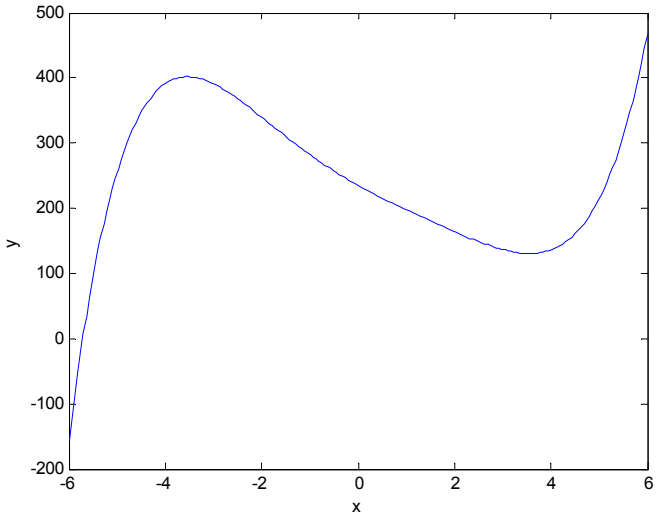
Chapter 8
Solved Problems

Problem 1

Script file:

```
clear, clc
p=[0.1 -0.2 -1 5 -41.5 235];
x=linspace(-6,6,200);
y=polyval(p,x);
plot(x,y)
xlabel('x')
ylabel('y')
```

Figure:

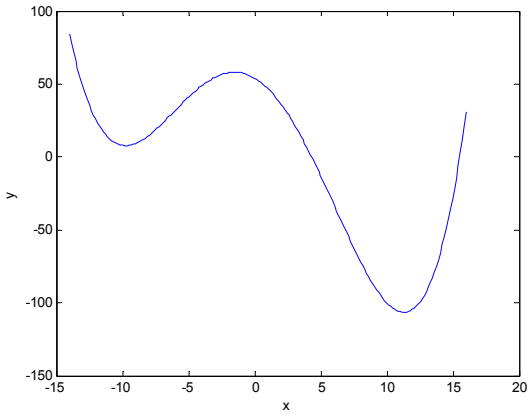


Problem 2

Script file:

```
clear, clc
p=[0.008 0 -1.8 -5.4 54];
x=linspace(-14,16,200);
y=polyval(p,x);
plot(x,y)
xlabel('x')
ylabel('y')
```

Figure:



Problem 3

Script File:

```
clear, clc
pa=[-1 0 5 -1];
pb=[1 2 0 -16 5];
c=conv(pa,pb)
```

Command Window:

```
c =
    -1    -2     5    25    -7   -80    41    -5
```

The answer is: $-x^7 - 2x^6 + 5x^5 + 25x^4 - 7x^3 - 80x^2 + 41x - 5$

Problem 4

Script file:

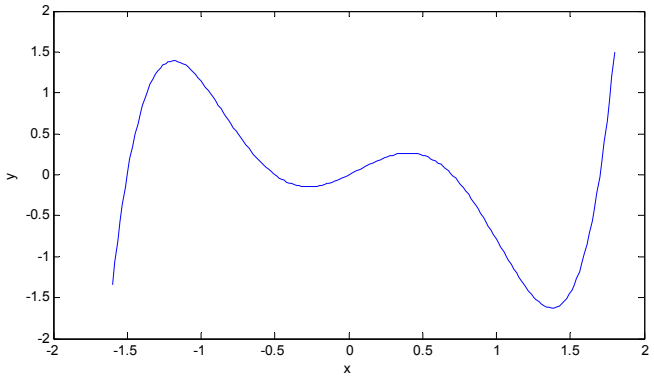
```
clear, clc
p1=[1 -1.7]; p2=[1 0.5]; p3=[1 -0.7]; p4=[1 1.5]; p5=[1 0];
p12=conv(p1,p2);
p34=conv(p3,p4);
p14=conv(p12,p34);
p=conv(p14,p5)
x=linspace(-1.6,1.8,200);
y=polyval(p,x);
plot(x,y)
xlabel('x')
ylabel('y')
```

Command Window:

```
p =
     1.0000    -0.4000    -2.8600     0.5800     0.8925
0
```

The answer is: $x^5 - 0.4x^4 - 2.86x^3 + 0.58x^2 + 0.8925x$

Figure:



Problem 5

Script File:

```
pa=[-10 -20 9 10 8 11 -3];
pb=[2 4 -1];
p=deconv(pa,pb)
```

Command Window:

```
p =
    -5     0     2     1     3
```

The answer is: $-5x^4 + 2x^2 + x + 3$

Problem 6

Script File:

```
pa=[-0.24 1.6 1.5 -7.41 -1.8 -4 -75.2 -91];
pb=[-0.8 0 5 6.5];
p=deconv(pa,pb)
```

Command Window:

```
p =
    0.3000   -2.0000         0   -0.8000  -14.0000
```

The answer is: $0.3x^4 - 2x^3 - 0.8x - 14$

Problem 7

Script file:

```
clear,clc
p1=[1 0]; p2=[1 1];
p=conv(p1,p2);
n=length(p);
p(n)=p(n)-6972;
s=roots(p)
```

Command Window:

```
s =
   -84
    83
```

The answer is: 83 and 83

Problem 8

Script file:

```
p1=[1 0]; p2=[1 5]; p3=[1 10];
p12=conv(p1,p2);
p=conv(p12,p3);
n=length(p);
p(n)=p(n)-10098;
s=roots(p)
```

Command Window:

```
s =
 -16.0000 +18.3848i
 -16.0000 -18.3848i
  17.0000 + 0.0000i
```

The answer is: 17 22 and 27

Problem 9

Mathematical formulation:

Solve the equation:

$$(V_{out} - V_{in})0.284 = 12212$$

where:

$V_{out} = 240 \cdot 120 \cdot 80$ and $V_{in} = (240 - t)(120 - t)(80 - 2t)$

Script file:

```
clear,clc
V=12212/0.284;
Vout=240*120*80;
p1=[-1 240]; p2=[-1 120]; p3=[-2 80];
pa=conv(p1,p2);
Vin=conv(pa,p3);
p=Vin;
n=length(p);
p(n)=p(n)+V-Vout;
t=roots(p)
```

Command Window:

```
t =
   1.0e+02 *
   1.9975 + 0.5568i
   1.9975 - 0.5568i
   0.0050 + 0.0000i
```

The last root is the answer: $t = 0.5$ in

Problem 10

Mathematical formulation:

$$V = \pi \cdot 10^2 \cdot 24 + \frac{4}{3}\pi 10^3 - \left[\pi \cdot (10-t)^2 \cdot 24 + \frac{4}{3}\pi(10-1.5t)^3\right] = \frac{42.27}{0.101}$$

Script File:

```
clear,clc
Cont=42.27/0.101-pi*10^2*24-4*pi*10^3/3;
p1=[-1 10];
p2=[-1.5 10];
p11=pi*24*conv(p1,p1);
p22=conv(p2,p2);
p23=4*pi/3*conv(p22,p2);
p=[0 p11]+p23+[0 0 0 Cont];
t=roots(p)
```

Command Window:

```
t =
  12.6042 + 8.8309i
  12.6042 - 8.8309i
   0.1250 + 0.0000i
```

The last root is the answer: $t = 0.125$ in

Problem 11

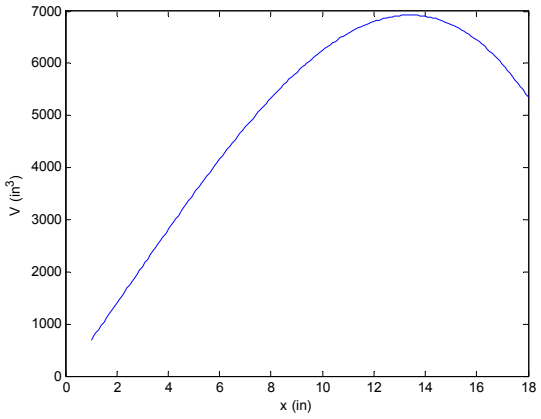
(*a*)

$$V = x(x+15)\frac{(20 \cdot 12 - 8x - 60)}{4} = x(x+15)(45-2x)$$

(*b*)
Script File:

```
p1=[1 15 0];
p2=[-2 45];
p=conv(p1, p2);
x=1:0.1:18;
V=polyval(p,x);
plot(x,V)
xlabel('x (in)')
ylabel('V (in^3)')
pder=polyder(p);
xVmaxmax=roots(pder)
Vmax=polyval(p,xVmaxmax(1))
```

Figure:



(*c*)
Command Window:

```
xVmaxmax =
   13.3972
   -8.3972
Vmax =
   6.9262e+03
```

Maximum volume 6926.2 in^3 at x=13.3972 in.

Problem 12

The volume is: $(40 - 2x)(22 - 2x)x = 4x^3 - 124x^2 + 880x$

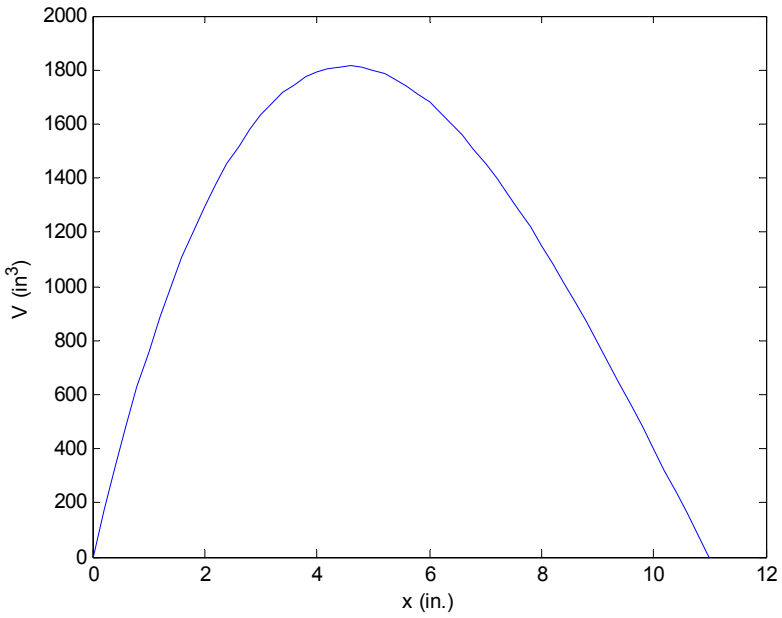
Script File:

```
% Part a
disp('Part a')
p=[4 -124 880 0]
% Part b
x=[0:0.2:11];
V=polyval(p,x);
plot(x,V)
xlabel('x (in.)')
ylabel('V (in^3)')
% Part c
disp('Part c')
pV1000=[4 -124 880 -1000];
x1000=roots(pV1000)
% Part d
disp('Part d')
pD=polyder(p); %Determine the derivative of the polynomial.
xr=roots(pD);   %Determine where the derivative is zero.
s=xr>0&xr<11;  % Find which root is between 0 and 11.
xmax=xr(s)   % Assign the root to xmax.
Vmax=polyval(p,xmax)  % Determine the root at xmax.
```

Command Window:

```
Part a
p =
     4   -124    880      0
Part c
x1000 =
   21.1625
    8.4374
    1.4001
Part d
xmax =
    4.5502
Vmax =
  1.8137e+003
```

In part c the two roots of `x1000` that apply to the problem are `8.4374` and `1.4001`.



Problem 13

User-defined function:

```
function p=polyadd(p1,p2,operation)
np1=length(p1);
np2=length(p2);
% Padding p2, if shorter than p1.
if np1>np2
    nd=np1-np2;
    p2add(1:nd)=0;
    p2=[p2add p2];
end
% Padding p1, if shorter than p2.
if np2>np1
    nd=np2-np1;
    p1add(1:nd)=0;
    p1=[p1add p1];
end
switch operation
    case 'add'
        p=p1+p2;
    case 'sub'
        p=p1-p2;
end
```

Command Window:

```
>> p1=[2 0 -3 -9 11 -8 4];
>> p2=[5 0 7 -10];
>> p1PLUSp2=polyadd(p1,p2,'add')
p1PLUSp2 =
     2     0    -3    -4    11    -1    -6
>> p1minusp2=polyadd(p1,p2,'sub')
p1minusp2 =
     2     0    -3   -14    11   -15    14
```

The answers are:

addition: $2x^6 - 3x^4 - 4x^3 + 11x^2 - x - 6$

subtraction: $2x^6 - 3x^4 - 14x^3 + 11x^2 - 15x + 14$

Problem 14

User-defined function:

```
function p = polymult(p1,p2)
%Multiply polynomials
na=length(p1); nb=length(p2);
if nb > na
    d=p1; p1=p2;
    clear b
    p2=d;
    nd=na; na=nb; nb=nd;
end
for k=1:nb
    p(k)=0;
    for i=1:k
        p(k)=p(k)+p1(i)*p2(k+1-i);
    end
end
for k=nb+1:na
    p(k)=0;
    for i=k-nb+1:k
        p(k)=p(k)+p1(i)*p2(k+1-i);
    end
end
for k=na+1:na+nb-1
    p(k)=0;
    for i=k-nb+1:na
        p(k)=p(k)+p1(i)*p2(k+1-i);
    end
end
```

Command Window:

```
>> pa=[2 0 -3 -9 11 -8 4];
>> pb=[5 0 7 -10];
>> pab = polymult(pa,pb)
pab =
```

```
    10     0    -1   -65    34   -73   187  -166   108
-40
>> conv(pa,pb)
ans =
    10     0    -1   -65    34   -73   187  -166   108
-40
```

Problem 15

User-defined function:

```
function [x, y, W] = maxormin(a,b,c)
x=-b/(2*a);
y=a*x^2+b*x+c;
W=2;
if a<0
    W=1;
end
```

Command Window:

8.*a*

```
>> [x y w]=maxormin(3, -7, 14)
x =
    1.1667
y =
    9.9167
w =
     2
```

8.*b*

```
>> [x y w]=maxormin(-5, -11, 15)
x =
   -1.1000
y =
   21.0500
w =
     1
```

Problem 16

Mathematical formulation:

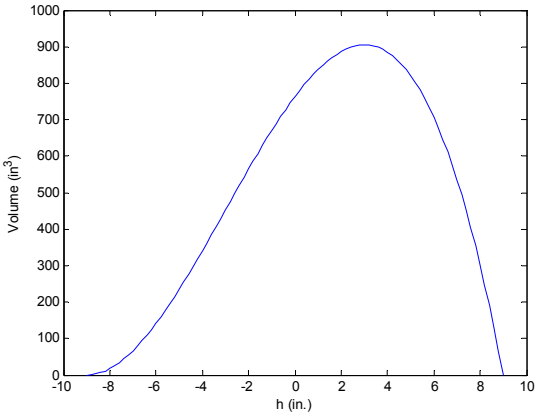
$$V = \frac{\pi}{3}(R^2 - h^2)(R + h) = \frac{\pi}{3}(-h^3 - Rh^2 + R^2h + R^3)$$

Script file:

```
R=9; V=500;
h=9:-0.2:-9;
% Part (a)
p=[-1 -R R^2 R^3];
Vh=polyval(p,h)*pi/3;
% Part (b)
plot(h,Vh)
xlabel('h (in.)')
ylabel('Volume (in^3)')
% Part (c)
disp('Part (c)')
hV500=[-1 -R R^2 R^3-3*V/pi];
h500=roots(hV500)
% Part (d)
disp('Part (d)')
Vpd=polyder(p);
rVmax=roots(Vpd)
Vmax=polyval(p,rVmax(2))*pi/3
```

Command Window:

```
Part (c)
h500 =
  -13.5967
    7.1751
   -2.5783
Part (d)
rVmax =
    -9
     3
Vmax =
  904.7787
```


1000
900
800
700
600
500
400
300
200
100
0
Volume (in3)
-10
-8
-6
-4
-2
0
2
4
6
8
10
h (in.)

Problem 17

Mathematical formulation:

$$d^2 = (x-3)^2 + [5.5 - [1.5(x-3)^2 + 1]]^2$$

$$d^2 = 2.25x^4 - 27x^3 + 109x^2 - 168x + 90$$

Script file:

```
Y=@ (x) 1.5*(x-3)^2+1;
p=[2.25 -27 109 -168 90];
x=3:0.05:6;
d2=polyval(p,x);
d=sqrt(d2);
% Part(b)
plot(x,d)
xlabel('x')
ylabel('y')
% Part(c)
pQ=[2.25 -27 109 -168 90-28^2];
disp('Part (c)')
xQd28=roots(pQ)
yQd28=Y(xQd28(1))
yQd28=Y(xQd28(4))
% Part(d)
disp('Part (d)')
pder=polyder(p);
xQdmin=roots(pder)
yQmin1=Y(xQdmin(1))
yQmin2=Y(xQdmin(3))
Qdmin1=sqrt(polyval(p,xQdmin(1)))
Qdmin2=sqrt(polyval(p,xQdmin(3)))
```

Command Window:

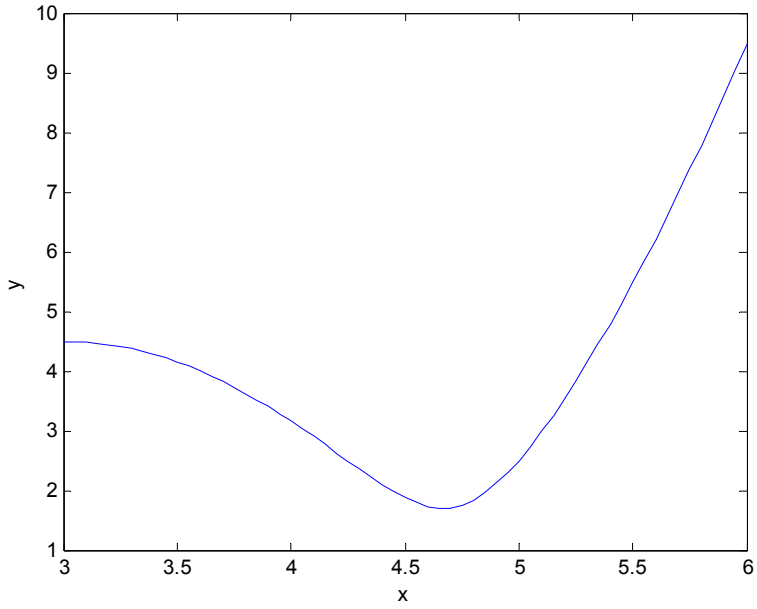
```
Part (c)
xQd28 =
   7.6271 + 0.0000i
   3.0000 + 3.9818i
   3.0000 - 3.9818i
  -1.6271 + 0.0000i
yQd28 =
   33.1150
yQd28 =
   33.1150
Part (d)
xQdmin =
    4.6667
    3.0000
    1.3333
yQmin1 =
    5.1667
yQmin2 =
    5.1667
Qdmin1 =
    1.6997
Qdmin2 =
    1.6997
```

Answers:

Part (*c*): (7.627, 33.115) and (-1.627, 33.115)

Part (*d*): (4.6667, 5.1667) and (1.333, 5.1667); d= 1.6997

Figure:



Problem 18

Script file:

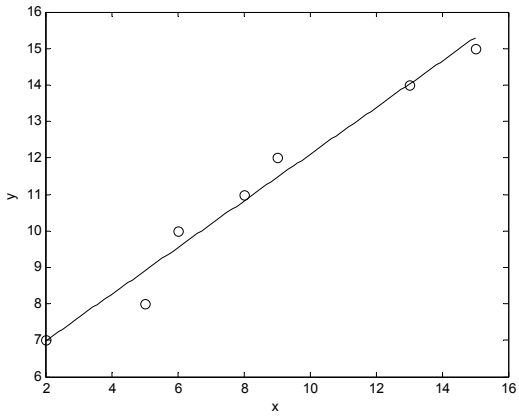
```
x=[2 5 6 8 9 13 15];
y=[7 8 10 11 12 14 15];
p1=polyfit(x,y,1)
xplot=linspace(2,15,100);
yplot=polyval(p1,xplot);
plot(x,y,'ok',xplot,yplot,'k')
xlabel('x')
ylabel('y')
```

Command Window:

```
p1 =
    0.6400    5.6968
```

The function is: $y = 0.64x + 5.6968$

Figure:



Problem 19

Script file:

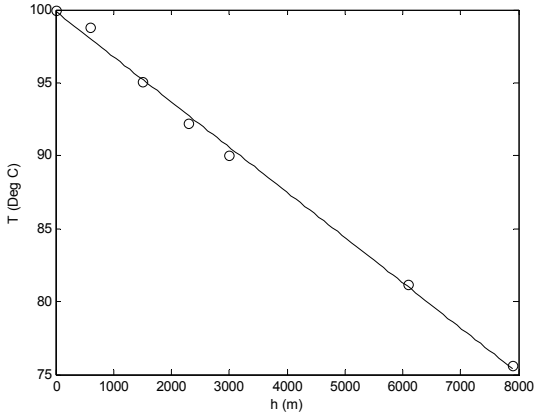
```
hsi=[0 600 1500 2300 3000 6100 7900];
Tsi=[100 98.8 95.1 92.2 90 81.2 75.6];
p=polyfit(hsi,Tsi,1)
T5000=polyval(p,5000)
xplot=linspace(0,7900,100);
yplot=polyval(p,xplot);
plot(hsi,Tsi,'ok',xplot,yplot,'k')
xlabel('h (m)')
ylabel('T (Deg C)')
```

Command Window:

```
p =
   -0.0031   99.8863
T5000 =
   84.394
```

The equation is: $T_B = (-0.0031)h + 99.8863$

Figure:



Problem 20

Script file:

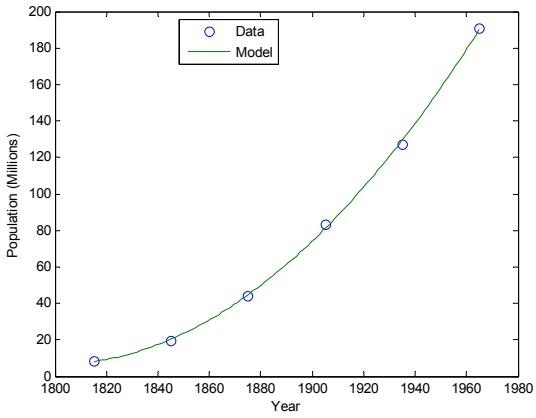
```
Y=[1815 1845 1875 1905 1935 1965];
t=Y-1800;
Pop=[8.3 19.7 44.4 83.3 127.1 190.9];
p=polyfit(t,Pop,2)
tp=linspace(1815,1965,100);
Pplot=polyval(p,tp-1800);
plot(Y,Pop,'o',tp,Pplot)
xlabel('Year')
ylabel('Population (Millions)')
legend('Data','Model',0)
Pop1915=polyval(p,1915-1800)
```

Command Window:

```
p =
           0.006714285714286           0.004857142857143
6.502142857142869
Pop1915 =
  95.857142857142904
```

The equation is: $P = 0.006714t^3 + 0.004857t^2 + 95.857$

Figure:



Problem 21

Script file:

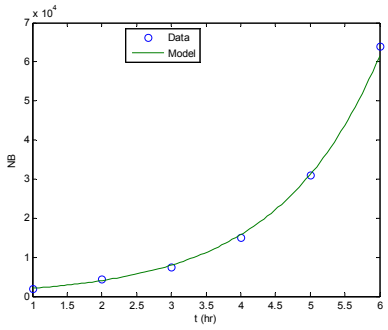
```
t=[1:6];
NB = [2 4.5 7.5 15 31 64]*1000;
p=polyfit(t,log(NB),1);
m=p(1)
b=exp(p(2))
tp=linspace(1,6,100);
F=@ (x) b*exp(m*x);
NBp=F(tp);
plot(t,NB,'o',tp,NBp)
xlabel('t (hr)')
ylabel('NB')
legend('Data','Model',0)
NB45=F(4.5)
```

Command Window:

```
m =
   0.680330174791006
b =
     1.038404848371576e+03
NB45 =
     2.217956839632734e+04
```

The equation is: $N_B = 1038.4e^{0.68033t}$

Figure:



Problem 22

Rewrite the equation in the form: $\frac{C}{H} - 1 = Ae^{-Bt}$.

This equation can be written in a linear form:

$$\ln\left(\frac{C}{H} - 1\right) = Ae^{-Bt} = \ln A + (-B)$$

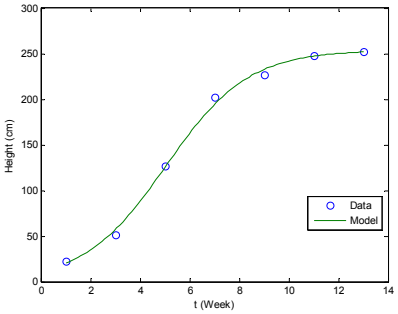
Script file:

```
C=254;
w=[1:2:13];
H = [22 51 127 202 227 248 252];
y=C./H-1;
p=polyfit(w,log(y),1);
B=-p(1)
A=exp(p(2))
wp=linspace(1,13,100);
F=@ (x) C./(1+A*exp(-B*x));
Hp=F(wp);
plot(w,H,'o',wp,Hp)
xlabel('t (Week)')
ylabel('Height (cm)')
legend('Data','Model',0)
H6=F(6)
```

Command Window:

```
B =
   0.605556122745790
A =
  21.161356448001833
H6 =
     1.628989083579548e+02
```

Figure:


300
250
200
150
100
50
0
Height (cm)
0
2
4
6
8
10
12
14
t (Week)
Data
Model

Problem 23

Script file:

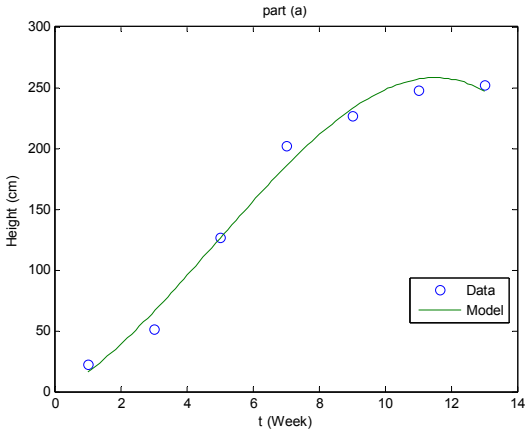
```
w=[1:2:13];
H = [22 51 127 202 227 248 252];
% Part (a)
disp('Part (a)')
p=polyfit(w,H,3);
wp=linspace(1,13,100);
Hp=polyval(p,wp);
plot(w,H,'o',wp,Hp)
xlabel('t (Week)')
ylabel('Height (cm)')
legend('Data','Model',0)
title('part (a)')
H6_Part_a=polyval(p,6)
% Part (b)
disp('Part (b)')
wp=linspace(1,13,100);
HpLin=interp1(w,H,wp,'linear');
HpSpl=interp1(w,H,wp,'spline');
figure
plot(w,H,'o',wp,HpLin,wp,HpSpl)
xlabel('t (Week)')
ylabel('Height (cm)')
legend('Data','Linear Interpolation','Spline
Interpolation',0)
title('part (b)')
H6_Part_bLinear=interp1(w,H,6,'linear')
H6_Part_bSpline=interp1(w,H,6,'spline')
```

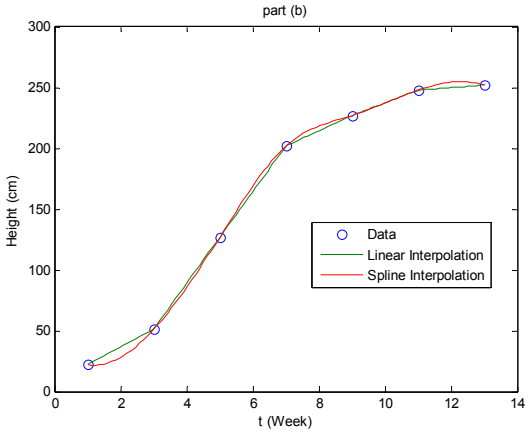
Command Window:

```
Part (a)
H6_Part_a =
  156.1830
Part (b)
H6_Part_bLinear =
```

```
  164.5000
H6_Part_bSpline =
  169.1451
```

Figures:



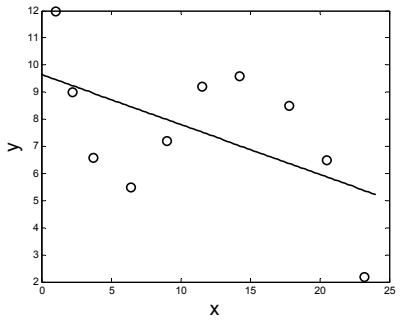


Problem 24

24.*a*

Script File:

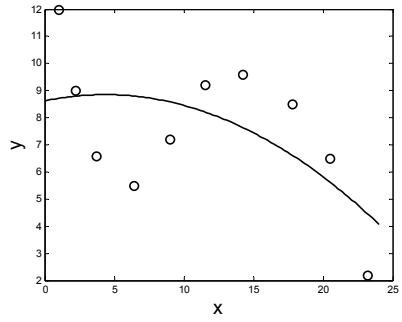
```
x=[1 2.2 3.7 6.4 9 11.5 14.2
17.8 20.5 23.2];
y=[12 9 6.6 5.5 7.2 9.2 9.6 8.5
6.5 2.2];
p1=polyfit(x,y,1);
xplot=linspace(0,24,100);
yplot=polyval(p1,xplot);
plot(x,y,'ok',xplot,yplot,'k',
'linewidth',2,'markersize',8)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
```



24.*b*

Script File:

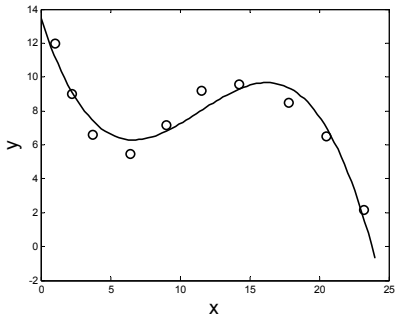
```
x=[1 2.2 3.7 6.4 9 11.5 14.2
17.8 20.5 23.2];
y=[12 9 6.6 5.5 7.2 9.2 9.6 8.5
6.5 2.2];
p1=polyfit(x,y,2);
xplot=linspace(0,24,100);
yplot=polyval(p1,xplot);
plot(x,y,'ok',xplot,yplot,'k',
'linewidth',2,'markersize',8)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
```



24.*c*

Script File:

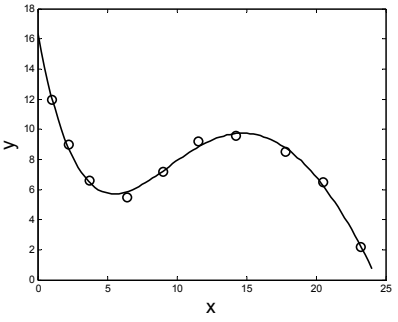
```
x=[1 2.2 3.7 6.4 9 11.5 14.2
17.8 20.5 23.2];
y=[12 9 6.6 5.5 7.2 9.2 9.6 8.5
6.5 2.2];
p1=polyfit(x,y,3);
xplot=linspace(0,24,100);
yplot=polyval(p1,xplot);
plot(x,y,'ok',xplot,yplot,'k',
'linewidth',2,'markersize',8)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
```



24.*d*

Script File:

```
x=[1 2.2 3.7 6.4 9 11.5 14.2
17.8 20.5 23.2];
y=[12 9 6.6 5.5 7.2 9.2 9.6 8.5
6.5 2.2];
p1=polyfit(x,y,5);
xplot=linspace(0,24,100);
yplot=polyval(p1,xplot);
plot(x,y,'ok',xplot,yplot,'k',
'linewidth',2,'markersize',8)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
```

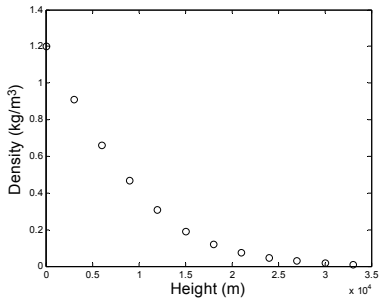


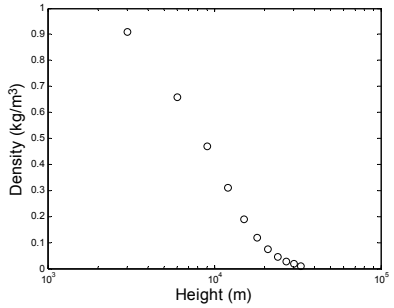
Problem 25

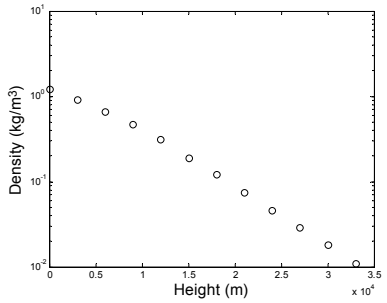
(*a*)
Script file :

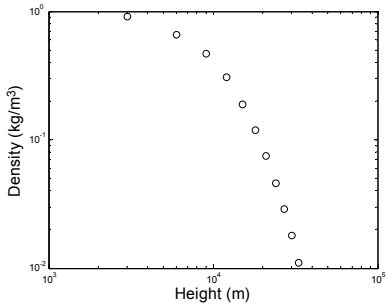
```
h=0:3000:33000;
Den=[1.2 0.91 0.66 0.47 0.31 0.19 0.12 0.075 0.046 0.029
0.018 0.011];
plot(h, Den,'ok')
xlabel('\fontsize{16}Height (m)')
ylabel('\fontsize{16}Density (kg/m^3)')
figure
semilogx(h, Den,'ok')
xlabel('\fontsize{16}Height (m)')
ylabel('\fontsize{16}Density (kg/m^3)')
figure
semilogy(h, Den,'ok')
xlabel('\fontsize{16}Height (m)')
ylabel('\fontsize{16}Density (kg/m^3)')
figure
loglog(h, Den,'ok')
xlabel('\fontsize{16}Height (m)')
ylabel('\fontsize{16}Density (kg/m^3)')
```

When the script file is executed four Figure Windows with the following figures open.









(*b*)
Fit the data with exponential function since the data points in the third plot appear to approximately be along a straight line.

Script file: (Determines the constants of the exponential function that best fits the data, and then plots the function and the points in a linear axes plot.)

```
h=0:3000:33000;
Den=[1.2 0.91 0.66 0.47 0.31 0.19 0.12 0.075 0.046 0.029
0.018 0.011];
p=polyfit(h,log(Den),1);
m=p(1)
```

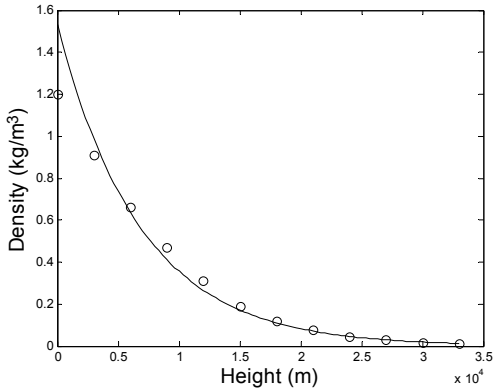
```
b=exp(p(2))
heq=linspace(0,33000,100);
Deq=b*exp(m*heq);
plot(h, Den,'ok',heq,Deq,'k')
xlabel('\fontsize{16}Height (m)')
ylabel('\fontsize{16}Density (kg/m^3)')
```

Command Window:

```
m =
 -1.4584e-004
b =
    1.5302
```

The function is: $D = 1.5302e^{(-1.4584\times10^{-4})h}$

The following figure is displayed:



Problem 26

User-defined function:

```
function [b,m]=powerfit(x,y)
p=polyfit(log(x),log(y),1);
m=p(1);
b=exp(p(2));
```

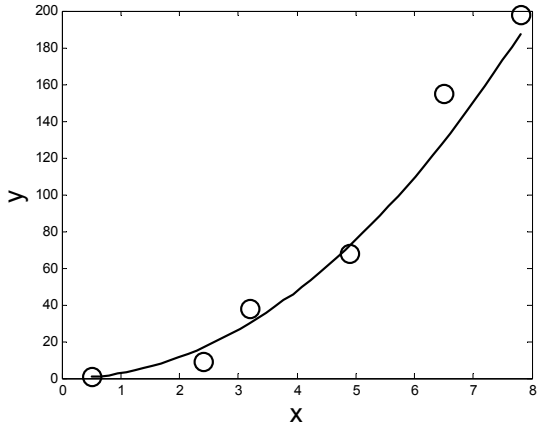
Script File:

```
x=[0.5 2.4 3.2 4.9 6.5 7.8];
y=[0.8 9.3 37.97 68.2 155 198];
[b, m]=powerfit(x,y)
xp=linspace(0.5,7.8,50);
yp=b*xp.^m;
plot(x,y,'ok',xp,yp,'k','linewidth',2,'markersize',12)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
```

Command Window:

```
b =
    2.7808
m =
    2.0496
```

Figure displayed:



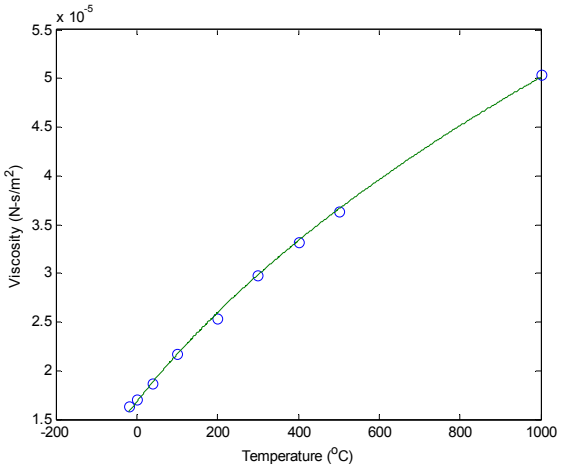
Problem 27

Script File:

```
T=[-20 0 40 100 200 300 400 500 1000];
TK=T+273.15;
meu=[1.63 1.71 1.87 2.17 2.53 2.98 3.32 3.64 5.04]*1e-5;
y=TK.^(3/2)./meu;
a=polyfit(TK,y,1)
C=1/a(1)
S=C*a(2)
Tp=-20:2:1000;
TpK=Tp+273.15;
meup=C*TpK.^(3/2)./(TpK+S);
plot(T,meu,'o',Tp,meup)
xlabel('Temperature (^oC)')
ylabel('Viscosity (N-s/m^2)')
```

Command Window:

```
a =
  1.0e+007 *
    0.0638    9.4479
C =
  1.5682e-006
S =
  148.1622
```



Problem 28

(*a*)

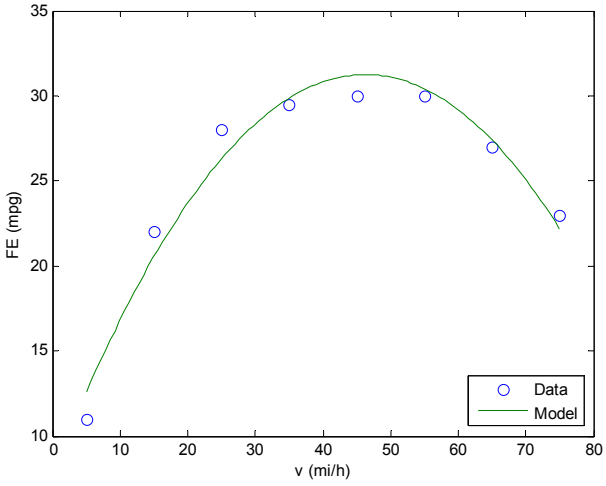
Script File:

```
v=[5:10:75];
FE = [11 22 28 29.5 30 30 27 23];
p=polyfit(v,FE,2);
xp=linspace(5,75,100);
yp=polyval(p,xp);
plot(v,FE,'o',xp,yp)
xlabel('v (mi/h)')
ylabel('FE (mpg)')
legend('Data','Model',0)
FE60=polyval(p,60)
```

Command Window:

```
FE60 =
   29.1853
```

Figure:



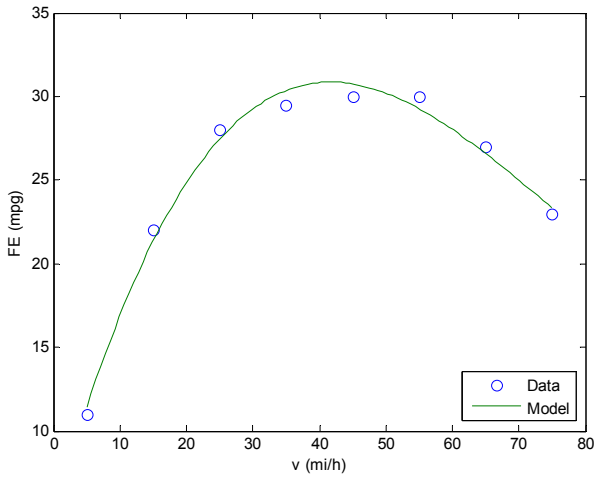
(*b*)
Script File:

```
v=[5:10:75];
FE = [11 22 28 29.5 30 30 27 23];
p=polyfit(v,FE,3);
xp=linspace(5,75,100);
yp=polyval(p,xp);
plot(v,FE,'o',xp,yp)
xlabel('v (mi/h)')
ylabel('FE (mpg)')
legend('Data','Model',0)
FE60=polyval(p,60)
```

Command Window:

```
FE60 =
    28.0319
```

Figure:



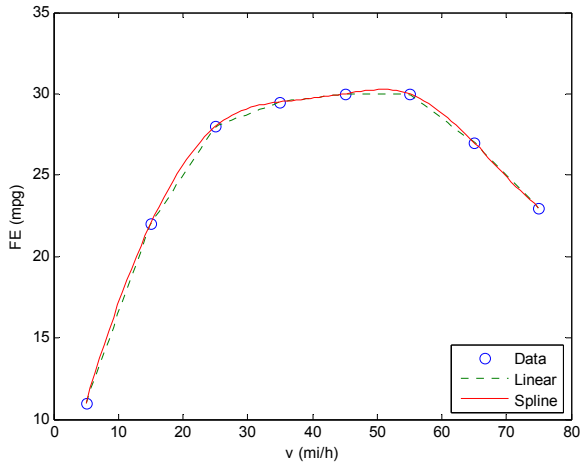
(*c*)
Script File:

```
v=[5:10:75];
FE = [11 22 28 29.5 30 30 27 23];
xp=linspace(5,75,100);
ypL=interp1(v,FE,xp,'linear');
ypS=interp1(v,FE,xp,'spline');
plot(v,FE,'o',xp,ypL,':',xp,ypS)
xlabel('Year')
xlabel('v (mi/h)')
ylabel('FE (mpg)')
legend('Data','Linear','Spline',0)
FE60L=interp1(v,FE,60,'linear')
FE60S=interp1(v,FE,60,'spline')
```

Command Window:

```
FE60L =
   28.5000
FE60S =
   28.8343
```

Figure:



Problem 29

Script File:

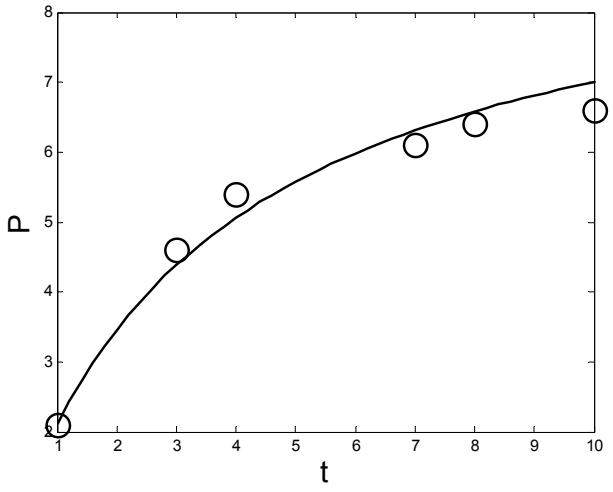
```
t=[1 3 4 7 8 10];
P=[2.1 4.6 5.4 6.1 6.4 6.6];
overt=1./t;
Pover=1./P;
a=polyfit(overt,Pover,1);
m=1/a(2)

b=m*a(1)
tp=1:0.2:10;
Pp=m*tp./(b+tp);
%plot(t,P,'o',tp,Pp)
plot(t,P,'ok',tp,Pp,'k','linewidth',2,'markersize',14)
xlabel('t','fontsize',18)
ylabel('P','fontsize',18)
```

Command Window:

```
m =
    9.4157
b =
    3.4418
```

Figure:



Problem 30

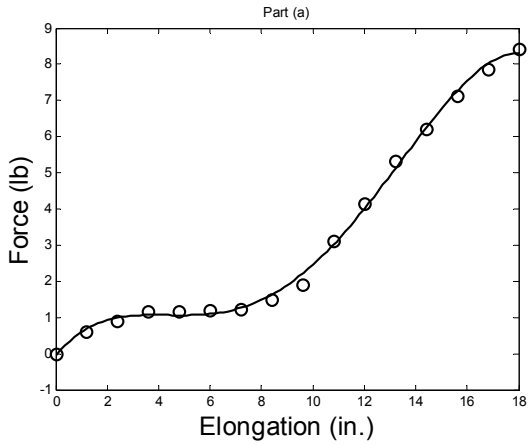
Script File:

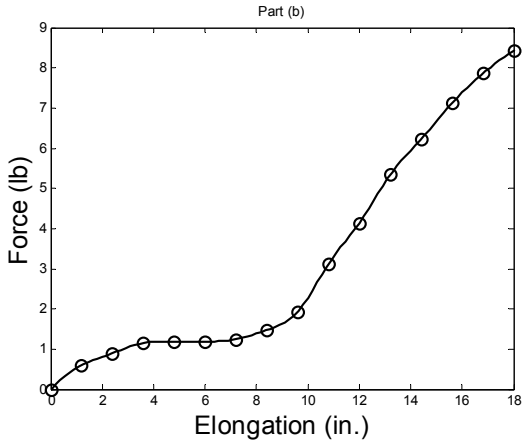
```
F=[0 0.6 0.9 1.16 1.18 1.19 1.24 1.48 1.92 3.12 4.14 5.34
6.22 7.12 7.86 8.42];
E=0:1.2:18;
%Part (a)
disp('Part (a)')
p1=polyfit(E,F,4);
Eplot=linspace(0,18,100);
Fplot=polyval(p1,Eplot);
plot(E,F,'ok',Eplot,Fplot,'k','linewidth',2,'markersize',8)
xlabel('Elongation (in.)','fontsize',18)
ylabel('Force (lb)','fontsize',18)
title('Part (a)')
ForceE115=polyval(p1,11.5)
%Part (b)
disp('Part (b)')
Eplot=linspace(0,18,100);
Fplot=interp1(E,F,Eplot,'spline');
figure
plot(E,F,'ok',Eplot,Fplot,'k','linewidth',2,'markersize',8)
xlabel('Elongation (in.)','fontsize',18)
ylabel('Force (lb)','fontsize',18)
title('Part (b)')
ForceE115=interp1(E,F,11.5,'spline')
```

Command Window:

```
Part (a)
ForceE115 =
    3.5720
Part (b)
ForceE115 =
    3.7182
```

Figures:


Part (a)
Force (lb)
Elongation (in.)
9
8
7
6
5
4
3
2
1
0
-1
0
2
4
6
8
10
12
14
16
18


Part (b)
Force (lb)
Elongation (in.)
9
8
7
6
5
4
3
2
1
0
0
2
4
6
8
10
12
14
16
18

Problem 31

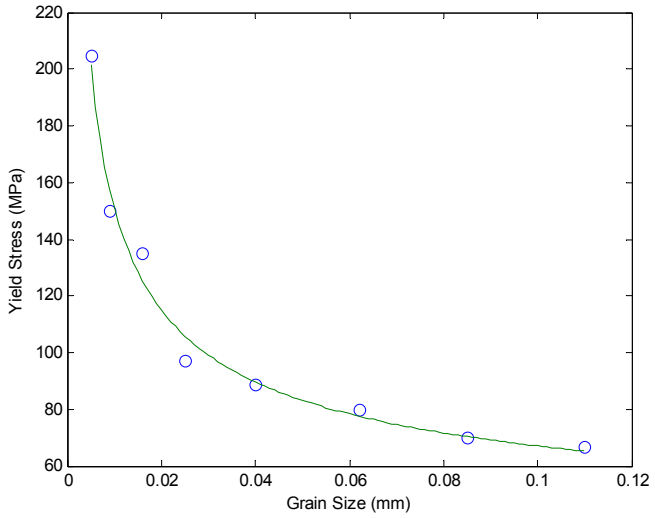
Part *a*

Script File:

```
d=[0.005 0.009 0.016 0.025 0.04 0.062 0.085 0.11];
Sy=[205 150 135 97 89 80 70 67];
x=d.^(-0.5);
p=polyfit(x,Sy,1);
k=p(1)
S0=p(2)
Sy05=S0+k*(0.05)^(-0.5)
dp=0.005:0.001:0.11;
Syp=S0+k*dp.^(-0.5);
plot(d,Sy,'o',dp,Syp)
xlabel('Grain Size (mm)')
ylabel('Yield Stress (MPa)')
```

Command Window:

```
k =
   12.2603
S0 =
   28.2938
Sy05 =
   83.1237
```



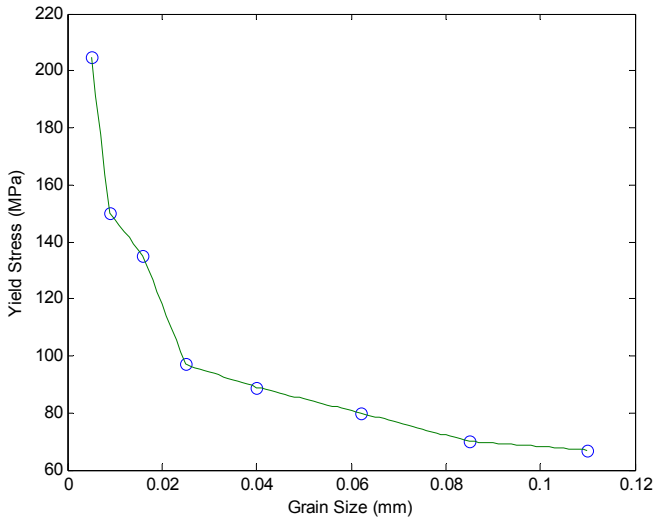
Part *b*

Script File:

```
d=[0.005 0.009 0.016 0.025 0.04 0.062 0.085 0.11];
Sy=[205 150 135 97 89 80 70 67];
Sy05L=interp1(d,Sy,0.05,'linear')
dp=0.005:0.001:0.11;
SyL=interp1(d,Sy,dp,'linear');
plot(d,Sy,'o',dp,SyL)
xlabel('Grain Size (mm)')
ylabel('Yield Stress (MPa)')
```

Command Window:

```
Sy05L =
   84.9091
```



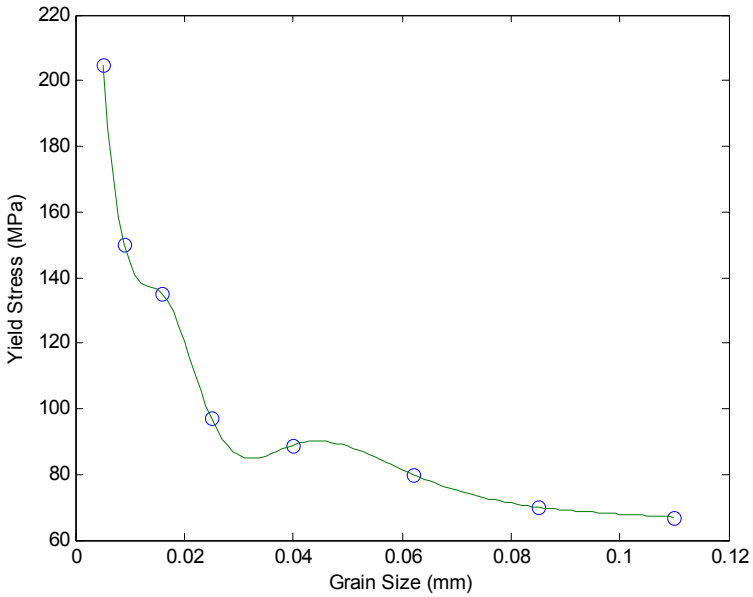
Part *c*

Script File:

```
d=[0.005 0.009 0.016 0.025 0.04 0.062 0.085 0.11];
Sy=[205 150 135 97 89 80 70 67];
Sy05S=interp1(d,Sy,0.05,'spline')
dp=0.005:0.001:0.11;
SyS=interp1(d,Sy,dp,'spline');
plot(d,Sy,'o',dp,SyS)
xlabel('Grain Size (mm)')
ylabel('Yield Stress (MPa)')
```

Command Window:

```
Sy05S =
   88.5457
```



Problem 32

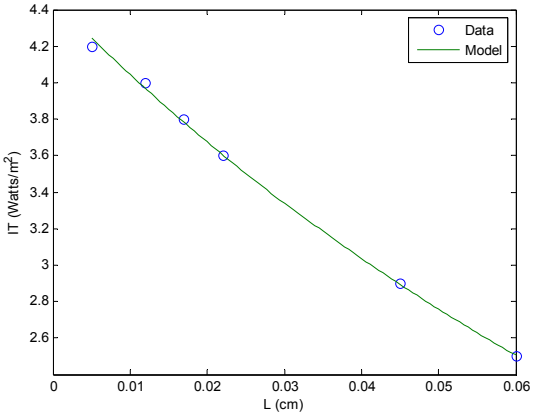
Script file:

```
I0=5;
L=[0.5 1.2 1.7 2.2 4.5 6]*1E-2;
IT = [4.2 4.0 3.8 3.6 2.9 2.5];
p=polyfit(L,log(IT),1);
beta=-p(1)
b=exp(p(2))
R=1-sqrt(b/I0)
n=(1+R^2)/(1-R^2)
Lp=linspace(0.005,0.06,100);
F=@ (x) I0*(1-R)^2*exp(-beta*x);
ITp=F(Lp);
plot(L,IT,'o',Lp,ITp)
xlabel('L (cm)')
ylabel('IT (Watts/m^2)')
legend('Data','Model',0)
```

Command Window:

```
beta =
    9.5611
b =
    4.4502
R =
    0.0566
n =
    1.0064
```

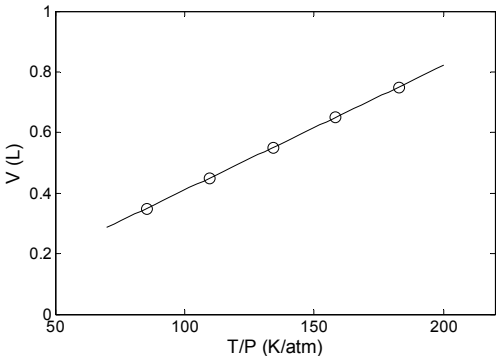
Figure


Data
Model
IT (Watts/m2)
L (cm)
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
0
0.01
0.02
0.03
0.04
0.05
0.06

Problem 33

Script file:

```
n=0.05;
V=[0.75 0.65 0.55 0.45 0.35
T=[25 37 45 56 65];
P=[1.63 1.96 2.37 3 3.96];
TdP=(T+273)./P;
p=polyfit(TdP,V,1);
R=p(1)/n
TdPplot=linspace(200,70,50)
Vplot=p(1)*TdPplot+p(2);
plot(TdP,V,'o',TdPplot,Vplot)
axis([50 220 0 1])
xlabel('T/P (K/atm)')
ylabel('V (L)')
```



Command Window:

```
>> format long
R =
   0.082156823269242
```

(Units of R: L-atm/mol-K)