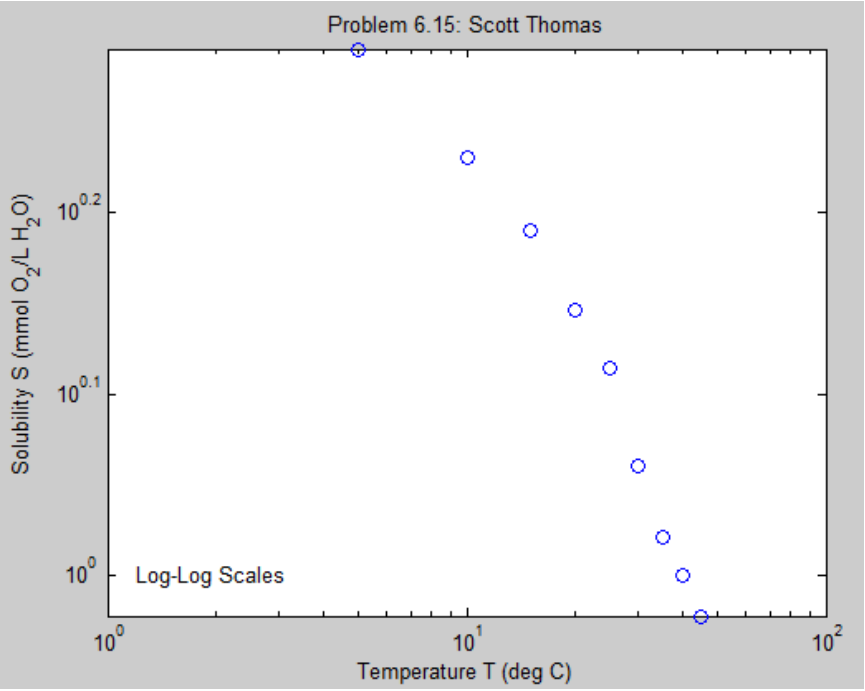
p1 = polyfit(temperature,solubility,1);
solubilityfit1 = p1(1)*temperatureplot + p1(2);
p2 = polyfit(temperature,solubility,2);
solubilityfit2 = p2(1)*temperatureplot.^2 + p2(2)*temperatureplot + p2(3);
p3 = polyfit(temperature,solubility,3)
solubilityfit3 = p3(1)*temperatureplot.^3 + p3(2)*temperatureplot.^2 + p3(3)*temperatureplot + p3(4);

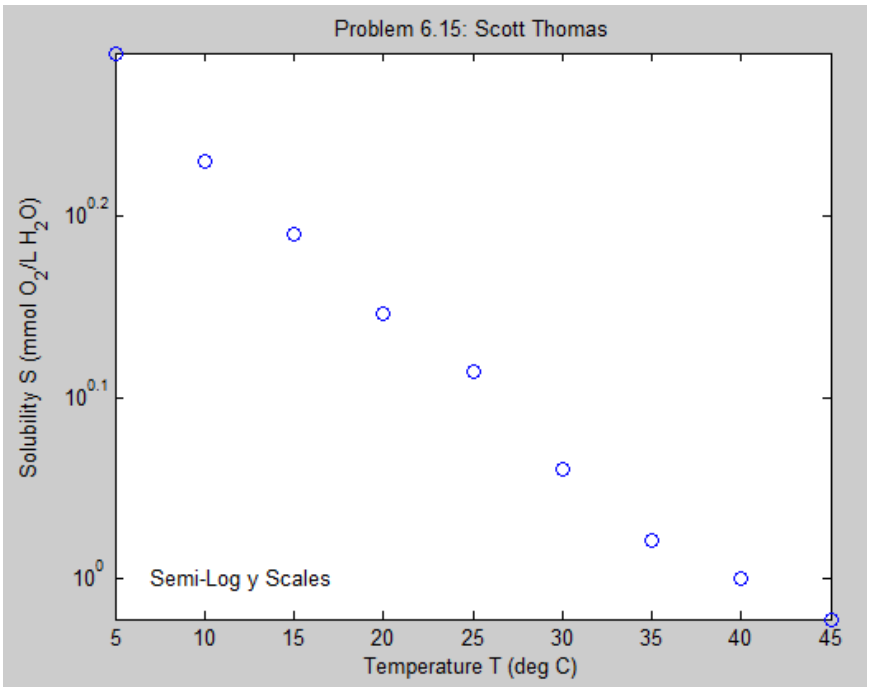
solubility8 = p3(1)*8^3 + p3(2)*8^2 + p3(3)*8 + p3(4)
solubility50 = p3(1)*50^3 + p3(2)*50^2 + p3(3)*50 + p3(4)

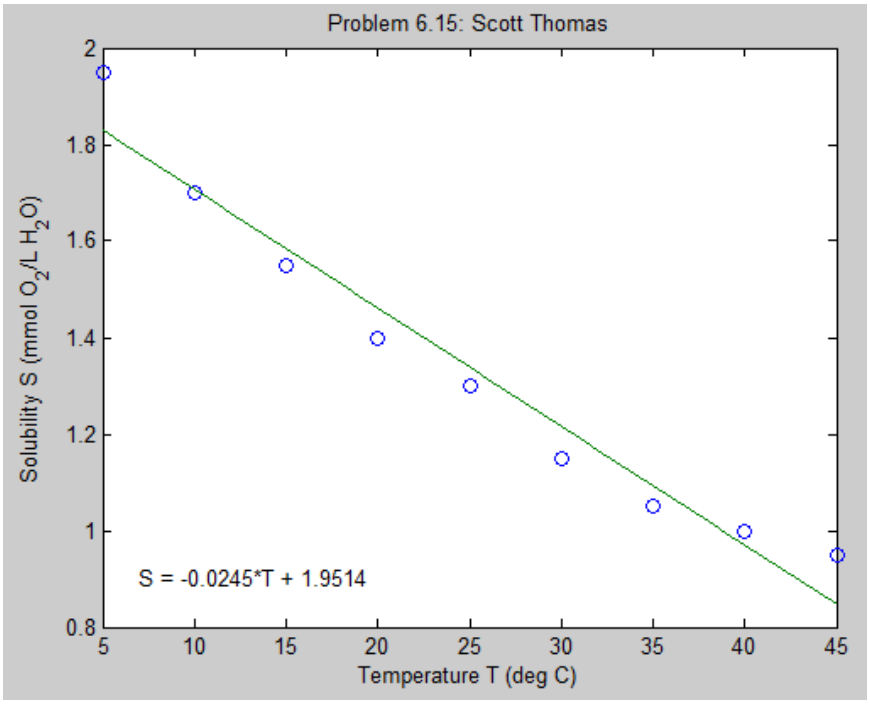
%plot(temperature,solubility, 'o', temperatureplot, solubilityfit1)
%plot(temperature,solubility, 'o', temperatureplot, solubilityfit2)
plot(temperature,solubility, 'o', temperatureplot, solubilityfit3)
%loglog(temperature,solubility, 'o')%, temperatureplot, solubilityfit1)
%semilogy(temperature,solubility, 'o')%, temperatureplot, solubilityfit1)
%plot(temperature,solubility, 'o', temperatureplot, solubilityfit2)
xlabel('Temperature T (deg C)'),
ylabel('Solubility S (mmol O_2/L H_2O)'),
title('Problem 6.15: Scott Thomas')
%text(7,0.9, 'S = -0.0245*T + 1.9514');
%text(7,0.9, 'S = 430.7359e-006*T^2 - 46.0368e-003*T + 2.1488');
text(7,0.9, 'S = -2.3569e-006*T^3 + 607.5036e-006*T^2 - 49.7607e-003*T + 2.1683');
%text(7, 0.9, 'Rectilinear Scales')
%text(1.2, 1, 'Log-Log Scales')
%text(7, 1, 'Semi-Log y Scales')

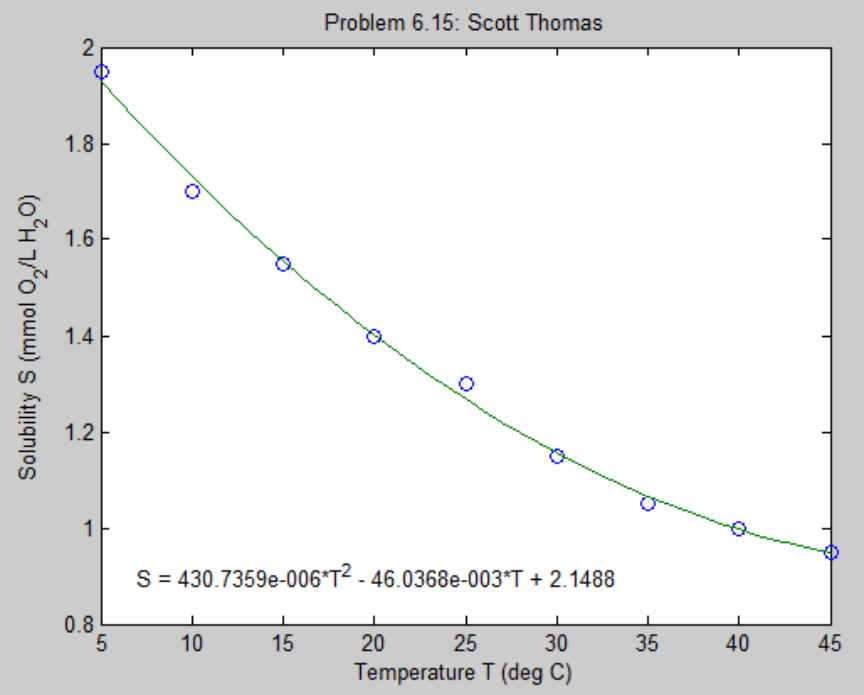
```

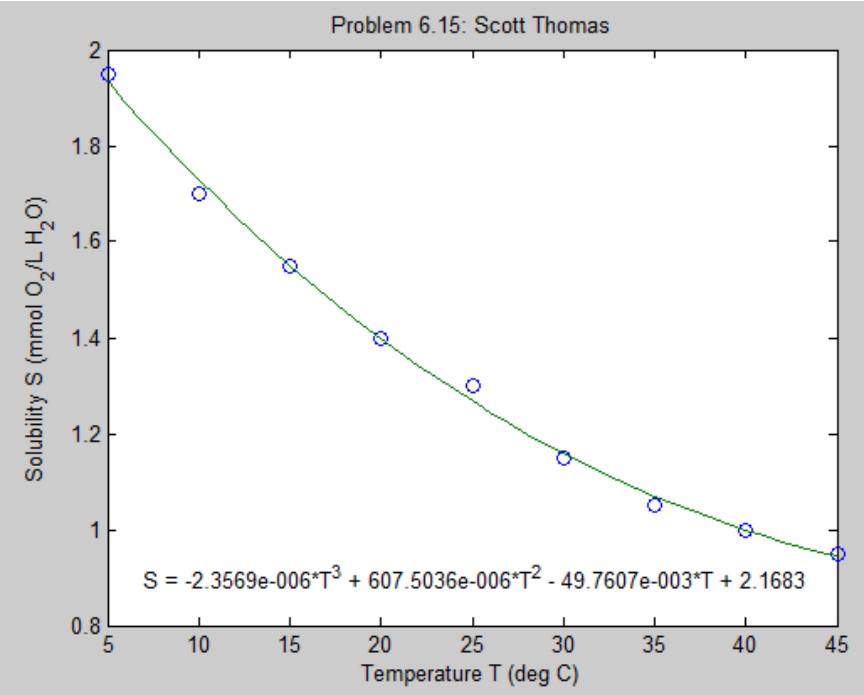

Problem 6.15: Scott Thomas
Solubility S (mmol O_2/L H_2O)
Temperature T (deg C)
Rectilinear Scales
2
1.8
1.6
1.4
1.2
1
0.8
5
10
15
20
25
30
35
40
45


Problem 6.15: Scott Thomas
Solubility S (mmol O_2/L H_2O)
Temperature T (deg C)
Log-Log Scales
$10^{0.2}$
$10^{0.1}$
10^{0}
10^{0}
10^{1}
10^{2}


Problem 6.15: Scott Thomas
Solubility S (mmol O2/L H2O)
10^0.2
10^0.1
10^0
Semi-Log y Scales
5
10
15
20
25
30
35
40
45
Temperature T (deg C)


Problem 6.15: Scott Thomas
Solubility S (mmol O2/L H2O)
2
1.8
1.6
1.4
1.2
1
0.8
S = -0.0245*T + 1.9514
5
10
15
20
25
30
35
40
45
Temperature T (deg C)


Problem 6.15: Scott Thomas
Solubility S (mmol O_2/L H_2O)
Temperature T (deg C)
S = 430.7359e-006*T^2 - 46.0368e-003*T + 2.1488
2
1.8
1.6
1.4
1.2
1
0.8
5
10
15
20
25
30
35
40
45


Problem 6.15: Scott Thomas
Solubility S (mmol O_2/L H_2O)
Temperature T (deg C)
S = -2.3569e-006*T^3 + 607.5036e-006*T^2 - 49.7607e-003*T + 2.1683
2
1.8
1.6
1.4
1.2
1
0.8
5
10
15
20
25
30
35
40
45

```
Problem 6.15: Scott Thomas

p3 =

    -2.3569e-006   607.5036e-006   -49.7607e-003     2.1683e+000


solubility8 =

     1.8078e+000


solubility50 =

   904.3651e-003

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