Chapter 1
Solved Problems

Problem 1

Script file:

```
clear, clc
disp('Part (a)')
(22+5.1^2)/(50-6.3^2)
disp('Part (b)')
44/7+8^2/5-99/3.9^2
```

Command Window:

```
Part (a)
ans =
    4.6566
Part (b)
ans =
   12.5768
```

Problem 2

Script file:

```
clear, clc
disp('Part (a)')
sqrt(41^2-5.2^2)/(exp(5)-100.53)
disp('Part (b)')
%alternative: nthroot(132,3)+log(500)/8
132^(1/3)+log(500)/8
```

Command Window:

```
Part (a)
ans =
    0.8493
Part (b)
ans =
    5.8685
```

Problem 3

Script file:

```
clear, clc
disp('Part (a)')
(14.8^3-6.3^2)/(sqrt(13)+5)^2
disp('Part (b)')
45*(288/9.3-4.6^2)-1065*exp(-1.5)
```

Command Window:

```
Part (a)
ans =
   43.2392
Part (b)
ans =
  203.7148
```

Problem 4

Script file:

```
clear, clc
disp('Part (a)')
(24.5+64/3.5^2+8.3*12.5^3)/(sqrt(76.4)-28/15)
disp('Part (b)')
(5.9^2-2.4^2)/3+(log10(12890)/exp(0.3))^2
```

Command Window:

```
Part (a)
ans =
   2.3626e+03
Part (b)
ans =
   18.9551
```

Problem 5

Script file:

```
clear, clc
disp('Part (a)')
%alternative:  sin(15*pi/180) instead of sind(15)
cos(7*pi/9)+tan(7*pi/15)*sind(15)
disp('Part (b)')
%alternatives:  could use nthroot(0.18,3), could convert to radians
%and use regular trig functions
sind(80)^2-(cosd(14)*sind(80))^2/(0.18)^(1/3)
```

Command Window:

```
Part (a)
ans =
    1.6965
Part (b)
ans =
   -0.6473
```

Problem 6

Script file:

```
clear, clc
x=6.7;
disp('Part (a)')
0.01*x^5-1.4*x^3+80*x+16.7
disp('Part (b)')
sqrt(x^3+exp(x)-51/x)
```

Command Window:

```
ans =
  266.6443
Part (b)
ans =
   33.2499
```

Problem 7

Script file:

```
clear, clc
t=3.2;
disp('Part (a)')
56*t-9.81*t^2/2
disp('Part (b)')
14*exp(-0.1*t)*sin(2*pi*t)
```

Command Window:

```
Part (a)
ans =
  128.9728
Part (b)
ans =
    9.6685
```

Problem 8

Script file:

```
clear, clc
x=5.1; y=4.2;
disp('Part (a)')
3/4*x*y-7*x/y^2+sqrt(x*y)
disp('Part (b)')
(x*y)^2-(x+y)/(x-y)^2 +sqrt((x+y)/(2*x-y))
```

Command Window:

```
Part (a)
ans =
   18.6694
Part (b)
ans =
  448.5799
```

Problem 9

Script file:

```
clear, clc
a=12; b=5.6; c=3*a/b^2; d=(a-b)^c/c;
disp('Part (a)')
a/b+(d-c)/(d+c)-(d-b)^2
disp('Part (b)')
exp((d-c)/(a-2*b))+log(abs(c-d+b/a))
```

Command Window:

```
Part (a)
ans =
   -0.1459
Part (b)
ans =
   2.2925e+03
```

Problem 10

Script file:

```
clear, clc
r=24;
disp('Part (a)')
%need to solve (a)(a/2)(a/4)=4/3 pi r^3
%could also use ^(1/3)
a=nthroot(8*4/3*pi*r^3,3)
disp('Part (b)')
%need to solve 2(a^2/2+a^2/4+a^2/8)=4 pi r^2
a=sqrt(8/7*4*pi*r^2)
disp(' ')
disp('Problem 11')
a=11; b=9;
%could be one long expression
s=sqrt(b^2+16*a^2);
Labc = s/2 + b^2/(8*a)*log((4*a+s)/b)
```

Command Window:

```
Part (a)
a =
   77.3756
Part (b)
a =
   90.9520
```

Problem 11

Script file:

```
clear, clc
a=11; b=9;
%could be one long expression
s=sqrt(b^2+16*a^2);
Labc = s/2 + b^2/(8*a)*log((4*a+s)/b)
```

Command Window:

```
Labc =
   24.5637
```

Problem 12

Script file:

```
clear, clc
x=pi/12;
disp('Part (a)')
%compare LHS and RHS
LHS = sin(5*x)
RHS = 5*sin(x)-20*sin(x)^3+16*sin(x)^5
disp('Part (b)')
LHS = sin(x)^2*cos(x)^2
RHS = (1-cos(4*x))/8
```

Command Window:

```
Part (a)
LHS =
    0.9659
RHS =
    0.9659
Part (b)
LHS =
    0.0625
RHS =
    0.0625
```

Problem 13

Script file:

```
clear, clc
x=24;
disp('Part (a)')
%compare LHS and RHS
LHS = tand(3*x)
RHS = (3*tand(x)-tand(x)^3)/(1-3*tand(x)^2)
disp('Part (b)')
LHS = cosd(4*x)
RHS = 8*(cosd(x)^4-cosd(x)^2)+1
```

Command Window:

```
Part (a)
LHS =
    3.0777
RHS =
    3.0777
```

```
Part (b)
LHS =
   -0.1045
RHS =
   -0.1045
```

Problem 14

Script file:

```
clear, clc
alpha=pi/6; beta=3*pi/8;
%compare LHS and RHS
LHS = sin(alpha)+sin(beta)
RHS = 2*sin((alpha+beta)/2)*cos((alpha-beta)/2)
```

Command Window:

```
LHS =
    1.4239
RHS =
    1.4239
```

Problem 15

Script file:

```
clear, clc
Integral=sin(a*3*pi/2)/a^2 - 3*pi/2*cos(a*3*pi/2)/a - ...
    sin(a*pi/3)/a^2 + pi/3*cos(a*pi/3)/a
```

Command Window:

```
Integral =
    8.1072
```

Problem 16

Script file:

```
clear, clc
a=5.3; gamma=42; b=6;
disp('Part (a)')
c=sqrt(a^2+b^2-2*a*b*cosd(gamma))
disp('Part (b)')
alpha = asind(a*sind(gamma)/c)
beta = asind(b*sind(gamma)/c)
disp('Part (c)')
Total = alpha+beta+gamma
```

Command Window:

```
Part (a)
c =
    4.1019
Part (b)
alpha =
   59.8328
beta =
   78.1672
Part (c)
Total = 180.0000
```

Problem 17

Script file:

```
clear, clc
a=5; b=7; gamma=25;
disp('Part (a)')
c=sqrt(a^2+b^2-2*a*b*cosd(gamma))
disp('Part (b)')
alpha = asind(a*sind(gamma)/c)
%note that beta is over 90 deg and asind will give 1st quadrant
beta = 180 - asind(b*sind(gamma)/c)
disp('Part (c)')
%compare LHS with RHS
LHS=(a-b)/(a+b)
RHS=tand((alpha-beta)/2)/tand((alpha+beta)/2)
```

Command Window:

```
Part (a)
c =
    3.2494
Part (b)
alpha =
   40.5647
beta =
  114.4353
Part (c)
LHS =
   -0.1667
RHS =
   -0.1667
```

Problem 18

Script file:

```
clear, clc
L=4; theta=35;
%radius of cone opening and height
r=L*sind(theta/2);
H=L*cosd(theta/2);
%volume of cone + volume of hemisphere
V=pi*r^2*H/3 + 2/3*pi*r^3
```

Command Window:

```
V =
    9.4245
```

Problem 19

Script file:

```
clear, clc
x=48; b=34; gamma=83;
disp('Part (a)')
c=sqrt(a^2+b^2-2*a*b*cosd(gamma))
disp('Part (b)')
s=(a+b+c)/2;
r=a*b*c/(4*sqrt(s*(s-a)*(s-b)*(s-c)))
```

Command Window:

```
Part (a)
c =
   33.7574
Part (b)
r =
   17.0055
```

Problem 20

Script file:

```
clear, clc
x0=-4; y0=-2; z0=-3; a=0.6; b=0.5; c=0.7;
xA=2; yA=-3; zA=1;
dA0=sqrt((xA-x0)^2+(yA-y0)^2+(zA-z0)^2);
d=dA0*sin(acos(((xA-x0)*a+(yA-y0)*b+(zA-z0)*c)/(dA0*sqrt(a^2+b^2+c^2))))
```

Command Window:

```
d =
    4.6211
```

Problem 21

Script file:

```
clear, clc
a=16; b=11;
C=pi*(3*(a+b)-sqrt((3*a+b)*(a+3*b)))
```

Command Window:

```
C =
   85.5518
```

Problem 22

Script file:

```
clear, clc
%alternate 37-rem(315,37)
empty=37*ceil(315/37)-315
```

Command Window:

```
empty =
    18
```

Problem 23

Script file:

```
clear, clc
%alternate rem(739,54)
unpacked=739-54*fix(739/54)
```

Command Window:

```
unpacked =
    37
```

Problem 24

Script file:

```
clear, clc
format long g
variable=316501.673;
%note basic matlab only has round function to nearest integer
%symbolic math toolbox has round function that allows rounding to
%specified digit, i.e round(variable,2) will round to 2nd digit after
%the decimal point, round(variable,-3) will round to the thousands digit.
disp('Part (a)')
round(100*variable)/100
disp('Part (b)')
round(variable/1000)*1000
```

Command Window:

```
Part (a)
ans =
                  316501.67
Part (b)
ans =
      317000
```

Problem 25

Script file:

```
clear, clc
V=14; R1=120.6; R2=119.3; R3=121.2; R4=118.8;
Vab=V*(R1*R3-R2*R4)/((R1+R3)*(R3+R4))
```

Command Window:

```
Vab =
    0.1071
```

Problem 26

Script file:

```
clear, clc
L=0.15; R=14; C=2.6e-6;
f=1/(2*pi)*sqrt(1/(L*C)-(R/L)^2)
```

Command Window:

```
f =
  254.4186
```

Problem 27

Script file:

```
clear, clc
L=0.15; R=14; C=2.6e-6;
disp('Part (a)')
number_combinations=factorial(49)/(factorial(6)*factorial(49-6))
disp('Part (b)')
chance_of_2=factorial(6)/(factorial(2)*factorial(6-2))* ...
    factorial(43)/(factorial(4)*factorial(43-4))/ ...
    (factorial(49)/(factorial(6)*factorial(49-6)))
```

Command Window:

```
Part (a)
number_combinations =
    13983816
Part (b)
chance_of_2 =
    0.1324
```

Problem 28

Script file:

```
disp('Part (a)')
log4=log(0.085)/log(4)
disp('Part (b)')
log6=log10(1500)/log10(6)
```

Command Window:

```
Part (a)
log4 =
   -1.7782
Part (b)
log6 =
    4.0816
```

Problem 29

Script file:

```
clear, clc
R1=120; R2=220; R3=75; R4=130;
Req=1/(1/R1+1/R2+1/R3+1/R4)
```

Command Window:

```
Req =
   29.4947
```

Problem 30

Script file:

```
clear, clc
V0=36; R=2500; C=1600*10^-6; t=8;
VC=V0*(1-exp(-t/(R*C)));
I=VC/R
```

Command Window:

```
I =
    0.0125
```

Problem 31

Script file:

```
clear, clc
k=log(0.5)/5730;
Age=round(log(.7745)/k)
```

Command Window:

```
Age =
        2112
```

Problem 32

Script file:

```
clear, clc
disp('Part (a)')
gcd(91,147)
disp('Part (b)')
gcd(555,962)
```

Command Window:

```
Part (a)
ans =
     7
Part (b)
ans =
    37
```

Problem 33

Script file:

```
clear, clc
ratio=10^(3*(9.5+10.7)/2)/10^(3*(8.7+10.7)/2)
```

Command Window:

```
ratio =
   15.8489
```

Problem 34

Script file:

```
clear, clc
L=2; v=5000; c=300*10^6;
delta=L*(1-sqrt(1-v^2/c^2))
```

Command Window:

```
delta =
   2.7778e-10
```

Problem 35

Script file:

```
clear, clc
format bank
%an interest rate of 10% is assumed
P=80000; n=5; r=.1;
bonus=P*(1+ r/365)^(365*n) - P*(1+ r)^n
```

Command Window:

```
bonus =
       3047.87
```

Problem 36

Script file:

```
clear, clc
%answer could be just decimal hours before 9:18 PM
T0=98.6; Ts=69; T1=79.5; T2=78; hr=9; min=18;
part=log((T1-Ts)/(T0-Ts))/log((T2-Ts)/(T0-Ts));
deltaT=part/(1-part);
t1=9+18/60;
t_death=t1-deltaT;
PM_hour_of_death=floor(t_death)
PM_min_of_death=round(60*(t_death-PM_hour_of_death))
```

Command Window:

```
PM_hour_of_death =
     2
PM_min_of_death =
    35
```

Problem 37

Script file:

```
clear, clc
sigma=12000; h=5; b=4; a=1.5;
K=sigma*sqrt(pi*a)*(1-a/(2*b)+0.326*(a/b)^2)/sqrt(1-a/b)
```

Command Window:

```
K =
   2.8283e+04
```

Problem 38

Script file:

```
clear, clc
disp('Part (a)')
t_minutes=log(2)/0.15
disp('Part (b)')
bigt_minutes=log(10^6/20)/0.15
```

Command Window:

```
Part (a)
t_minutes =
    4.6210
```

```
Part (b)
bigt_minutes =
   72.1319
```

Problem 39

Script file:

```
clear, clc
format rat
disp('Part (a)')
5/8+16/6
disp('Part (b)')
1/3-11/13+2.7^2
```

Command Window:

```
Part (a)
ans =
      79/24
Part (b)
ans =
    1247/184
```

Problem 40

Script file:

```
clear, clc
factorial_20=sqrt(2*pi*20)*(20/exp(1))^20
error=(factorial(20)-factorial_20)/factorial(20)
```

Command Window:

```
factorial_20 =
   2.4228e+18
error =
    0.0042
```

Chapter 2
Solved Problems

Problem 1

Script file:

```
clear, clc
row=[8 10/4 12*1.4 51 tand(85) sqrt(26) 0.15]
```

Command Window:

```
row =
    8.0000    2.5000   16.8000   51.0000   11.4301    5.0990    0.1500
```

Problem 2

Script file:

```
clear, clc
row=[sqrt(15)*10^3, 25/(14-6^2), log(35)/0.4^3, sind(65)/cosd(80), ...
    129, cos(pi/20)^2]
```

Command Window:

```
row =
   1.0e+03 *
    3.8730   -0.0011    0.0556    0.0052    0.1290    0.0010
```

Problem 3

Script file:

```
clear, clc
col=[25.5; 14*tand(58)/(2.1^2+11); factorial(6); 2.7^4; 0.0375; pi/5]
```

Command Window:

```
col =
   25.5000
    1.4539
  720.0000
   53.1441
    0.0375
    0.6283
```

Problem 4

Script file:

```
clear, clc
col=[32/3.2^2; sind(35)^2; 6.1; log(29^2); 0.00552; log(29)^2; 133]
```

Command Window:

```
col =
    3.1250
    0.3290
    6.1000
    6.7346
    0.0055
   11.3387
  133.0000
```

Problem 5

Script file:

```
clear, clc
x=0.85; y=12.5;
col=[y; y^x; log(y/x); x*y; x+y]
```

Command Window:

```
col =
   12.5000
    8.5580
    2.6882
   10.6250
   13.3500
```

Problem 6

Script file:

```
clear, clc
a=3.5; b=-6.4;
row=[a a^2 a/b a*b sqrt(a)]
```

Command Window:

```
row =
    3.5000   12.2500   -0.5469  -22.4000    1.8708
```

Problem 7

Script file:

```
clear, clc
row=1:6:43
```

Command Window:

```
row =
     1     7    13    19    25    31    37    43
```

Problem 8

Script file:

```
clear, clc
%alternative row = 96:-9.4:2
row=linspace(96,2,11)
```

Command Window:

```
row =
   96.0000   86.6000   77.2000   67.8000   58.4000   49.0000   39.6000
30.2000   20.8000   11.4000    2.0000
```

Problem 9

Script file:

```
clear, clc
%square brackets needed, else ' only applied to -10
col = [26:-3.6:-10]'
```

Command Window:

```
col =
   26.0000
   22.4000
   18.8000
   15.2000
   11.6000
    8.0000
    4.4000
    0.8000
   -2.8000
   -6.4000
  -10.0000
```

Problem 10

Script file:

```
clear, clc
%alternative col = [-34:27/8:-7]'
%for alternative square brackets needed, else ' only applied to -7
col=linspace(-34,-7,9)'
```

Command Window:

```
col =
  -34.0000
  -30.6250
  -27.2500
  -23.8750
  -20.5000
  -17.1250
  -13.7500
  -10.3750
   -7.0000
```

Problem 11

Script file:

```
clear, clc
Fives(1:5)=5
```

Command Window:

```
Fives =
     5     5     5     5     5
```

Problem 12

Script file:

```
clear, clc
Nines=linspace(9,9,9)
```

Command Window:

```
Nines =
     9     9     9     9     9     9     9     9     9
```

Problem 13

Script file:

```
clear, clc
a=[zeros(1,5) 4.7]
```

Command Window:

```
a =
         0         0         0         0         0    4.7000
```

Problem 14

Script file:

```
clear, clc
%alternate b=[linspace(0,0,5) linspace(3.8,3.8,3)]
b=[zeros(1,5) 3.8*ones(1,3)]
```

Command Window:

```
b =
  Columns 1 through 7
         0         0         0         0         0    3.8000    3.8000
  Column 8
    3.8000
```

Problem 15

Script file:

```
clear, clc
b=[0:2:12 9:-3:0]
```

Command Window:

```
b =
     0     2     4     6     8    10    12     9     6     3     0
```

Problem 16

Script file:

```
clear, clc
a=2:3:17; b=3:4:15;
c=[a,b]
```

Command Window:

```
c =
     2     5     8    11    14    17     3     7    11    15
```

Problem 17

Script file:

```
clear, clc
a=[2:3:17]'; b=[3:4:15]';
c=[a;b]
```

Command Window:

```
c =
     2
     5
     8
    11
    14
    17
     3
     7
    11
    15
```

Problem 18

Script file:

```
clear, clc
vtA=8:7:71;
%alternatives vtB=vtA([1:4 8:10]),vtB=vtA([1:4 end-2:end]),
% vtB=[vtA(1:4) vtA(end-2:end)]
vtB=[vtA(1:4) vtA(8:10)]
```

Command Window:

```
vtB =
     8    15    22    29    57    64    71
```

Problem 19

Script file:

```
clear, clc
vctC=5:4:49;
disp('Part (a)')
Codd=vctC(1:2:11)
disp('Part (b)')
Ceven=vctC(2:2:12)
```

Command Window:

```
Part (a)
Codd =
     5    13    21    29    37    45
Part (b)
Ceven =
     9    17    25    33    41    49
```

Problem 20

Script file:

```
clear, clc
vctD=0:3:27;
%alternatives vctDop(10:-1:1)=vctD, vctDop(end:-1:1)=vctD'
% vctDop=vctD(10:-1:1)
vctDop=vctD(end:-1:1)
```

Command Window:

```
vctDop =
    27    24    21    18    15    12     9     6     3     0
```

Problem 21

Script file:

```
clear, clc
A=[130:-20:10; linspace(1,12,7); 12:10:72]
```

Command Window:

```
A =
  130.0000  110.0000   90.0000   70.0000   50.0000   30.0000   10.0000
    1.0000    2.8333    4.6667    6.5000    8.3333   10.1667   12.0000
   12.0000   22.0000   32.0000   42.0000   52.0000   62.0000   72.0000
```

Problem 22

Script file:

```
clear, clc
B=[linspace(5,5,5);linspace(2,2,5);linspace(3,3,5);]'
```

Command Window:

```
B =
     5     2     3
     5     2     3
     5     2     3
     5     2     3
     5     2     3
```

Problem 23

Script file:

```
clear, clc
%alternative C = [linspace(7,7,5); linspace(7,7,5)]
C=7*ones(2,5)
```

Command Window:

```
C =
     7     7     7     7     7
     7     7     7     7     7
```

Problem 24

Script file:

```
clear, clc
D=[zeros(3,4) [8:-1:6]']
```

Command Window:

```
D =
     0     0     0     0     8
     0     0     0     0     7
     0     0     0     0     6
```

Problem 25

Script file:

```
E=[zeros(2,5); zeros(2) [5:-1:3; 2:-1:0]]
```

Command Window:

```
E =
     0     0     0     0     0
     0     0     0     0     0
     0     0     5     4     3
     0     0     2     1     0
```

Problem 26

Script file:

```
clear, clc
F=[linspace(0,0,5); zeros(3,2) [1:3;10:-2:6;20:6:32]']
```

Command Window:

```
F =
     0     0     0     0     0
     0     0     1    10    20
     0     0     2     8    26
     0     0     3     6    32
```

Problem 27

Script file:

```
clear, clc
a=[3 -1 5 11 -4 2]; b=[7 -9 2 13 1 -2]; c=[-2 4 -7 8 0 9];
disp('Part (a)')
matrixA=[a;b;c]
disp('Part (b)')
%alternative matrixB=[b' c' a']
matrixB=[b;c;a]'
```

Command Window:

```
Part (a)
matrixA =
     3    -1     5    11    -4     2
     7    -9     2    13     1    -2
    -2     4    -7     8     0     9
```

```
Part (b)
matrixB =
     7    -2     3
    -9     4    -1
     2    -7     5
    13     8    11
     1     0    -4
    -2     9     2
```

Problem 28

Script file:

```
a=[3 -1 5 11 -4 2]; b=[7 -9 2 13 1 -2]; c=[-2 4 -7 8 0 9];
disp('Part (a)')
matrixA=[a(3:6); b(3:6); c(3:6)]
disp('Part (b)')
%alternate matrixB = [a(1:3); b(1:3); c(1:3)]'
matrixB=[a(1:3)' b(1:3)' c(1:3)']
```

Command Window:

```
Part (a)
matrixA =
     5    11    -4     2
     2    13     1    -2
    -7     8     0     9
Part (b)
matrixB =
     3     7    -2
    -1    -9     4
     5     2    -7
```

Problem 29

Script file:

```
clear, clc
a=[3 9 -0.5 3.6 1.5 -0.8 4]; b=[12 -0.8 6 2 5 3 7.4];
disp('Part (a)')
matrixA=[a(3:6);a(4:7);b(2:5)]
disp('Part (b)')
%alternate matrixB = [a(2:7); b(1:3) b(5:7)]'
matrixB=[a(2:7)' b([1:3 5:7])']
```

Command Window:

```
Part (a)
matrixA =
   -0.5000    3.6000    1.5000   -0.8000
    3.6000    1.5000   -0.8000    4.0000
   -0.8000    6.0000    2.0000    5.0000
Part (b)
matrixB =
    9.0000   12.0000
   -0.5000   -0.8000
    3.6000    6.0000
    1.5000    5.0000
   -0.8000    3.0000
    4.0000    7.4000
```

Problem 30

Script file:

```
clear, clc
disp('Part (a)')
a=1:4:17
disp('Part (b)')
b=[a(1:3) a]
disp('Part (c)')
c=[a;a]'
disp('Part (d)')
d=[a' a']
disp('Part (e)')
e=[[a; a; a; a; a] a']
```

Command Window:

```
Part (a)
a =
     1     5     9    13    17
Part (b)
b =
     1     5     9     1     5     9    13    17
Part (c)
c =
     1     1
     5     5
     9     9
    13    13
    17    17
```

```
Part (d)
d =
     1     1
     5     5
     9     9
    13    13
    17    17
Part (e)
e =
     1     5     9    13    17     1
     1     5     9    13    17     5
     1     5     9    13    17     9
     1     5     9    13    17    13
     1     5     9    13    17    17
```

Problem 31

Script file:

```
clear, clc
v=[6 11 -4 5 8 1 -0.2 -7 19 5];
disp('Part (a)')
a=v(3:8)
disp('Part (b)')
b=v([1,3,2:7,4,6])
disp('Part (c)')
c=v([9,1,5,4])'
```

Command Window:

```
Part (a)
a =
   -4.0000    5.0000    8.0000    1.0000   -0.2000   -7.0000
Part (b)
b =
    6.0000   -4.0000   11.0000   -4.0000    5.0000    8.0000    1.0000   -
0.2000    5.0000    1.0000
Part (c)
c =
    19
     6
     8
     5
```

Problem 32

Script file:

```
clear, clc
v=[6 11 -4 5 8 1 -0.2 -7 19 5];
disp('Part (a)')
a=[v([1:3 7:-1:5]); v([10,1,4:6,2])]
disp('Part (b)')
b=[v([9,2:4,1])' v([5 3 10 2 7])' v([10:-2:4,10])']
```

Command Window:

```
Part (a)
a =
    6.0000   11.0000   -4.0000   -0.2000    1.0000    8.0000
    5.0000    6.0000    5.0000    8.0000    1.0000   11.0000
Part (b)
b =
   19.0000    8.0000    5.0000
   11.0000   -4.0000   -7.0000
   -4.0000    5.0000    1.0000
    5.0000   11.0000    5.0000
    6.0000   -0.2000    5.0000
```

Problem 33

Script file:

```
clear, clc
A=[36:-2:26; 24:-2:14; 12:-2:2];
disp('Part (a)')
ha=A(2,:)
disp('Part (b)')
hb=A(:,6)
disp('Part (c)')
hc=[A(3,[1 2]) A(1,4:6)]
```

Command Window:

```
Part (a)
ha =
    24    22    20    18    16    14
Part (b)
hb =
    26
    14
     2
Part (c)
hc =
    12    10    30    28    26
```

Problem 34

Script file:

```
clear, clc
A=1:18;
B=reshape(A,3,6)
disp('Part (a)')
Ba=[B(:,1);B(:,3);B(:,5)]
disp('Part (b)')
Bb=[B(2,2:5) B(:,3)']
disp('Part (c)')
Bc=[B(1,3:5) B(3,2:4)]
```

Command Window:

```
B =
     1     4     7    10    13    16
     2     5     8    11    14    17
     3     6     9    12    15    18
Part (a)
Ba =
     1
     2
     3
     7
     8
     9
    13
    14
    15
Part (b)
Bb =
     5     8    11    14     7     8     9
Part (c)
Bc =
     7    10    13     6     9    12
```

Problem 35

Script file:

```
clear, clc
C=[1.5:.5:5 9.6:-.5:6.1];
D=reshape(C,4,4)'
disp('Part (a)')
%alternate Da=[D(1,:)'; D(3,:)']
Da = [D(1,:) D(3,:)]'
disp('Part (b)')
%alternate Db = [D(:,2); D(:,4)]'
Db=[D(:,2)' D(:,4)']
disp('Part (c)')
Dc=[D(1,1:2) D(2:4,2)' D(4,1:3)]
```

Command Window:

```
D =
    1.5000    2.0000    2.5000    3.0000
    3.5000    4.0000    4.5000    5.0000
    9.6000    9.1000    8.6000    8.1000
    7.6000    7.1000    6.6000    6.1000
Part (a)
Da =
    1.5000
    2.0000
    2.5000
    3.0000
    9.6000
    9.1000
    8.6000
    8.1000
Part (b)
Db =
    2.0000    4.0000    9.1000    7.1000    3.0000    5.0000    8.1000
6.1000
Part (c)
Dc =
    1.5000    2.0000    4.0000    9.1000    7.1000    7.6000    7.1000
6.6000
```

Problem 36

Script file:

```
clear, clc
E=[0 5*ones(1,5);0.1:0.2:0.7 0.7 0.9;12:-3:-3;6:11]
disp('Part (a)')
F=E(2:3,3:5)
disp('Part (b)')
G=E(:,3:6)
```

Command Window:

```
E =
         0    5.0000    5.0000    5.0000    5.0000    5.0000
    0.1000    0.3000    0.5000    0.7000    0.7000    0.9000
   12.0000    9.0000    6.0000    3.0000         0   -3.0000
    6.0000    7.0000    8.0000    9.0000   10.0000   11.0000
Part (a)
F =
    0.5000    0.7000    0.7000
    6.0000    3.0000         0
Part (b)
G =
    5.0000    5.0000    5.0000    5.0000
    0.5000    0.7000    0.7000    0.9000
    6.0000    3.0000         0   -3.0000
    8.0000    9.0000   10.0000   11.0000
```

Problem 37

Script file:

```
clear, clc
H=[1.25:.25:2.75; 1:3 1:4; 45:-5:15];
disp('Part (a)')
G=[H(1,[1:3 6 7]); H(3,3:7)]
disp('Part (b)')
K=H(:,[2 3 5 7])'
```

Command Window:

```
Part (a)
G =
    1.2500    1.5000    1.7500    2.5000    2.7500
   35.0000   30.0000   25.0000   20.0000   15.0000
```

```
Part (b)
K =
    1.5000    2.0000   40.0000
    1.7500    3.0000   35.0000
    2.2500    2.0000   25.0000
    2.7500    4.0000   15.0000
     8       -1500.0
     9        2121.3
```

Problem 38

Script file:

```
clear, clc
M=reshape(1:18,3,6);
disp('Part (a)')
A=M([1,3],[1,5,6])
disp('Part (b)')
B=M(:,[4,4:6])
disp('Part (c)')
C=M([1,2],:)
disp('Part (d)')
D=M([2,3],[2,3])
```

Command Window:

```
Part (a)
A =
     1    13    16
     3    15    18
Part (b)
B =
    10    10    13    16
    11    11    14    17
    12    12    15    18
Part (c)
C =
     1     4     7    10    13    16
     2     5     8    11    14    17
Part (d)
D =
     5     8
     6     9
```

Problem 39

Script file:

```
clear, clc
N=reshape([2:2:20 23:3:50],4,5);
disp('Part (a)')
A=[N(1,1:4)',N(2,2:5)']
disp('Part (b)')
B=[N(:,3)' N(3,:)]
disp('Part (c)')
C(3:4,5:6)=N(2:3,4:5)
```

Command Window:

```
Part (a)
A =
     2    12
    10    20
    18    32
    29    44
Part (b)
B =
    18    20    23    26     6    14    23    35    47
Part (c)
C =
     1     4     7    10    13    16
     2     5     8    11    14    17
     0     0     0     0    32    44
     0     0     0     0    35    47
```

Problem 40

Script file:

```
v=1:2:23
M=reshape(v,3,4)
M(2,:)=[]
M(:,3)=[]
N=ones(size(M))
```

Command Window:

```
v =
     1     3     5     7     9    11    13    15    17    19    21    23
M =
     1     7    13    19
     3     9    15    21
     5    11    17    23
M =
     1     7    13    19
     5    11    17    23
M =
     1     7    19
     5    11    23
N =
     1     1     1
     1     1     1
```

Problem 41

Script file:

```
clear, clc
disp('Part (a)')
matrixA=[ones(2) zeros(2)]
disp('Part (b)')
matrixB=[eye(2) zeros(2) ones(2)]
disp('Part (c)')
matrixC=[ones(1,4);zeros(2,4)]
```

Command Window:

```
Part (a)
matrixA =
     1     1     0     0
     1     1     0     0
Part (b)
matrixB =
     1     0     0     0     1     1
     0     1     0     0     1     1
Part (c)
matrixC =
     1     1     1     1
     0     0     0     0
     0     0     0     0
```

Problem 42

Script file:

```
clear, clc
disp('Part (a)')
matrixA=[eye(2) ones(2) zeros(2,1)]
disp('Part (b)')
matrixB=[ones(2,4);eye(2) zeros(2)]
disp('Part (c)')
matrixC=[zeros(2,1) ones(2,3) zeros(2,1); zeros(2,4) ones(2,1)]
```

Command Window:

```
Part (a)
matrixA =
     1     0     1     1     0
     0     1     1     1     0
Part (b)
matrixB =
     1     1     1     1
     1     1     1     1
     1     0     0     0
     0     1     0     0
Part (c)
matrixC =
     0     1     1     1     0
     0     1     1     1     0
     0     0     0     0     1
     0     0     0     0     1
```

Problem 43

Script file:

```
A=eye(2); B=ones(2); C=zeros(2);
D=[A B C;C B A]
```

Command Window:

```
D =
     1     0     1     1     0     0
     0     1     1     1     0     0
     0     0     1     1     1     0
     0     0     1     1     0     1
```

Problem 44

Script file:

```
clear, clc
A=ones(2,3);
A=A';
A(4:6,[3 4])=A
```

Command Window:

```
A =
     1     1     0     0
     1     1     0     0
     1     1     0     0
     0     0     1     1
     0     0     1     1
     0     0     1     1
```

Chapter 3
Solved Problems

Problem 1

Script file:

```
clear, clc
x=-3:3;
y=x.^2-exp(0.5*x)+x
```

Command Window:

```
y =
    5.7769    1.6321   -0.6065   -1.0000    0.3513    3.2817    7.5183
```

Problem 2

Script file:

```
clear, clc
x=1:6;
y=(x+5).^3./x.^2
```

Command Window:

```
y =
  216.0000   85.7500   56.8889   45.5625   40.0000   36.9722
```

Problem 3

Script file:

```
clear, clc
x=[1.5:5.5 6.6];
y=(x+7).^4./((x+1).*sqrt(x))
```

Command Window:

```
y =

   1.0e+03 *

    1.7049    1.4718    1.4438    1.4991    1.6016    1.7521
```

Problem 4

Script file:

```
clear, clc
x=20:10:70;
y=(2*sind(x)+cosd(x).^2)./sind(x).^2
```

Command Window:

```
y =
   13.3962    7.0000    4.5317    3.3149    2.6427    2.2608
```

Problem 5

Script file:

```
clear, clc
s=50:50:300;
r=sqrt(s/pi)/2;
V=4*pi*r.^3/3;
table=[s' V']
```

Command Window:

```
table =
   50.0000   33.2452
  100.0000   94.0316
  150.0000  172.7471
  200.0000  265.9615
  250.0000  371.6925
  300.0000  488.6025
```

Problem 6

Script file:

```
clear, clc
e0=8.85e-12; lambda=1.7e-7; R=6;
disp('Part (a)')
z=0:2:10;
E=lambda*R*z./(2*e0*(z.^2+R^2).^(3/2))
disp('Part (b)')
z=2:.01:6;
E=lambda*R*z./(2*e0*(z.^2+R^2).^(3/2));
[m indx]=max(E);
maxE=m
at_z=z(indx)
```

Command Window:

```
Part (a)
E =
         0  455.5824  614.7264  565.9518  461.0169  363.3445
Part (b)
maxE =
  616.1301
at_z =
    4.2400
```

Problem 7

Script file:

```
clear, clc
V0=24; R=3800; C=4000*10^-6;
T0=R*C;
t=0:2:20;
Vc=V0*(1-exp(-t/T0));
i=V0/R*exp(-t/T0);
%table display introduced in Ch. 4
table=[t' Vc' i']
```

Command Window:

```
table =
         0         0    0.0063
    2.0000    2.9590    0.0055
    4.0000    5.5531    0.0049
    6.0000    7.8274    0.0043
    8.0000    9.8213    0.0037
   10.0000   11.5694    0.0033
   12.0000   13.1020    0.0029
   14.0000   14.4456    0.0025
   16.0000   15.6236    0.0022
   18.0000   16.6563    0.0019
   20.0000   17.5617    0.0017
```

Problem 8

Script file:

```
clear, clc
u=[23.5 -17 6];
disp('Part (a)')
length_u=sqrt(u(1)^2+u(2)^2+u(3)^2)
disp('Part (b)')
length_u=sqrt(sum(u.*u))
```

Command Window:

```
Part (a)
length_u =
   29.6184
Part (b)
length_u =
   29.6184
```

Problem 9

Script file:

```
clear, clc
u=[7,-4,-11];
vector=18*u/sqrt(sum(u.*u))
```

Command Window:

```
vector =
    9.2388   -5.2793  -14.5181
```

Problem 10

Script file:

```
clear, clc
v=[15,8,-6]; u=[3,-2,6];
disp('Part (a)')
v./u
disp('Part (b)')
u'*v
disp('Part (c)')
u*v'
```

Command Window:

```
Part (a)
ans =
     5    -4    -1
Part (b)
ans =
    45    24   -18
   -30   -16    12
    90    48   -36
Part (c)
ans =
    -7
```

Problem 11

Script file:

```
clear, clc
u=[5,-6,9]; v=[11,7,-4];
disp('Part (a)')
dotuv=sum(u.*v)
disp('Part (b)')
dotuv=u*v'
disp('Part (c)')
dotuv=dot(u,v)
```

Command Window:

```
Part (a)
dotuv =
   -23
Part (b)
dotuv =
   -23
Part (c)
dotuv =
   -23
```

Problem 12

Script file:

```
clear, clc
v=2:2:6;
disp('Part (a)')
a=2*v
disp('Part (b)')
b=v.^3
disp('Part (c)')
c=v.^2
disp('Part (d)')
d=v/2
```

Command Window:

```
Part (a)
a =
     4     8    12
Part (b)
b =
     8    64   216
Part (c)
c =
     4    16    36
```

```
Part (d)
d =
     1     2     3
```

Problem 13

Script file:

```
clear, clc
v=8:-2:2;
disp('Part (a)')
a=v./v
disp('Part (b)')
b=1./v.^2
disp('Part (c)')
c=1./sqrt(v)
disp('Part (d)')
d=v-5
```

Command Window:

```
Part (a)
a =
     1     1     1     1
Part (b)
b =
    0.0156    0.0278    0.0625    0.2500
Part (c)
c =
    0.3536    0.4082    0.5000    0.7071
Part (d)
d =
     3     1    -1    -3
```

Problem 14

Script file:

```
clear, clc
disp('Problem 14')
x=1:5; y=2*x;
disp('Part (a)')
z=(x+y).^2./(x-y)
disp('Part (b)')
w=x.*log(x.^2+y.^2) + sqrt(y.^3./(y-x).^2)
```

Command Window:

```
Part (a)
z =
    -9   -18   -27   -36   -45
```

```
Part (b)
w =
    4.4379    9.9915   16.3190   23.1850   30.4661
```

Problem 15

Script file:

```
clear, clc
r=1.6e3; s=14.2;
t=1:5; x=2*(t-1); y=3*t;
disp('Part (a)')
G=x.*t+r/s^2*(y.^2-x).*t
disp('Part (b)')
R=r*(-x.*t+y.*t.^2)/15-s^2*(y-0.5*x.^2).*t
```

Command Window:

```
Part (a)
G =
   1.0e+03 *
    0.0714    0.5436    1.8450    4.4041    8.6494
Part (b)
R =
   1.0e+04 *
   -0.0285    0.0520    0.6755    2.2759    5.2873
```

Problem 16

Script file:

```
clear, clc
rOA=[8,5,-4]; rOB=[-7,9,6]; rOC=[-5,-2,11];
rAB = rOB-rOA; rAC=rOC-rOA;
Area = sqrt(sum(cross(rAB,rAC).^2))/2
```

Command Window:

```
Area =
  112.4433
```

Problem 17

Script file:

```
clear, clc
rOA=[2,5,1]; rOB=[1,3,6]; rOC=[-6,8,2];
rAC=rOC-rOA;
%note, if order of rOC and rAC reversed will get negative volume
Volume=dot(rOB,cross(rOC,rAC))
```

Command Window:

```
Volume =
   248
```

Problem 18

Script file:

```
clear, clc
u=[5,-2,4]; v=[-2,7,3]; w=[8,1,-3];
%compare LHS and RHS
LHS=dot(u+v,cross(v+w,w+u))
RHS=2*dot(u,cross(v,w))
```

Command Window:

```
LHS =

  -776

RHS =

  -776
```

Problem 19

Script file:

```
clear, clc
r1=[6,-3,2]; r2=[2,9,10];
theta=acosd(dot(r1,r2)/(sqrt(dot(r1,r1))*sqrt(dot(r2,r2))))
```

Command Window:

```
theta =
   86.9897
```

Problem 20

Script file:

```
clear, clc
R=14; xA=8.4; yA=sqrt(R^2-xA^2);
B=[-R,0]; A=[xA,yA]; C=[R,0];
rAB=B-A; rAC=C-A;
disp('Part (a)')
alpha=acosd(dot(rAB,rAC)/(sqrt(dot(rAB,rAB))*sqrt(dot(rAC,rAC))))
disp('Part (b)')
%cross function requires 3rd dimension or could just use
%sqrt(abs(rAB(1)*rAC(2)-rAB(2)*rAC(1))) to explicitly calc cross product
alpha=asind(sqrt(sum(cross([rAB 0],[rAC 0]).^2))/ ...
    (sqrt(dot(rAB,rAB))*sqrt(dot(rAC,rAC))))
```

Command Window:

```
Part (a)
alpha =
    90
Part (b)
alpha =
   90.0000
```

Problem 21

Script file:

```
clear, clc
g=9.81; v0=162; alpha=70;
t=1:5:31;
x=v0*cosd(alpha)*t;
y=v0*sind(alpha)*t - g*t.^2/2;
r = sqrt(x.^2+y.^2)
theta = atand(y./x)
```

Command Window:

```
r =
   1.0e+03 *
    0.1574    0.8083    1.2410    1.4759    1.5564    1.5773    1.7176
theta =
   69.3893   65.7152   60.5858   53.0831   41.6187   24.0270    0.1812
```

Problem 22

Script file:

```
clear, clc
format long
e_squared=exp(2)
disp('Part (a)')
n=0:5;
sum_5=sum(2.^n./factorial(n))
disp('Part (b)')
n=0:10;
sum_10=sum(2.^n./factorial(n))
disp('Part (c)')
n=0:50;
sum_50=sum(2.^n./factorial(n))
```

Command Window:

```
e_squared =
   7.389056098930650
Part (a)
sum_5 =
   7.266666666666667
Part (b)
sum_10 =
   7.388994708994708
Part (c)
sum_50 =
   7.389056098930649
```

Problem 23

Script file:

```
clear, clc
format long
nat_log_10=log(10)
disp('Part (a)')
n=1:10;
sum_10=sum((9/10).^n./n)
disp('Part (b)')
n=1:50;
sum_50=sum((9/10).^n./n)
disp('Part (c)')
n=1:100;
sum_100=sum((9/10).^n./n)
```

Command Window:

```
nat_log_10 =
   2.302585092994046
Part (a)
sum_10 =
   2.118747594831429
Part (b)
sum_50 =
   2.301796252501072
Part (c)
sum_100 =
   2.302582905639062
```

Problem 24

Script file:

```
clear, clc
format long
disp('Part (a)')
n=1:5;
sum_5=sum(1./2.^n)
disp('Part (b)')
n=1:10;
sum_10=sum(1./2.^n)
disp('Part (c)')
n=1:40;
sum_40=sum(1./2.^n)
```

Command Window:

```
Part (a)

sum_5 =

   0.968750000000000

Part (b)

sum_10 =

   0.999023437500000

Part (c)

sum_40 =

   0.999999999999091
```

Problem 25

Script file:

```
clear, clc
format long
x=[1 .5 .1 .01 .001 .0001]
each_result=(cos(2*x)-1)./(cos(x)-1)
disp(' ')
disp('Problem 26')
x=[2, 1.5, 1.1, 1.01, 1.001, 1.00001, 1.0000001]
each_result=(x.^(1/3)-1)./(x.^(1/4)-1)
```

Command Window:

```
x =
  Columns 1 through 3
   1.000000000000000   0.500000000000000   0.100000000000000
  Columns 4 through 6
   0.010000000000000   0.001000000000000   0.000100000000000
each_result =
  Columns 1 through 3
   3.080604611736280   3.755165123780746   3.990008330556008
  Columns 4 through 6
   3.999900000832619   3.999999000133061   4.000000000000000
```

Problem 26

Script file:

```
clear, clc
format long
x=[2, 1.5, 1.1, 1.01, 1.001, 1.00001, 1.0000001]
each_result=(x.^(1/3)-1)./(x.^(1/4)-1)
```

Command Window:

```
x =
  Columns 1 through 3
   2.000000000000000   1.500000000000000   1.100000000000000
  Columns 4 through 6
   1.010000000000000   1.001000000000000   1.000010000000000
  Column 7
   1.000000100000000
each_result =
  Columns 1 through 3
   1.373738243887579   1.356502047955700   1.338663501189040
  Columns 4 through 6
   1.333886511598036   1.333388864983563   1.333333888920624
  Column 7
   1.333333336293928
```

Problem 27

Script file:

```
clear, clc
P=10:10:200;
Q=1020*sqrt(P).*(1-.01*sqrt(P))
```

Command Window:

```
Q =
   1.0e+04 *
  Columns 1 through 7
    0.3124    0.4358    0.5281    0.6043    0.6702    0.7289    0.7820
  Columns 8 through 14
    0.8307    0.8759    0.9180    0.9576    0.9950    1.0304    1.0641
  Columns 15 through 20
    1.0962    1.1270    1.1565    1.1849    1.2122    1.2385
```

Problem 28

Script file:

```
clear, clc
R=0.08206; T=300; n=1; a=1.39; b=0.0391;
V=0.1:.02:1;
P_ideal=n*R*T./V;
P_vW=n*R*T./(V-n*b)-n^2*a./V.^2;
error=100*(P_ideal-P_vW)./P_vW;
[m indx]=max(error);
max_error=m
at_volume=V(indx)
```

Command Window:

```
max_error =
    4.2359
at_volume =
    0.2400
```

Problem 29

Script file:

```
clear, clc
A=[1 -3 5; 2 2 4; -2 0 6]; B=[0 -2 1; 5 1 -6; 2 7 -1];
C=[-3 4 -1; 0 8 2; -3 5 3];
disp('Part (a)')
AplusB=A+B
BplusA=B+A
disp('Part (b)')
AplusBandC=A+(B+C)
AandBplusC=(A+B)+C
disp('Part (c)')
together=3*(A+C)
apart=3*A+3*C
disp('Part (d)')
%element by element
e_by_e_together=A.*(B+C)
e_by_e_apart=A.*B+A.*C
%matrix multiplication
mm_together=A*(B+C)
mm_apart=A*B+A*C
```

Command Window:

```
Part (a)
AplusB =
     1    -5     6
     7     3    -2
     0     7     5
BplusA =
     1    -5     6
     7     3    -2
     0     7     5
Part (b)
AplusBandC =
    -2    -1     5
     7    11     0
    -3    12     8
AandBplusC =
    -2    -1     5
     7    11     0
    -3    12     8
```

```
Part (c)
together =
    -6     3    12
     6    30    18
   -15    15    27
apart =
    -6     3    12
     6    30    18
   -15    15    27
Part (d)
e_by_e_together =
    -3    -6     0
    10    18   -16
     2     0    12
e_by_e_apart =
    -3    -6     0
    10    18   -16
     2     0    12
mm_together =
   -23    35    22
     0    70     0
     0    68    12
mm_apart =
   -23    35    22
     0    70     0
     0    68    12
```

Problem 30

Script file:

```
clear, clc
disp('Part (a)')
p1=A*B
p2=B*A
disp('no')
disp('Part (b)')
v1=A*(B*C)
v2=(A*B)*C
disp('yes')
disp('Part (c)')
t1=(A*B)'
t2=A'*B'
disp('no')
disp('Part (d)')
s1=(A+B)'
s2=A'+B'
disp('yes')
```

Command Window:

```
Part (a)
p1 =
    -5    30    14
    18    26   -14
    12    46    -8
p2 =
    -6    -4    -2
    19   -13    -7
    18     8    32
no
Part (b)
v1 =
   -27   290   107
   -12   210    -8
   -12   376    56
v2 =
   -27   290   107
   -12   210    -8
   -12   376    56
yes
Part (c)
t1 =
    -5    18    12
    30    26    46
    14   -14    -8
t2 =
    -6    19    18
    -4   -13     8
    -2    -7    32
no
Part (d)
s1 =
     1     7     0
    -5     3     7
     6    -2     5
s2 =
     1     7     0
    -5     3     7
     6    -2     5
Yes
```

Problem 31

Script file:

```
clear, clc
A=10*rand(4,4)
disp('Part (a)')
disp('linear algebra multiplication')
R=A*A
disp('Part (b)')
disp('element-by-element multiplication')
R=A.*A
disp('Part (c)')
disp('linear algebra, left division (left multiply by inverse)')
R=A\A
disp('Part (d)')
disp('element-by element, right division')
R=A./A
disp('Part (e)')
disp('determinant')
R=det(A)
disp('Part (f)')
disp('inverse')
R=inv(A)
```

Command Window:

```
A =

    8.1472    6.3236    9.5751    9.5717

    9.0579    0.9754    9.6489    4.8538

    1.2699    2.7850    1.5761    8.0028

    9.1338    5.4688    9.7059    1.4189

Part (a)

linear algebra multiplication

R =

  223.2405  136.6999  247.0195  198.8841

  139.2180  111.6463  158.4599  175.5387

  110.6692   58.9020  119.1899   49.6407

  149.2358   97.8828  169.2935  193.6574

Part (b)

element-by-element multiplication
```

```
R =

   66.3775   39.9878   91.6819   91.6169

   82.0459    0.9514   93.1010   23.5590

    1.6126    7.7561    2.4842   64.0449

   83.4255   29.9079   94.2050    2.0132
```

Part (c)

linear algebra, left division (left multiply by inverse)

```
R =

    1.0000         0    0.0000   -0.0000

    0.0000    1.0000   -0.0000   -0.0000

   -0.0000         0    1.0000    0.0000

    0.0000         0         0    1.0000
```

Part (d)

element-by element, right division

```
R =

     1     1     1     1

     1     1     1     1

     1     1     1     1

     1     1     1     1
```

Part (e)

determinant

```
R =

 -261.4072
```

```
Part (f)

inverse

R =

   -1.5300    0.3076    1.4723    0.9645

   -0.0209   -0.1844    0.1037    0.1871

    1.4569   -0.1934   -1.4650   -0.9041

   -0.0369    0.0535    0.1438   -0.0401
```

Problem 32

Script file:

```
clear, clc
M=magic(6);
disp('check rows')
sum_rows=sum(M')
disp('check columns')
sum_cols=sum(M)
disp('check one diagonal')
dum_d1=sum(diag(M))
disp('check other diagonal')
dum_d1=sum(diag(fliplr(M)))
```

Command Window:

```
check rows
sum_rows =
   111   111   111   111   111   111
check columns
sum_cols =
   111   111   111   111   111   111
check one diagonal
dum_d1 =
   111
check other diagonal
dum_d1 =
   111
```

Problem 33

Script file:

```
clear, clc
A=[-4 3 1; 5 6 -2; 2 -5 4.5]; y=[-18.2 -48.8 92.5]';
result=A\y
```

Command Window:

```
result =

    2.8000

   -6.4000

   12.2000
```

Problem 34

Script file:

```
clear, clc
B=[2.5 -1 3 1.5 -2; 3 4 -2 2.5 -1; -4 3 1 -6 2; 2 3 1 -2.5 4; 1 2 5 -3 4];
y=[57.1 27.6 -81.2 -22.2 -12.2]';
result=B\y
disp('check')
B*result
```

Command Window:

```
result =
    8.2000
   -2.0000
    4.8000
    6.0000
   -5.6000
```

Problem 35

Script file:

```
clear, clc
R=[3 1 1 2 1; 1 2 1 3 1; 1 1 0 3 3; 2 0 3 1 2; 1 2 3 0 2];
p=16*[128 118 112 112 104]';
result=R\p
```

Command Window:

```
result =
  320.0000
  224.0000
  192.0000
  256.0000
  160.0000
```

Problem 36

Script file:

```
clear, clc
V1=18; V2=18; V3=12; V4=28;
R1=4; R2=4; R3=6; R4=4; R5=2; R6=3; R7=2.5;
A=[-(R1+R2+R4) R2 R4 0; R2 -(R2+R3+R5) 0 R5; R4 0 -(R4+R6) R6; ...
    0 R5 R6 -(R5+R6+R7)];
V=[18 -18 12 -28]';
I=A\V
```

Command Window:

```
I =
   -1.1310
    1.7795
   -0.6725
    3.9389
```

Problem 37

Script file:

```
clear, clc
V1=40; V2=30; V3=36;
R1=16; R2=20; R3=10; R4=14; R5=8; R6=16; R7=10; R8=15; R9=6; R10=4;
A=[-(R1+R2+R3) R2 R3 0 0; R2 -(R2+R4+R5+R6) R5 R6 R4; ...
    R3 R5 -(R3+R5+R7) R7 0; 0 R6 R7 -(R6+R7+R8+R9) R8; ...
    0 R4 0 R8 -(R4+R8+R10)];
V=[-V1 0 -V2 V3 V1]';
I=A\V
```

Command Window:

```
I =
    0.7406
   -0.6047
    0.6161
   -1.5316
   -2.1649
```

Chapter 4
Solved Problems

Problem 1

Script file:

```
clear, clc
T=input('Please enter the temperature in deg F: ');
R=input('Please enter the relative humidity in percent: ');
HI=-42.379+2.04901523*T+10.14333127*R-0.22475541*T*R-6.83783e-3*T^2 ...
    - 5.481717e-2*R^2+1.22874e-3*T^2*R + 8.5282e-4*T*R^2-1.99e-6*T^2*R^2;
fprintf('\nThe Heat Index Temperature is: %.0f\n',HI)
```

Command Window:

```
Please enter the temperature in deg F: 90
Please enter the relative humidity in percent: 90

The Heat Index Temperature is: 122
```

Problem 2

Script file:

```
clear, clc
format bank
F=100000; r=4.35; years=5:10;
%convert percent to decimal
r=r/100;
monthly_deposit=F*(r/12)./((1+r/12).^(12*years)-1);
tbl=[years' monthly_deposit'];
disp('                     Monthly')
disp('         Years       Deposit')
disp(tbl)
```

Command Window:

```
                     Monthly
         Years       Deposit
          5.00       1494.99
          6.00       1218.02
          7.00       1020.55
          8.00        872.78
          9.00        758.13
         10.00        666.67
```

Problem 3

Script file:

```
clear, clc
%40 minutes is 2/3 hour
format short g
k=1.5*log(2);
t=2:2:24;
Number_of_bactera=exp(k*t)
```

Command Window:

```
Number_of_bactera =
  Columns 1 through 5
            8           64          512         4096        32768
  Columns 6 through 10
   2.6214e+05   2.0972e+06   1.6777e+07   1.3422e+08   1.0737e+09
  Columns 11 through 12
   8.5899e+09   6.8719e+10
```

Problem 4

Script file:

```
clear, clc
format short g
r2=12:4:28;
r1=0.7*r2;
S=pi^2*(r2.^2-r1.^2);
V=1/4*pi^2*(r1+r2).*(r2-r1).^2;
tbl=[r2' r1' V' S'];
disp('         Outer        Inner                  Surface')
disp('         Radius       Radius      Volume       Area')
disp('          (in)         (in)      (in^3)       (in^2)')
disp(tbl)
```

Command Window:

```
         Outer        Inner                  Surface
         Radius       Radius      Volume       Area
          (in)         (in)      (in^3)       (in^2)
           12          8.4       652.34       724.82
           16         11.2       1546.3       1288.6
           20           14       3020.1       2013.4
           24         16.8       5218.7       2899.3
           28         19.6       8287.2       3946.3
```

Problem 5

Script file:

```
clear, clc
format short g
W=500; L=120; h=50;
x=10:20:110;
Tension=W*L*sqrt(h^2+x.^2)./(h*x)
```

Command Window:

```
Tension =
  Columns 1 through 5
       6118.8        2332.4        1697.1        1474.7        1372.8
  Column 6
       1318.2
```

Problem 6

Script file:

```
clear, clc
grades=input('Please enter the grades as a vector [x x x]: ');
number=length(grades);
aver=mean(grades);
standard_dev=std(grades);
middle=median(grades);
fprintf('\nThere are %i grades.\n',number)
fprintf('The average grade is %.1f.\n',aver)
fprintf('The standard deviation is %.1f.\n',standard_dev)
fprintf('The median grade is %.1f.\n',middle)
```

Command Window:

```
Please enter the grades as a vector [x x x]: [92 74 53 61 100 42 80 66 71 78
91 85 79 68]

There are 14 grades.
The average grade is 74.3.
The standard deviation is 15.8.
The median grade is 76.0.
```

Problem 7

Script file:

```
clear, clc
format short g
h=4:4:40;  theta=[2 2.9 3.5 4.1 4.5 5 5.4 5.7 6.1 6.4];
R=h.*cosd(theta)./(1-cosd(theta));
average=mean(R);
disp('The average estimated radius of the earth in km is:')
disp(average)
```

Command Window:

```
The average estimated radius of the earth in km is:
       6363.1
```

Problem 8

Script file:

```
clear, clc
k=log(0.5)/13.3;
t=0:4:48;
ratio=exp(k*t)
```

Command Window:

```
ratio =
  Columns 1 through 7
    1.0000    0.8118    0.6591    0.5350    0.4344    0.3526    0.2863
  Columns 8 through 13
    0.2324    0.1887    0.1532    0.1244    0.1010    0.0820
```

Problem 9

Script file:

```
clear, clc
L=input('Please enter the mortgage amount: ');
N=input('Please enter the number of years: ');
r=input('Please enter the interest rate in percent: ');
P=L*(r/1200)*(1+r/1200)^(12*N)/((1+r/1200)^(12*N)-1);
fprintf('\nThe monthly payment of a %i years %.2f mortgage\n',N,L)
fprintf('with interest rate of %.2f percent is $%.2f\n',r,P)
```

Command Window:

```
Please enter the mortgage amount: 250000
Please enter the number of years: 30
Please enter the interest rate in percent: 4.5

The monthly payment of a 30 years 250000.00 mortgage
with interest rate of 4.50 percent is $1266.71
```

Problem 10

Script file:

```
clear, clc
format bank
A=20000; r=6.5; P=391.32; month=6:6:60;
B=A*(1+r/1200).^month-P*1200/r*((1+r/1200).^month-1);
perc=100*B/A;
tbl=[month' B' perc'];
disp('                   Balance        Remaining')
disp('         Month          $                %')
disp(tbl)
```

Command Window:

```
                   Balance        Remaining
         Month        $               %
          6.00     18278.92         91.39
         12.00     16501.14         82.51
         18.00     14664.80         73.32
         24.00     12767.96         63.84
         30.00     10808.63         54.04
         36.00      8784.76         43.92
         42.00      6694.22         33.47
         48.00      4534.80         22.67
         54.00      2304.25         11.52
         60.00         0.21          0.00
```

Problem 11

Script file:

```
clear, clc
format short g
alt=-500:500:10000;
p=29.921*(1-6.8753e-6*alt);
Tb=49.16*log(p)+44.932;
tbl=[alt' Tb'];
disp('                    Boiling')
disp('       Altitude   Temperature')
disp('         (ft)        (degF)')
disp(tbl)
```

Command Window:

```
                    Boiling
       Altitude   Temperature
         (ft)       (degF)
         -500       212.17
            0       212.01
          500       211.84
         1000       211.67
         1500        211.5
         2000       211.32
         2500       211.15
         3000       210.98
         3500       210.81
         4000       210.63
         4500       210.46
         5000       210.29
         5500       210.11
         6000       209.93
         6500       209.76
         7000       209.58
         7500        209.4
         8000       209.22
         8500       209.04
         9000       208.87
         9500       208.68
        10000        208.5
```

Problem 12

Script file:

```
clear, clc
a=10:.1:120;
h=2*600./a;
theta=atan(a./(2*h));
height=h+2+2./sin(theta);
base=2*height.*tan(theta);
[min_area indx] = min(0.5*base.*height);
inner_base=a(indx)
inner_height=h(indx)
outer_base=base(indx)
outer_height=height(indx)
```

Command Window:

```
inner_base =
   37.2000
inner_height =
   32.2581
outer_base =
   44.1237
outer_height =
   38.2620
```

Problem 13

Script file:

```
clear, clc
a=5:.25:100; R=55;
b=sqrt((2*R)^2-a.^2);
h=b-20; w=a-8;
[max_area indx] = max(h.*w);
width_a=a(indx)
height_b=b(indx)
```

Command Window:

```
width_a =
   74.5000
height_b =
   80.9305
```

Problem 14

Script file:

```
clear, clc
vrun=3; vswim=1; L=48; ds=30; dw=42;
y=20:1:48;
ls = sqrt(y.^2+ds^2);
lw = sqrt((L-y).^2+dw^2);
t=ls/vrun + lw/vswim;
[tmin indx] = min(t);
min_t=t(indx)
y_at_min=y(indx)
phi = atan(y_at_min/ds);
alpha = atan((L-y_at_min)/dw);
sin_ratio=sin(phi)/sin(alpha)
speed_ratio=vrun/vswim
```

Command Window:

```
min_t =
   59.2946
y_at_min =
    37
sin_ratio =
    3.0658
speed_ratio =
     3
```

Discussion: The minimum time is 59.29 seconds with the lifeguard entering the water at 37 m. Snell's law seems only approximately satisfied, but this is due to the relatively large increment in y. The ratio converges to Snell's law as the increment decreases. For example, decreasing the increment to .01 gives a sine ratio of 2.9996.

Problem 15

Script file:

```
clear, clc
H=70; h=900;
x=50:.5:1500;
theta=atan(h./x)-atan((h-H)./x);
[max_th indx]=max(theta);
disp('The best target view occurs at a distance in feet of')
disp(x(indx))
```

Command Window:

```
The best target view occurs at a distance in feet of
  864.5000
```

Problem 16

Script file:

```
clear, clc
load stress_data.txt
M=stress_data(1); b=stress_data(2); t=stress_data(3); a=stress_data(4);
alpha=a/b; beta=pi*alpha/2;
C=sqrt(tan(beta)/beta)*((0.923+0.199*(1-sin(beta))^2)/cos(beta));
sigma=6*M/(t*b^2);
K=C*sigma*sqrt(pi*a);
fprintf('The stress intensity factor for a beam that is %.2f m wide',b)
fprintf(' and %.2f m thick\nwith an edge crack of %.2f m and an',t,a)
fprintf(' applied moment of %.0f is %.0f pa-sqrt(m).\n',M,K)
```

Text File (stress_data.txt):

```
20 .25 .01 .05
```

Command Window:

```
The stress intensity factor for a beam that is 0.25 m wide and 0.01 m thick
with an edge crack of 0.05 m and an applied moment of 20 is 82836 pa-sqrt(m).
```

Problem 17

Script file:

```
clear, clc
v=50; rho=2000; h=500;
t_90=pi*rho/(2*v);
t=linspace(0,t_90,15);
alpha=v*t/rho;
r=sqrt(rho^2 + (h+rho)^2 - 2*rho*(rho+h)*cos(alpha));
theta=90-asind(rho*sin(alpha)./r);
fprintf('For a plane flying at a speed of %.0f m/s in a circular path ',v)
fprintf('of radius %.0f m\ncentered above the tracking station and ',rho)
fprintf('%.0f m above the station at its lowest point:\n\n',h)
%fprintf accesses elements column by column
%can also use disp as shown in problem 11
tbl=[t;theta;r];
fprintf('    Time      Tracking       Distance\n')
fprintf('     (s)     Angle (deg)        (m)\n')
fprintf('    %4.1f        %4.1f          %6.1f\n',tbl)
```

Command Window:

```
For a plane flying at a speed of 50 m/s in a circular path of radius 2000 m
centered above the tracking station and 500 m above the station at its lowest
point:

    Time       Tracking        Distance
     (s)      Angle (deg)        (m)
     0.0         90.0           500.0
     4.5         66.4           559.4
     9.0         51.0           707.6
    13.5         42.8           900.6
    18.0         38.8          1113.7
    22.4         37.2          1335.2
    26.9         36.9          1559.4
    31.4         37.5          1783.0
    35.9         38.7          2003.8
    40.4         40.3          2220.3
    44.9         42.2          2431.3
    49.4         44.3          2635.8
    53.9         46.5          2832.8
    58.3         48.9          3021.6
    62.8         51.3          3201.6
```

Problem 18

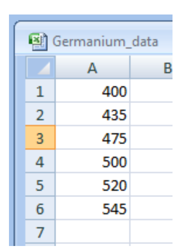
Script file:

```
clear, clc
C=13.83; Eg=0.67; k=8.62e-5;
T=xlsread('Germanium_data.xlsx');
sigma=exp(C-Eg./(2*k*T));
tbl=[T sigma];
disp('                 Intrinsic')
disp('   Temperature  Conductivity')
disp('      deg K      (ohm-m)^-1')
%can also use disp as shown in problem 11
fprintf('      %4.0f         %5.1f\n',tbl')
```

Command Window:

```
                 Intrinsic
   Temperature  Conductivity
      deg K      (ohm-m)^-1
       400          61.2
       435         133.7
       475         283.8
       500         427.3
       520         576.1
       545         811.7
```

Excel File:



Germanium_data

	A	B
1	400	
2	435	
3	475	
4	500	
5	520	
6	545	
7		

Problem 19

Script file:

```
clear, clc
rho=input('Please input the fluid density in kg/m^3: ');
v=input('Please input the fluid velocity in m/s: ');
d_ratio=input('Please input the pipe diameter ratio as a vector [x x x]: ');
delP=0.5*(1-d_ratio.^2).^2*rho*v^2;
fprintf('\nFor gasoline with a density of %.0f kg/m^3 and a flow ',rho)
fprintf('velocity of %.1f m/s\n\n',v)
tbl=[d_ratio;delP];
disp('             delta P')
disp('    d/D        (Pa)')
fprintf('    %3.1f      %6.1f\n',tbl)
```

Command Window:

```
Please input the fluid density in kg/m^3: 737
Please input the fluid velocity in m/s: 5
Please input the pipe diameter ratio as a vector [x x x]: [.9:-.1:.4 .2]

For gasoline with a density of 737 kg/m^3 and a flow velocity of 5.0 m/s

             delta P
    d/D        (Pa)
    0.9       332.6
    0.8      1193.9
    0.7      2396.2
    0.6      3773.4
    0.5      5182.0
    0.4      6500.3
    0.2      8490.2
```

Problem 20

Script file:

```
clear, clc
sigma=5.669e-8;
T1=input('Please input the temperature of plate 1 in deg K: ');
T2=input('Please input the temperature of plate 2 in deg K: ');
a=input('Please input the radius of plate 1 in m: ');
b=input('Please input the radius of plate 2 in m: ');
c=input('Please input the distance between plate 1 and plate 2 in m: ');
X=a./c; Y=c/b; Z=1+(1+X.^2).*Y.^2;
F_1_2 = 0.5*(Z-sqrt(Z.^2-4*X.^2.*Y.^2));
q=sigma*pi*b^2*F_1_2*(T1^4-T2^4);
fprintf('\nFor circular plate 1 with radius %i m and temperature %i',a,T1)
fprintf(' deg K\nand circular plate 2 with radius %i m and temperature',b)
fprintf(' %i deg K\n',T2)
tbl=[c;q];
fprintf('\n                       Radiation\n')
fprintf('     Separation     Heat Exchange\n')
fprintf('         (m)           (Watts)\n')
fprintf('        %4.1f            %6.0f\n',tbl)
```

Command Window:

```
Please input the temperature of plate 1 in deg K: 400
Please input the temperature of plate 2 in deg K: 600
Please input the radius of plate 1 in m: 1
Please input the radius of plate 2 in m: 2
Please input the distance between plate 1 and plate 2 in m: 10.^(-1:1)

For circular plate 1 with radius 1 m and temperature 400 deg K
and circular plate 2 with radius 2 m and temperature 600 deg K

                       Radiation
     Separation     Heat Exchange
         (m)           (Watts)
         0.1            -18461
         1.0            -14150
        10.0              -706
```

Problem 21

Script file:

```
clear, clc
x1=input('Please enter the coordinates of point 1 as a vector [x x]: ');
x2=input('Please enter the coordinates of point 2 as a vector [x x]: ');
x3=input('Please enter the coordinates of point 3 as a vector [x x]: ');
A=2*[x1(1)-x2(1) x1(2)-x2(2); x2(1)-x3(1) x2(2)-x3(2)];
B=[x1(1)^2+x1(2)^2-x2(1)^2-x2(2)^2; x2(1)^2+x2(2)^2-x3(1)^2-x3(2)^2];
C=A\B;
r=sqrt((x1(1)-C(1))^2 + (x1(2)-C(2))^2);
fprintf('\nThe coordinates of the center are (%.1f, %.1f) ',C)
fprintf('and the radius is %.1f.\n',r)
```

Command Window:

```
Please enter the coordinates of point 1 as a vector [x x]: [10.5, 4]
Please enter the coordinates of point 2 as a vector [x x]: [2, 8.6]
Please enter the coordinates of point 3 as a vector [x x]: [-4, -7]

The coordinates of the center are (2.5, -0.6) and the radius is 9.2.
```

Problem 22

Script file:

```
clear, clc
T=[cosd(48.81) 1 0 0 0 0 0 0 0
    0 -1 0 0 cosd(48.81) 1 0 0 0
    0 0 1 0 sind(48.81) 0 0 0 0
    -cosd(48.81) 0 0 1 0 0 0 0 0
    -sind(48.84) 0 -1 0 0 0 0 0 0
    0 0 0 -1 -cosd(48.81) 0 0 0 0
    0 0 0 0 -sind(48.81) 0 -1 0 -sind(45)
    0 0 0 0 0 0 0 0 sind(45)
    0 0 0 0 0 0 0 -1 -cosd(45)];
A=[0; 0; 0; 0; 1800; 1200; 0; 1500; 0];
N=1:9;
F=T\A;
tbl=[N;F'];
disp(' ')
disp('  Member      Force')
disp('    No.        lbf')
fprintf('     %1i       %7.1f\n',tbl)
```

Command Window:

```
  Member      Force
    No.        lbf
     1       -2106.6
     2        1387.3
     3        -214.0
     4       -1387.3
     5         284.4
     6        1200.0
     7       -1714.0
     8       -1500.0
     9        2121.3
```

Problem 23

Script file:

```
clear, clc
T=[.7071 1 0 0 0 0 0 0 0 0 0 0 0; 0 -1 0 0 0 1 0 0 0 0 0 0 0; ...
    0 0 1 0 0 0 0 0 0 0 0 0 0; -.7071 0 0 1 .6585 0 0 0 0 0 0 0 0; ...
    .7071 0 1 0 .7526 0 0 0 0 0 0 0 0; 0 0 0 -1 0 0 1 .6585 0 0 0 0 0; ...
    0 0 0 0 0 0 0 .7526 1 0 0 0 0; 0 0 0 0 -.6585 -1 0 0 0 1 0 0 0; ...
    0 0 0 0 .7526 0 0 0 1 0 0 0 0; 0 0 0 0 0 0 -1 0 0 0 .7071 0 0; ...
    0 0 0 0 0 0 0 0 0 0 .7071 1 0; 0 0 0 0 0 0 0 .7526 0 0 0 1 0; ...
    0 0 0 0 0 0 0 0 0 0 .7071 0 1];
A=[0; 0; 2000; 0; -2000; 0; 0; 0; 1000; 0; -3000; 2000; 0];
N=1:13; F=T\A;
tbl=[N;F'];
disp(' ')
disp('  Member      Force')
disp('    No.        lbf')
fprintf('    %2i       %7.1f\n',tbl)
```

Command Window:

```
  Member      Force
    No.        lbf
     1       -6741.2
     2        4766.7
     3        2000.0
     4       -5437.5
     5        1018.7
     6        4766.7
     7       -5233.3
     8        -310.0
     9         233.3
    10        5437.5
    11       -7401.1
    12        2233.3
    13        5233.3
```

Problem 24

Script file:

```
clear, clc
x=[-2.6 0.5 1.5 3.5]; y=[-68; 5.7; 4.9; 88]; power=3:-1:0;
X=[x(1).^power; x(2).^power; x(3).^power; x(4).^power];
coefs=X\y;
fprintf('\nThe equation is f(x)=%.3fx^3 + %.3fx^2 + %.3fx + %.3f\n',coefs)
```

Command Window:

```
The equation is f(x)=3.297x^3 + -4.016x^2 + -3.483x + 8.033
```

Problem 25

Script file:

```
c=1; t=0.2;
x=[.15 .35 .5 .7 .85]; y=[.08909 .09914 .08823 .06107 .03421];
A=sqrt(x/c); B=x/c; C=(x/c).^2; D=(x/c).^3; E=(x/c).^4;
X=[A' B' C' D' E']; Y=0.2*y'/(t*c);
coefs=X\Y;
fprintf('The coefficients are:\n')
fprintf('a0=%.4f, a1=%.4f, a2=%.4f, a3=%.4f, a4=%.4f\n',coefs)
```

Command Window:

```
The coefficients are:
a0=0.2969, a1=-0.1258, a2=-0.3526, a3=0.2861, a4=-0.1025
```

Problem 26

Script file:

```
clear, clc
X=[1 2 1 1; 2 3 0 1; 1 4 1 0; 1 3 2 0]; Y=[5; 12; 11; 8];
coefs=X\Y;
fprintf('The scoring values are:\nEagle: %.1f\nBirdie: %.1f\n',coefs(1:2))
fprintf('Bogey: %.1f\nDouble: %.1f\n',coefs(3:4))
```

Command Window:

```
The scoring values are:
Eagle: 4.0
Birdie: 2.0
Bogey: -1.0
Double: -2.0
```

Problem 27

Script file:

```
clear, clc
X=[1 0 0 -1 0 0 0; 1 0 0 0 -1 0 0; 0 1 0 0 0 -1 0; 0 3 0 0 -4 -1 -1; ...
    0 0 1 0 0 0 -2; 0 -1 1 -2 2 0 0; 1 0 0 0 0 0 0];
disp('Try a=1')
Y=[0; 0; 0; 0; 0; 0; 1];
coefs=(X\Y)'
disp('Try a=2')
Y=[0; 0; 0; 0; 0; 0; 2];
coefs=(X\Y)'
disp('Try a=3')
Y=[0; 0; 0; 0; 0; 0; 3];
coefs=(X\Y)'
```

Command Window:

```
Try a=1
coefs =
    1.0000    2.6667    2.6667    1.0000    1.0000    2.6667    1.3333
Try a=2
coefs =
    2.0000    5.3333    5.3333    2.0000    2.0000    5.3333    2.6667
Try a=3
coefs =
    3.0000    8.0000    8.0000    3.0000    3.0000    8.0000    4.0000
```

Problem 28

Script file:

```
Ts=40:-10:-40; T=[Ts;Ts;Ts;Ts;Ts;Ts];
vs=[10:10:60]'; v=[vs, vs, vs, vs, vs, vs, vs, vs, vs];
%if using disp for table need round function
Twc=35.74+0.6215*T-35.75*v.^0.16+0.4275*T.*v.^0.16;
tbl=[vs Twc]';
fprintf('                          Temperature (F)\n       ')
fprintf('   %3i',Ts)
fprintf('\n    Speed\n   (mi/hr)\n')
fprintf('     %3.0f   %3.0f   %3.0f   %3.0f   %3.0f   %3.0f   %3.0f   %3.0f
%3.0f   %3.0f\n',tbl)
```

Command Window:

```
                          Temperature (F)
            40    30    20    10     0   -10   -20   -30   -40
    Speed
   (mi/hr)
      10    34    21     9    -4   -16   -28   -41   -53   -66
      20    30    17     4    -9   -22   -35   -48   -61   -74
      30    28    15     1   -12   -26   -39   -53   -67   -80
      40    27    13    -1   -15   -29   -43   -57   -71   -84
      50    26    12    -3   -17   -31   -45   -60   -74   -88
      60    25    10    -4   -19   -33   -48   -62   -76   -91
```

Problem 29

Script file:

```
clear, clc
a_b=0:.05:.95;
C=0.265*(1-a_b)+(0.857+0.265*a_b)./(1-a_b).^1.5;
tbl=[a_b;C];
fprintf('    a/b          C\n')
fprintf('    %4.2f      %6.3f\n',tbl)
```

Command Window:

```
    a/b          C
    0.00       1.122
    0.05       1.192
    0.10       1.273
    0.15       1.370
    0.20       1.484
    0.25       1.620
    0.30       1.785
    0.35       1.985
    0.40       2.231
    0.45       2.539
    0.50       2.931
    0.55       3.441
    0.60       4.122
    0.65       5.063
    0.70       6.424
    0.75       8.512
    0.80      12.005
    0.85      18.669
    0.90      34.669
    0.95      99.183
```

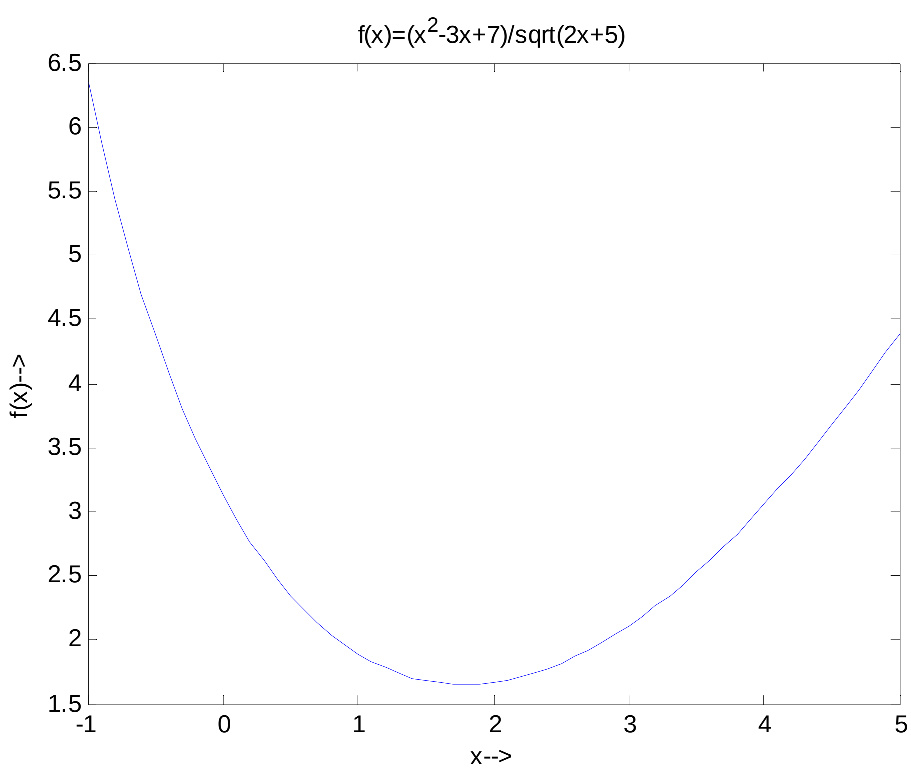
Chapter 5
Solved Problems

Problem 1

Script file:

```
clear, clc
%.1 is usually a good interval to start with - then adjust if necessary
x=-1:.1:5;
f=(x.^2-3*x+7)./sqrt(2*x+5);
plot(x,f)
%note all plot annotation functions will accept some basic tex syntax
title('f(x)=(x^2-3x+7)/sqrt(2x+5)')
%and latex commands for fancier
%title('$$f(x)=\frac{x^2-3x+7}{\sqrt{2x+5}}$$','Interpreter','latex')
xlabel('x-->')
ylabel('f(x)-->')
```

Figure Window:

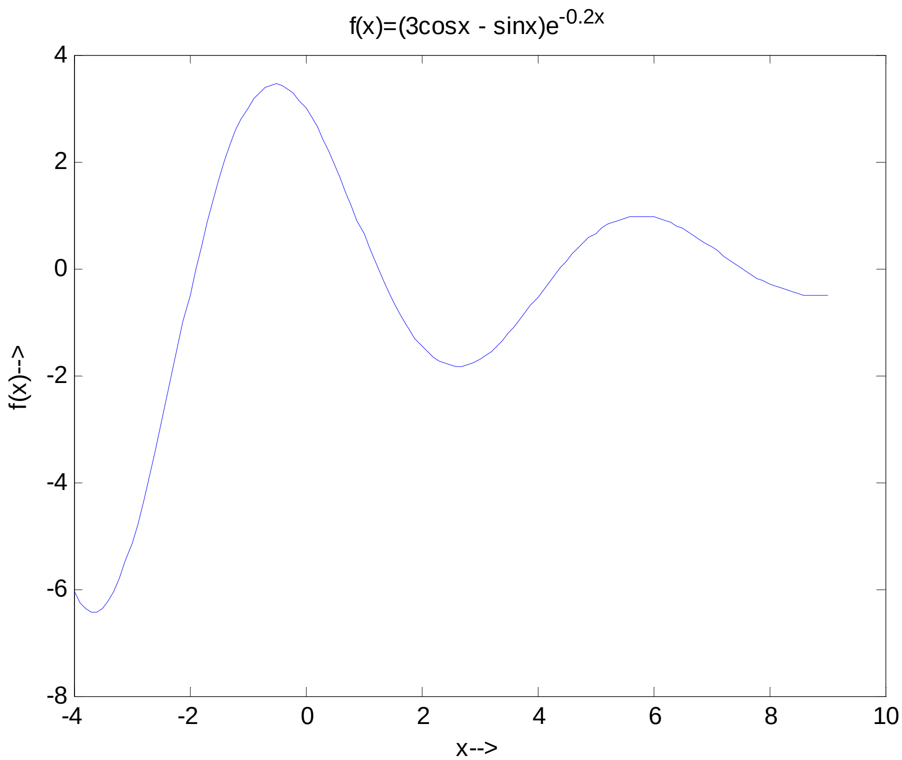


Problem 2

Script file:

```
x=-4:.1:9;
f=(3*cos(x)-sin(x)).*exp(-0.2*x);
plot(x,f)
title('f(x)=(3cosx - sinx)e^{-0.2x}')
xlabel('x-->')
ylabel('f(x)-->')
```

Figure Window:

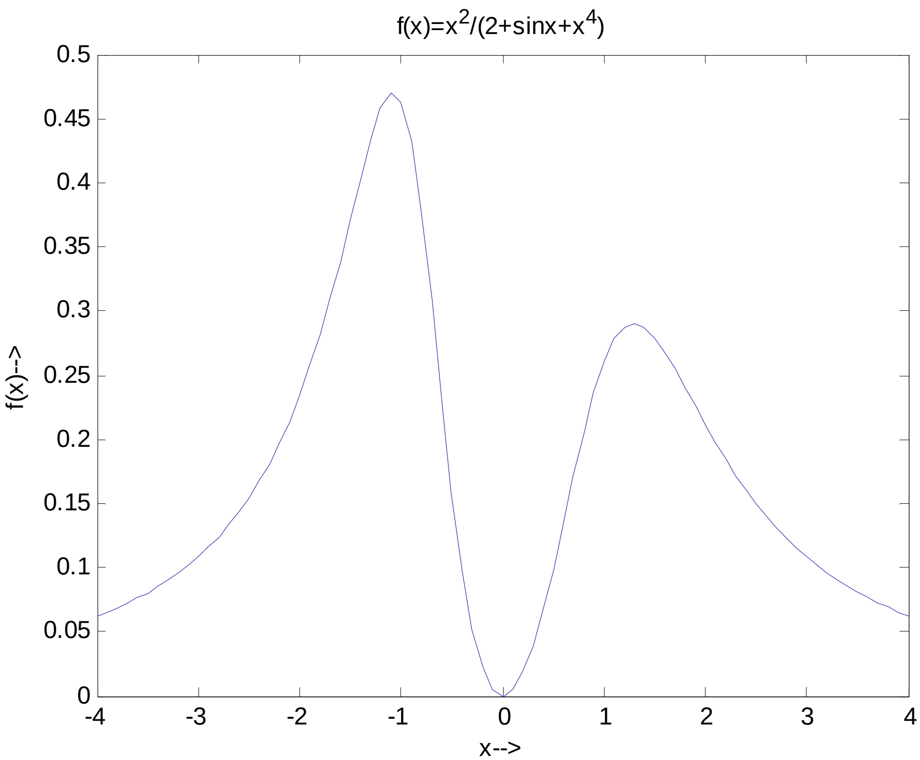


Problem 3

Script file:

```
clear, clc
x=-4:.1:4;
f=x.^2./(2+sin(x)+x.^4);
plot(x,f)
title('f(x)=x^2/(2+sinx+x^4)')
xlabel('x-->')
ylabel('f(x)-->')
```

Figure Window:

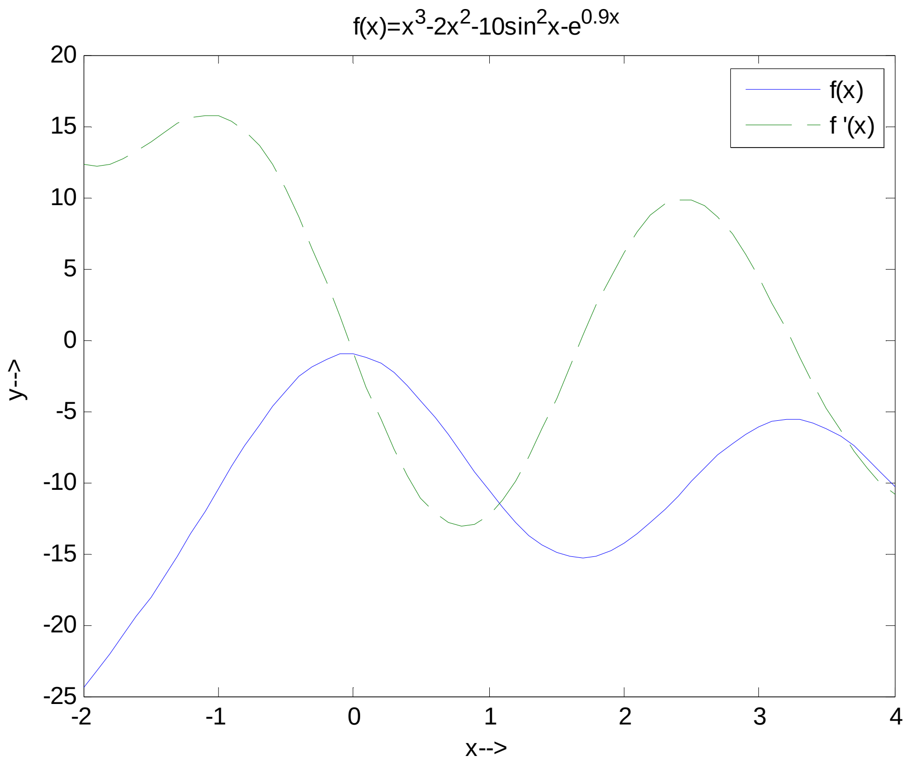


Problem 4

Script file:

```
clear, clc
x=-2:.1:4;
f=x.^3 - 2*x.^2-10*sin(x).^2-exp(0.9*x);
fp=3*x.^2-4*x-20*sin(x).*cos(x)-0.9*exp(0.9*x);
plot(x,f,x,fp,'--')
title('f(x)=x^3-2x^2-10sin^2x-e^{0.9x}')
legend('f(x)','f ''(x)')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:

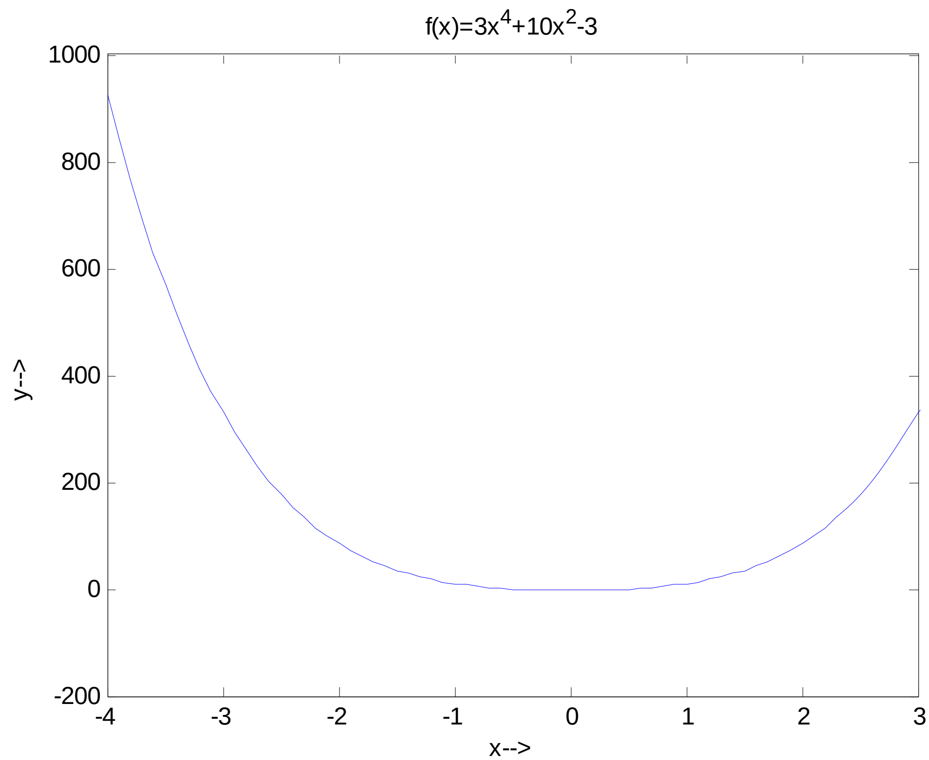


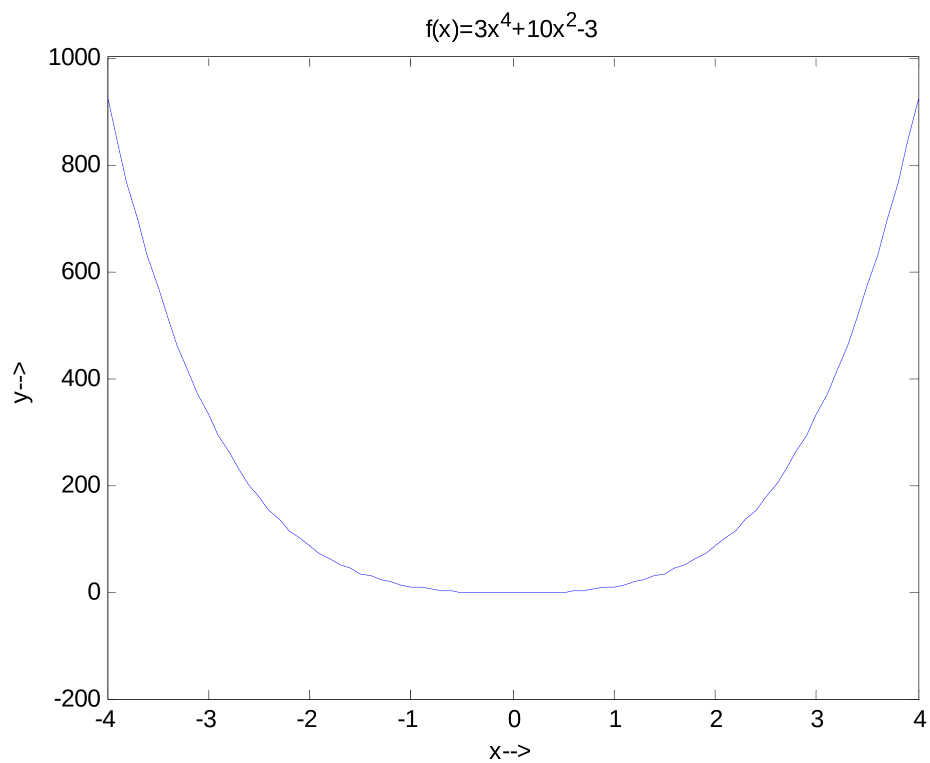
Problem 5

Script file:

```
x=-4:.1:4;
f=3*x.^4+10*x.^2-3;
figure(1)
plot(x,f)
axis([-4 3 -200 1000])
title('f(x)=3x^4+10x^2-3')
xlabel('x-->')
ylabel('y-->')
figure(2)
plot(x,f)
title('f(x)=3x^4+10x^2-3')
xlabel('x-->')
ylabel('y-->')
```

Figure Windows:



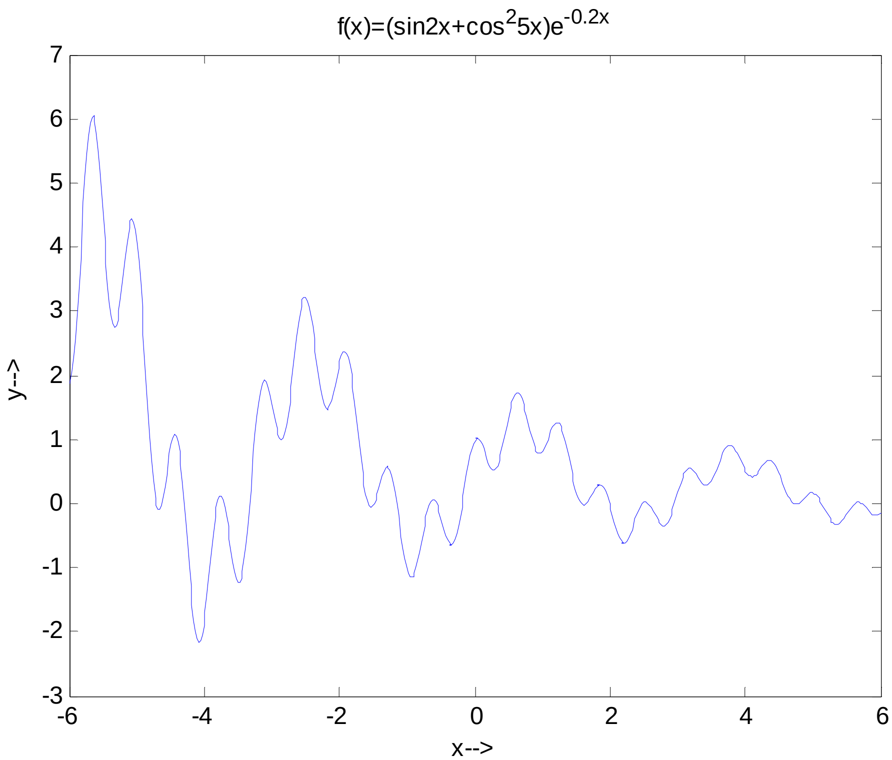


Problem 6

Script file:

```
clear, clc
fplot('(sin(2*x)+cos(5*x)^2)*exp(-0.2*x)',[-6 6])
title('f(x)=(sin2x+cos^25x)e^{-0.2x}')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:

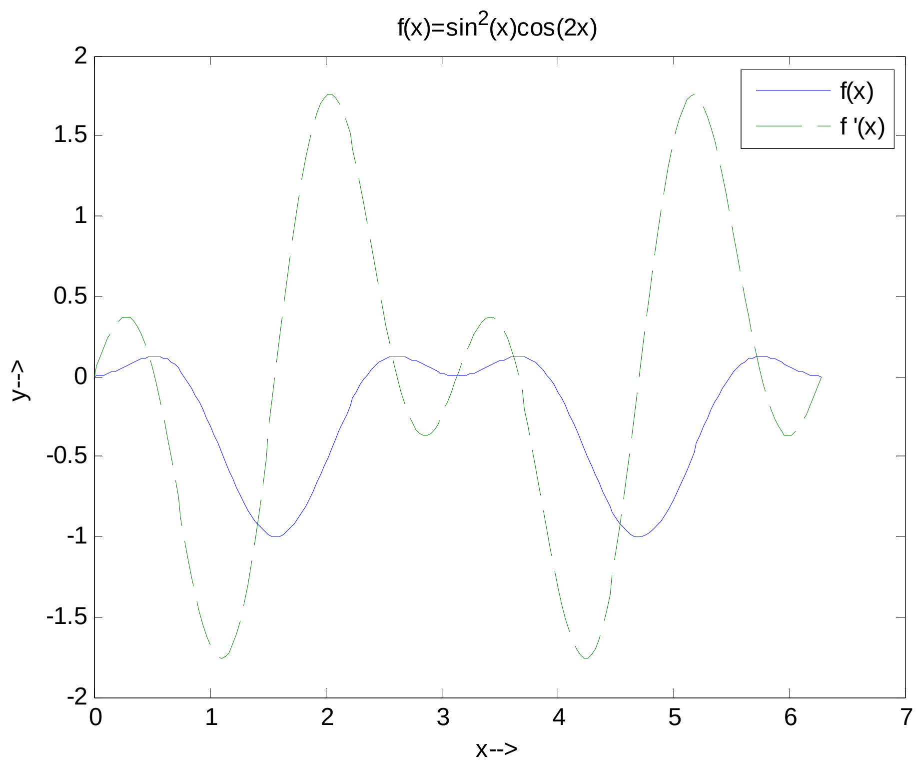


Problem 7

Script file:

```
clear, clc
x=linspace(0,2*pi,200);
f=sin(x).^2.*cos(2*x);
fp=2*sin(x).*cos(x).*cos(2*x)-2*sin(x).^2.*sin(2*x);
plot(x,f,x,fp,'--')
title('f(x)=sin^2(x)cos(2x)')
legend('f(x)','f ''(x)')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:

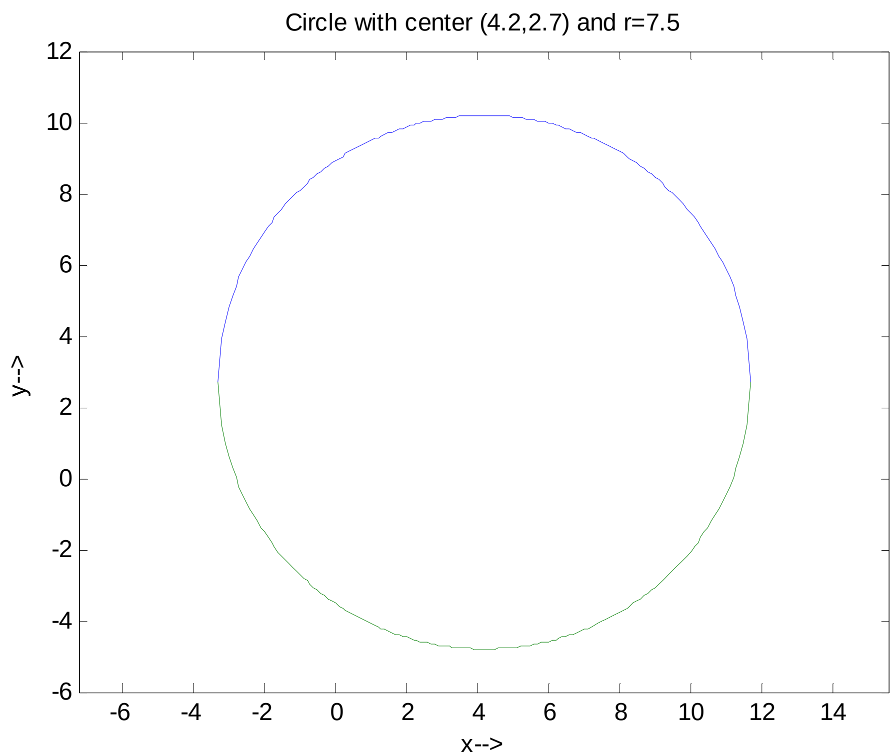


Problem 8

Script file:

```
x=(4.2-7.5):.1:(4.2+7.5);
y1=2.7+sqrt(7.5^2-(x-4.2).^2);
y2=2.7-sqrt(7.5^2-(x-4.2).^2);
plot(x,y1,x,y2)
axis([-4 12 -6 12])
axis equal
title('Circle with center (4.2,2.7) and r=7.5')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:

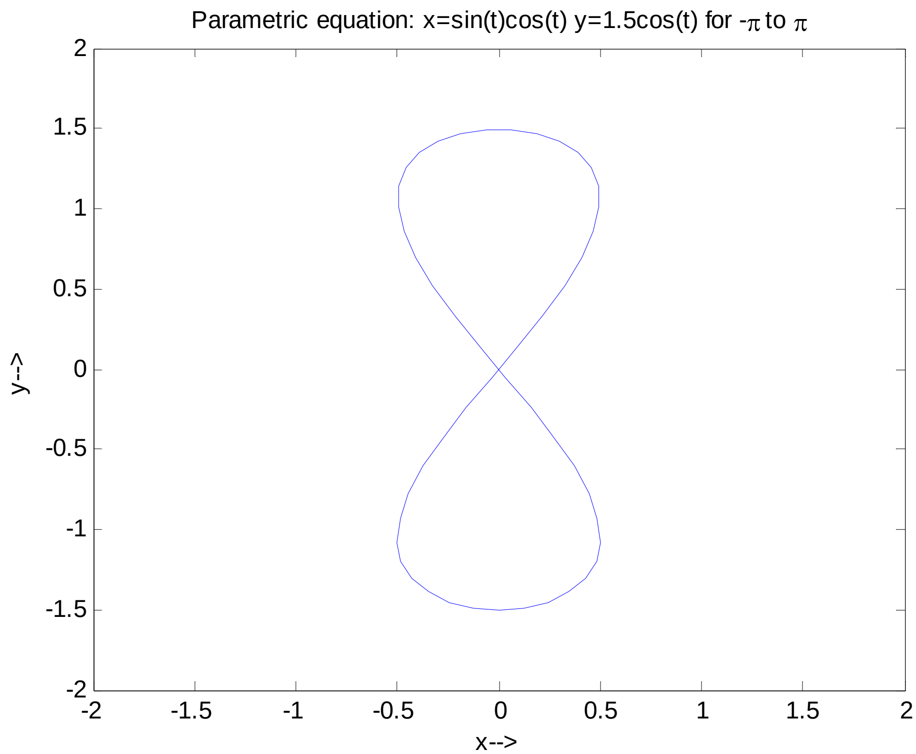


Problem 9

Script file:

```
clear, clc
t=linspace(-pi,pi,50);
x=sin(t).*cos(t); y=1.5*cos(t);
plot(x,y)
axis([-2 2 -2 2])
title('Parametric equation: x=sin(t)cos(t) y=1.5cos(t) for -\pi to \pi')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:

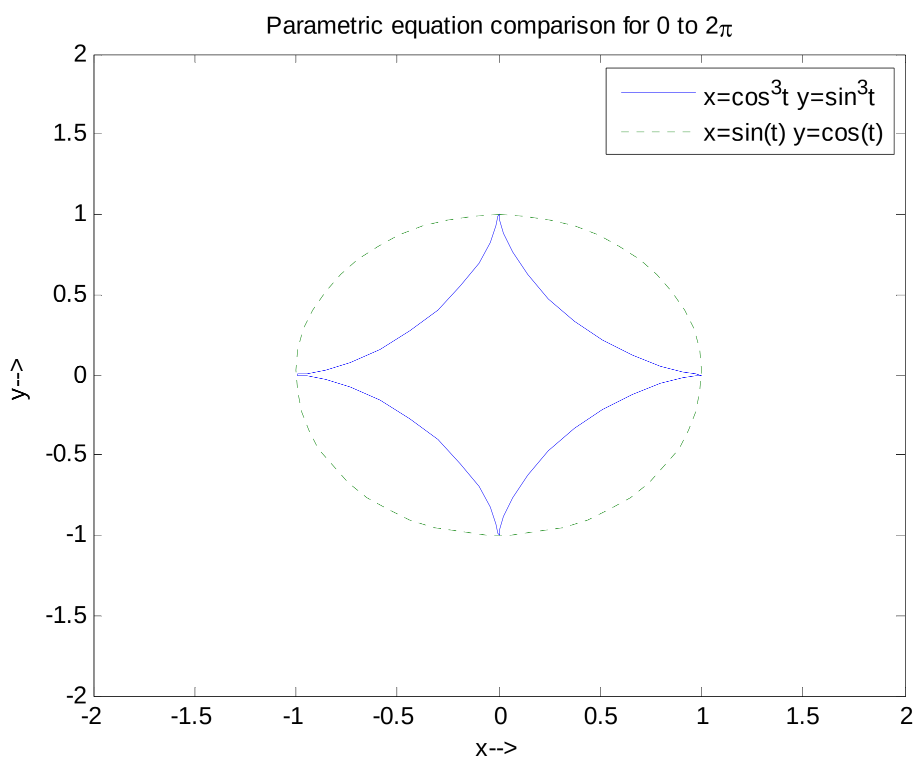


Problem 10

Script file:

```
clear, clc
t=linspace(0,2*pi,50);
x=cos(t).^3; y=sin(t).^3;
u=sin(t); v=cos(t);
plot(x,y,u,v,':')
axis([-2 2 -2 2])
title('Parametric equation comparison for 0 to 2\pi')
legend('x=cos^3t y=sin^3t','x=sin(t) y=cos(t)')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:

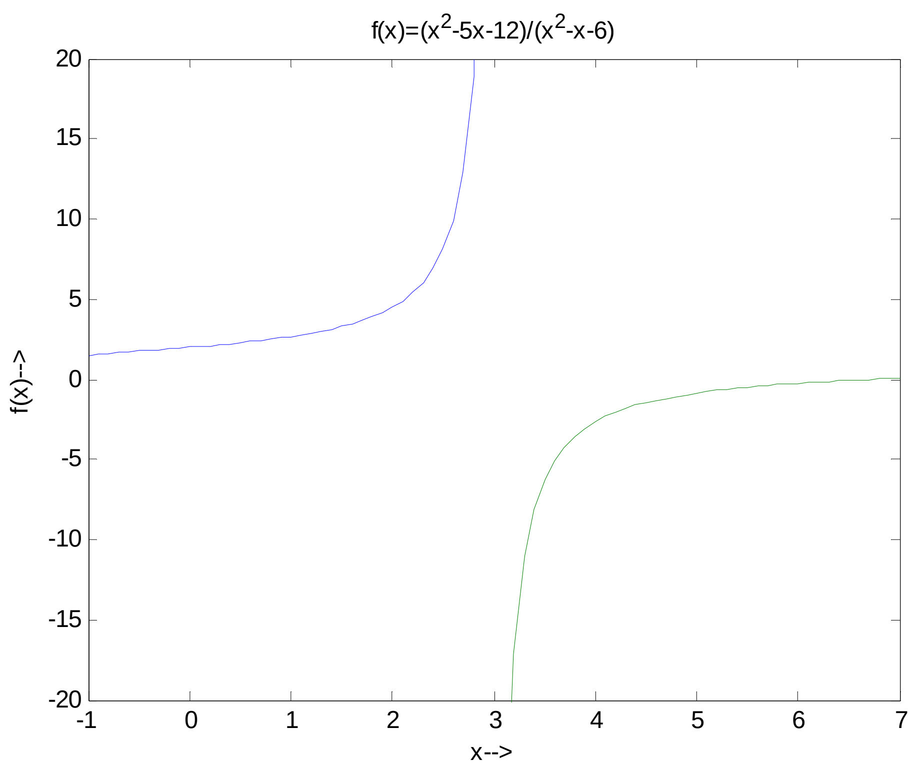


Problem 11

Script file:

```
clear, clc
x1=-1:.1:2.9; x2=3.1:.1:7;
y1=(x1.^2-5*x1-12)./(x1.^2-x1-6);
y2=(x2.^2-5*x2-12)./(x2.^2-x2-6);
plot(x1,y1,x2,y2)
axis([-1 7 -20 20])
title('f(x)=(x^2-5x-12)/(x^2-x-6)')
xlabel('x-->')
ylabel('f(x)-->')
```

Figure Window:

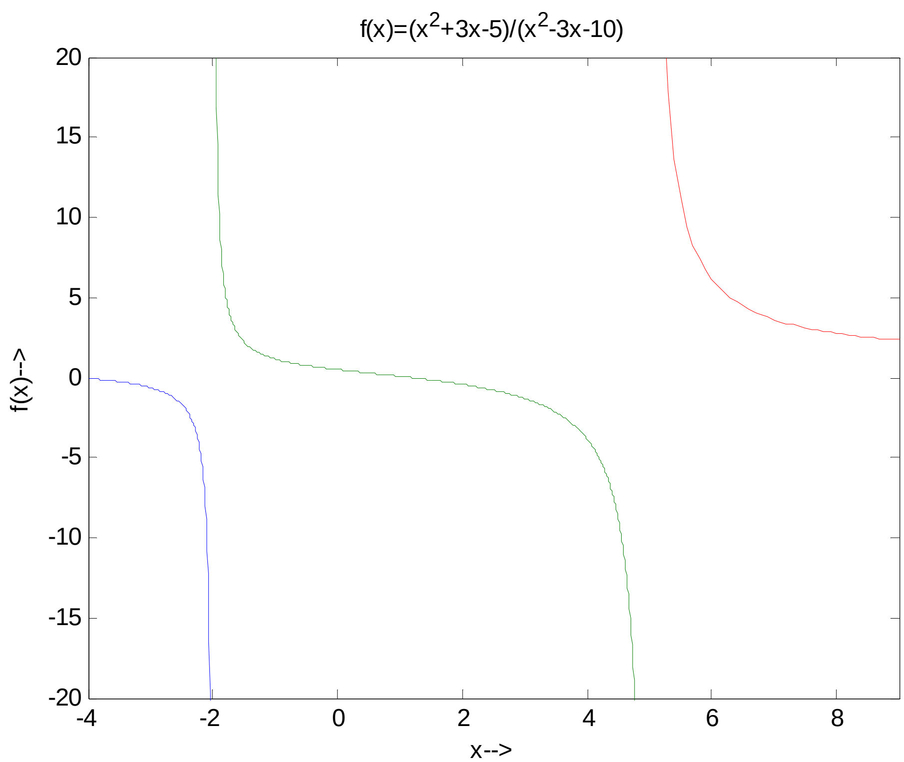


Problem 12

Script file:

```
clear, clc
x1=-4:.01:-2.01; x2=-1.99:.01:4.9; x3=5.1:.1:9;
y1=(x1.^2+3*x1-5)./(x1.^2-3*x1-10);
y2=(x2.^2+3*x2-5)./(x2.^2-3*x2-10);
y3=(x3.^2+3*x3-5)./(x3.^2-3*x3-10);
plot(x1,y1,x2,y2,x3,y3)
axis([-4 9 -20 20])
title('f(x)=(x^2+3x-5)/(x^2-3x-10)')
xlabel('x-->')
ylabel('f(x)-->')
```

Figure Window:

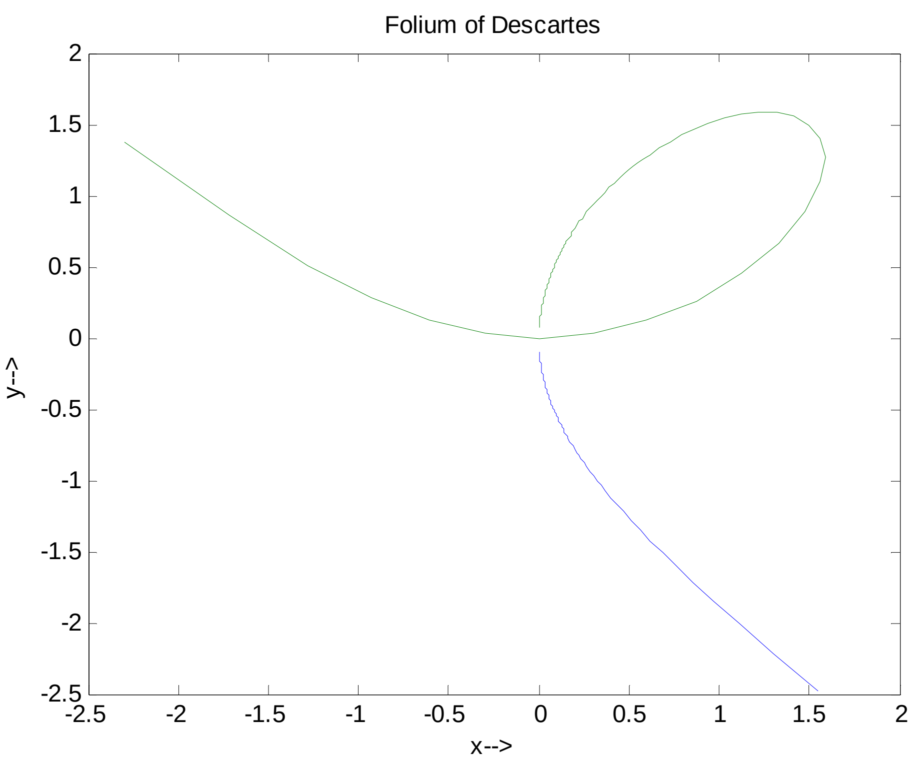


Problem 13

Script file:

```
clear, clc
t1=-30:.1:-1.6; t2=-0.6:.1:40;
x1=3*t1./(1+t1.^3); y1=3*t1.^2./(1+t1.^3);
x2=3*t2./(1+t2.^3); y2=3*t2.^2./(1+t2.^3);
plot(x1,y1,x2,y2)
title('Folium of Descartes')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:

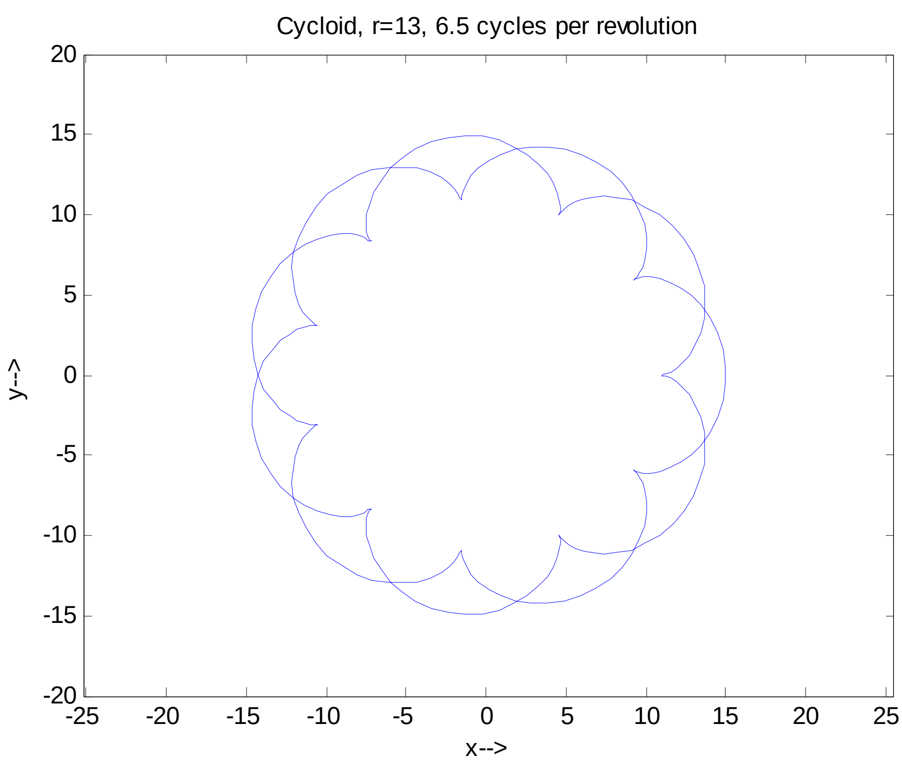


Problem 14

Script file:

```
clear, clc
t=linspace(0,4*pi,300);
x=13*cos(t)-2*cos(6.5*t); y=13*sin(t)-2*sin(6.5*t);
plot(x,y)
axis([-20 20 -20 20])
axis equal
title('Cycloid, r=13, 6.5 cycles per revolution')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:

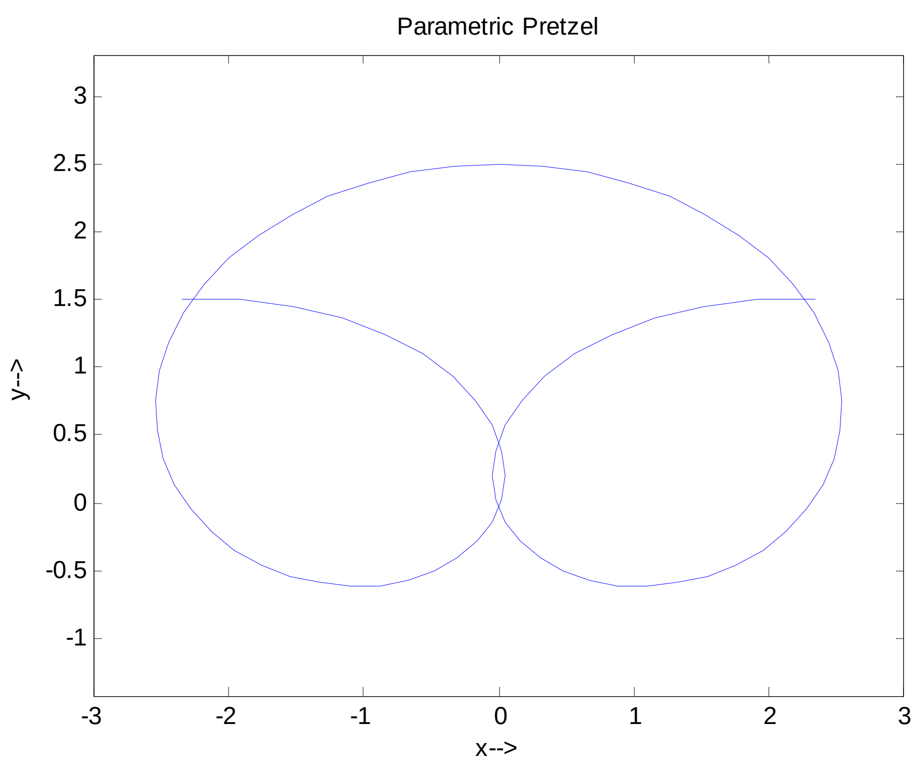


Problem 15

Script file:

```
clear, clc
t=-4:.1:4;
x=(3.3-0.4*t.^2).*sin(t); y=(2.5-0.3*t.^2).*cos(t);
plot(x,y)
axis([-3 3 -1 3])
axis equal
title('Parametric Pretzel')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:

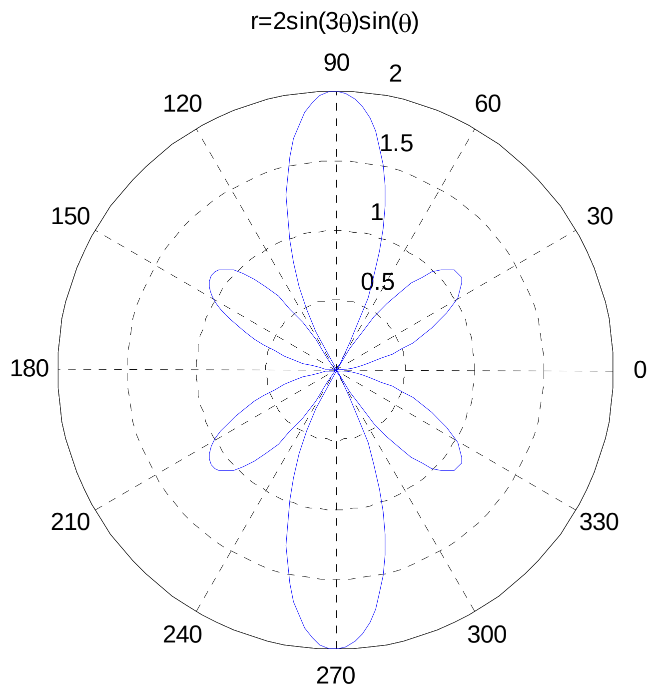


Problem 16

Script file:

```
clear, clc
t=-4:.1:4;
theta=linspace(0,2*pi,200)
r=2*sin(3*theta).*sin(theta);
polar(theta,r)
title('r=2sin(3\theta)sin(\theta)')
```

Figure Window:

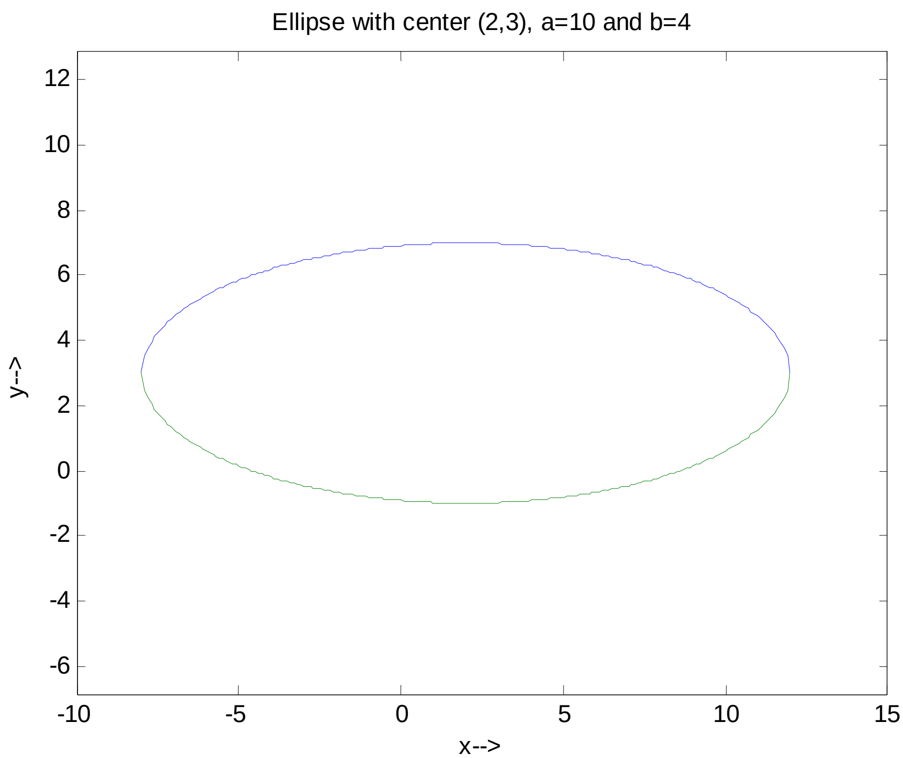


Problem 17

Script file:

```
clear, clc
x=-8:.1:12;
y1=3+sqrt(16-4*(x-2).^2/25);
y2=3-sqrt(16-4*(x-2).^2/25);
plot(x,y1,x,y2)
axis([-10 15 -5 5])
axis equal
title('Ellipse with center (2,3), a=10 and b=4')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:

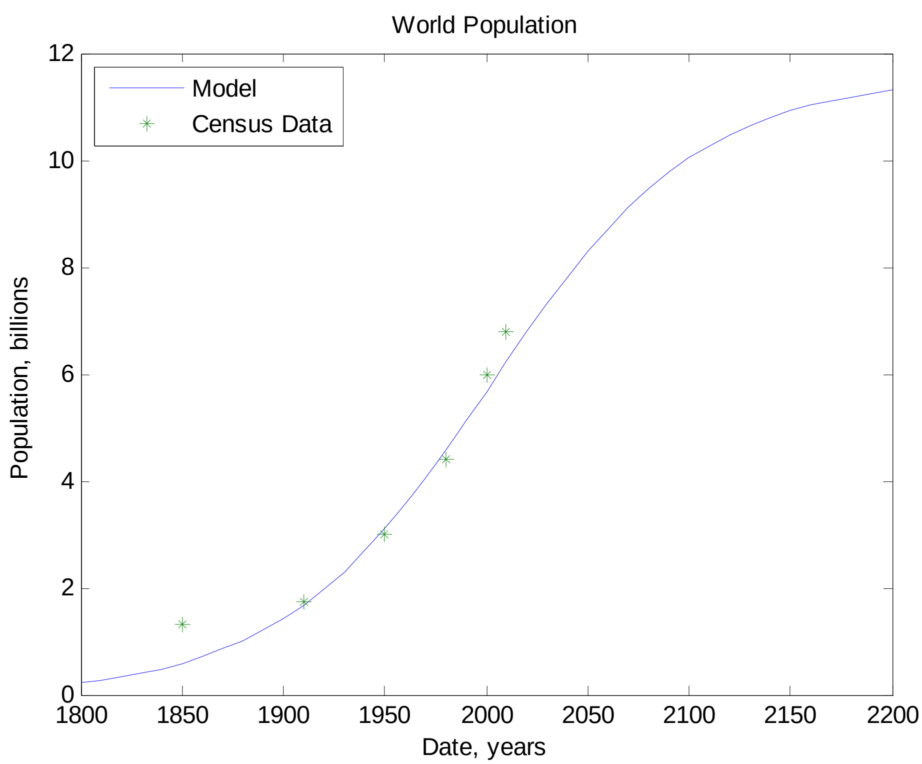


Problem 18

Script file:

```
clear, clc
year=[1850 1910 1950 1980 2000 2010];
pop=[1.3 1.75 3 4.4 6 6.8];
t=-50:10:350;
P=11.55./(1+18.7*exp(-0.0193*t));
plot(t+1850,P,year,pop,'*')
title('World Population')
legend('Model','Census Data','location','NorthWest')
xlabel('Date, years')
ylabel('Population, billions')
```

Figure Window:



Problem 19

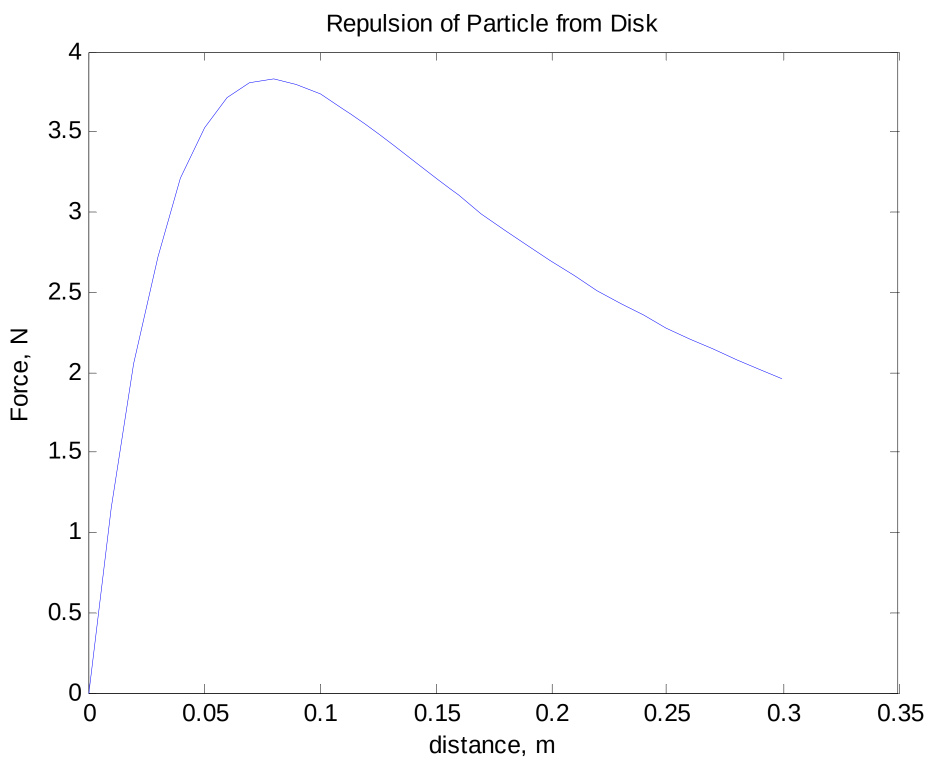
Script file:

```
e0=0.885e-12; Q=9.4e-6; q=2.4e-5; R=0.1;
z=0:.01:.3;
F=Q*q*z.*(1-z./sqrt(z.^2+R^2))/(2*e0);
plot(z,F)
title('Repulsion of Particle from Disk')
xlabel('distance, m')
ylabel('Force, N')
[Fmax indx] = max(F);
fprintf('The maximum repulsion (%.2fN) occurs at a distance of %.2f m\n',...
    Fmax,z(indx))
```

Command Window:

The maximum repulsion (3.83N) occurs at a distance of 0.08 m

Figure Window:

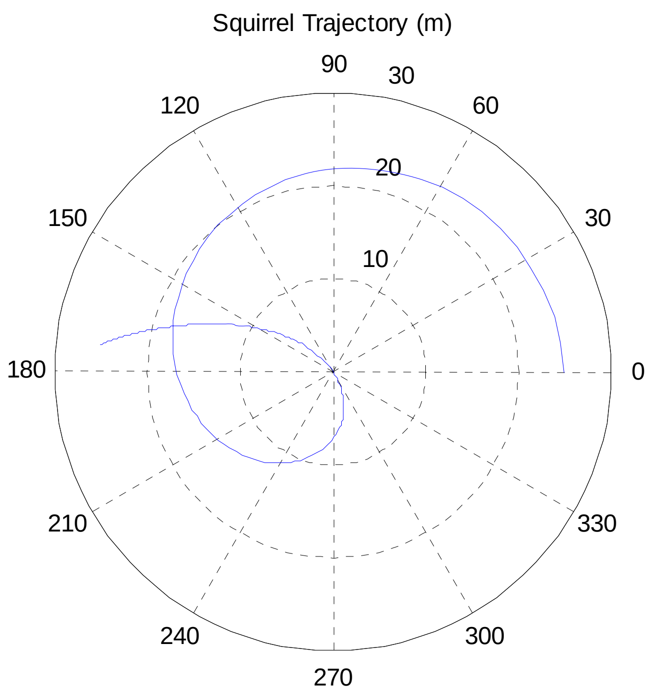


Problem 20

Script file:

```
clear, clc
t=0:.1:20;
r=25+30*(1-exp(sin(0.07*t)));
theta=2*pi*(1-exp(-0.2*t));
polar(theta,r)
title('Squirrel Trajectory (m)')
```

Figure Window:

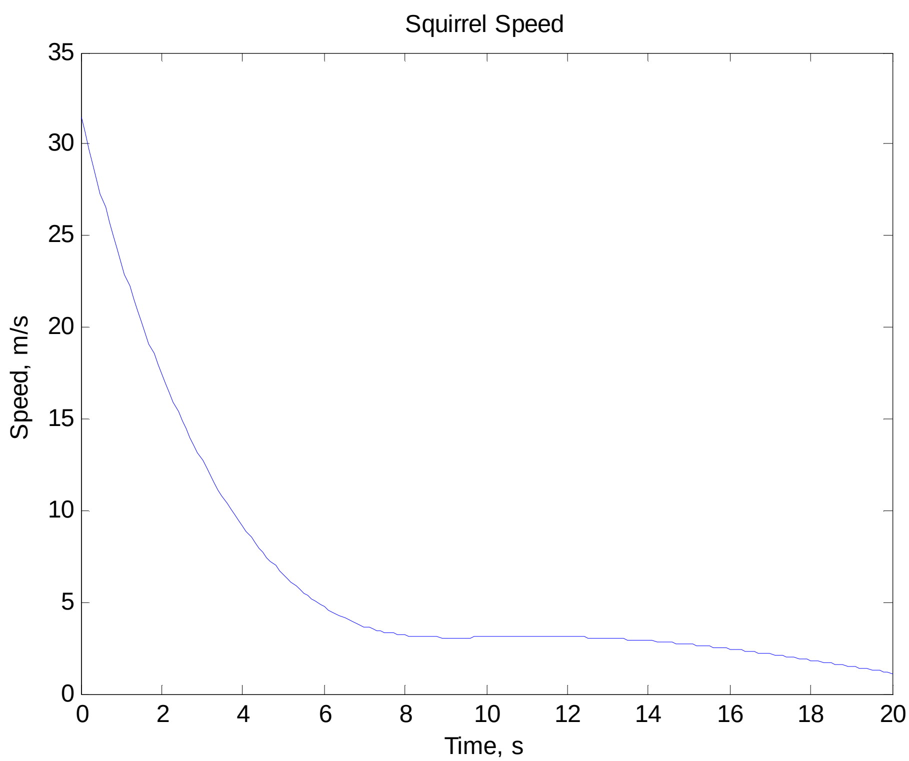


Problem 21

Script file:

```
clear, clc
t=0:.1:20;
r=25+30*(1-exp(sin(0.07*t)));
vr=-30*0.07*exp(sin(0.07*t)).*cos(0.07*t);
vt=2*pi*0.2*r.*exp(-0.2*t);
v=sqrt(vr.^2+vt.^2);
plot(t,v)
title('Squirrel Speed')
xlabel('Time, s')
ylabel('Speed, m/s')
```

Figure Window:

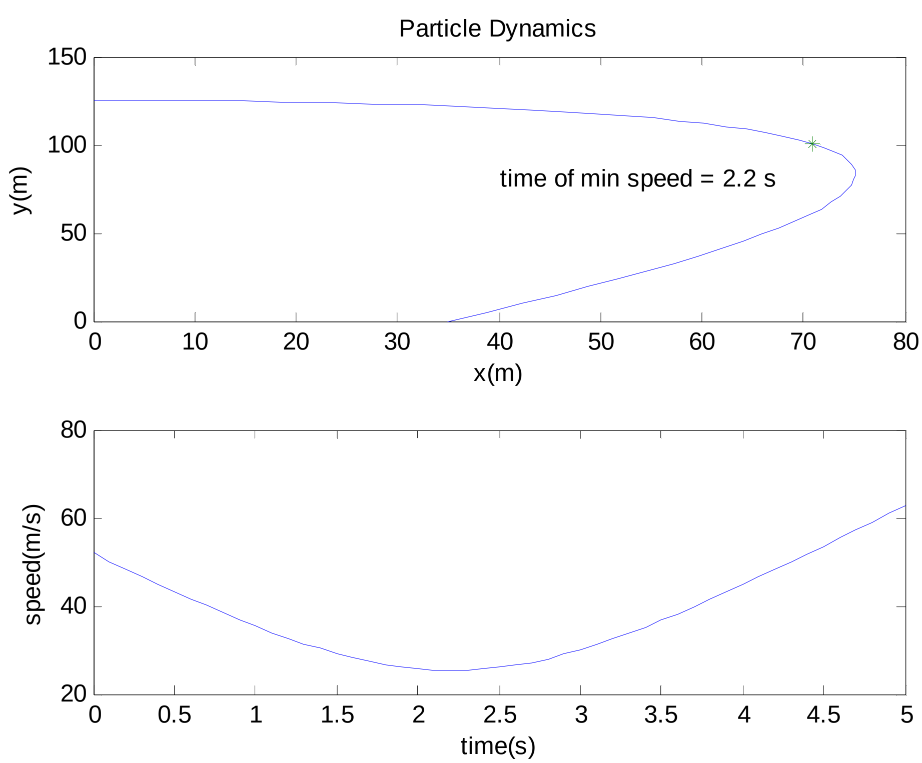


Problem 22

Script file:

```
t=0:.1:5;
x=52*t-9*t.^2; y=125-5*t.^2;
vx=52-18*t; vy=-10*t;
v=sqrt(vx.^2+vy.^2);
[vmin indx]=min(v);
tmin=t(indx);
subplot(2,1,1)
plot(x,y,x(indx),y(indx),'*')
title('Particle Dynamics')
xlabel('x(m)')
ylabel('y(m)')
text(40,80,['time of min speed = ',num2str(tmin,'%.1f'),' s'])
subplot(2,1,2)
plot(t,v)
xlabel('time(s)')
ylabel('speed(m/s)')
```

Figure Window:

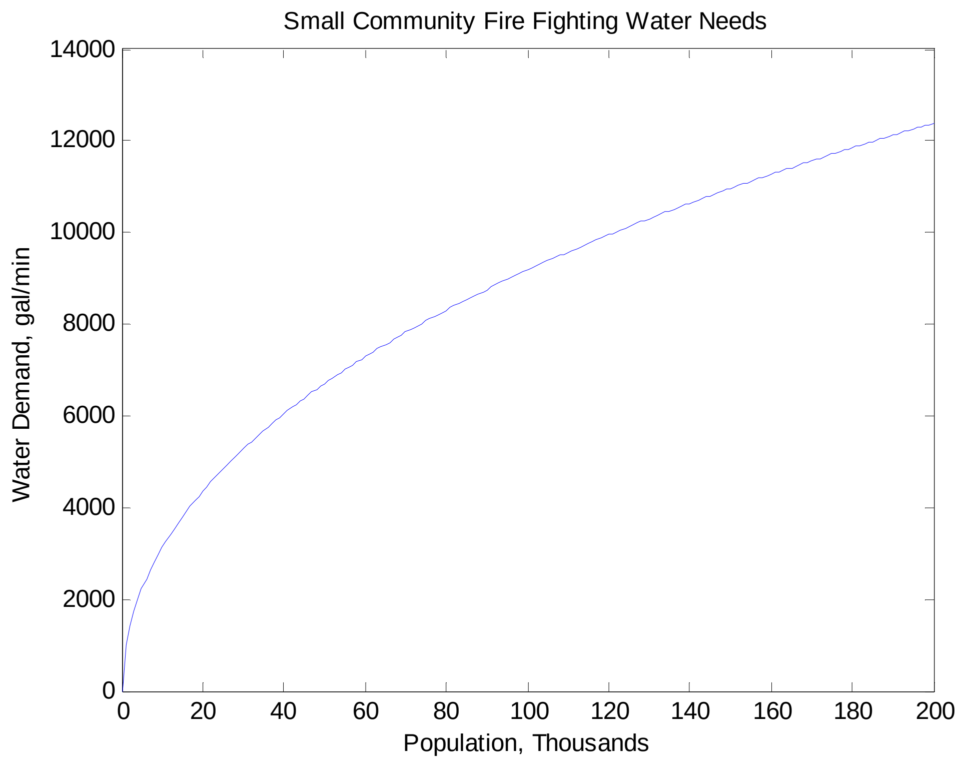


Problem 23

Script file:

```
clear, clc
P=0:200;
Q=1020*sqrt(P).*(1-0.01*sqrt(P));
plot(P,Q)
title('Small Community Fire Fighting Water Needs')
xlabel('Population, Thousands')
ylabel('Water Demand, gal/min')
```

Figure Window:

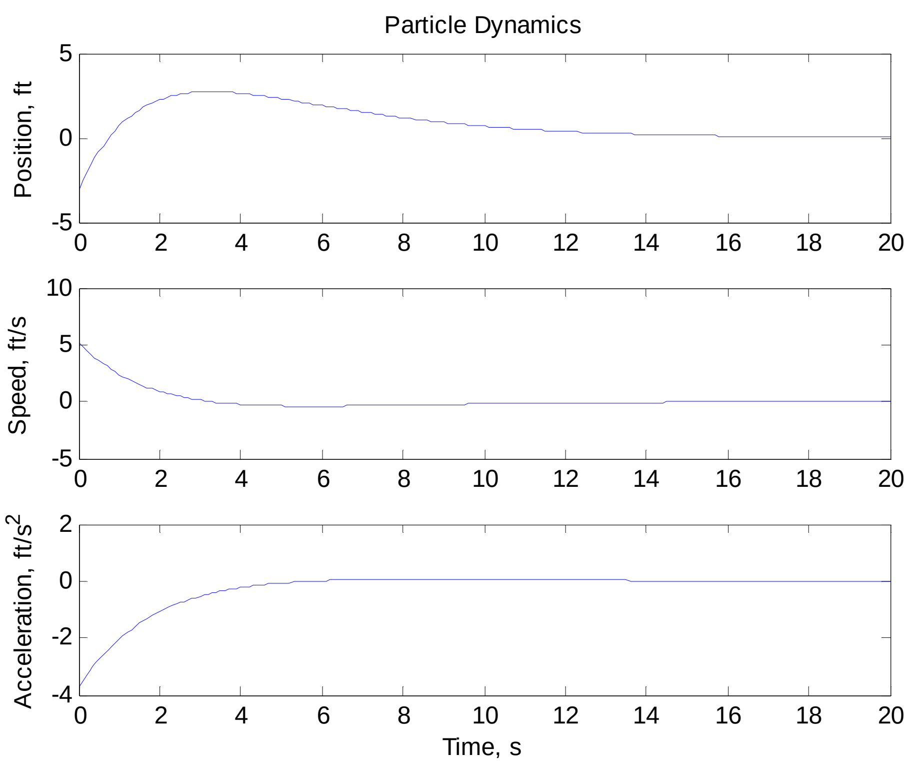


Problem 24

Script file:

```
clear, clc
t=0:.1:20;
x=(-3+4*t).*exp(-0.4*t);
v=4*exp(-0.4*t)-0.4*(-3+4*t).*exp(-0.4*t);
a=-1.6*exp(-0.4*t)-1.6*exp(-0.4*t)+0.16*(-3+4*t).*exp(-0.4*t);
subplot(3,1,1)
plot(t,x)
title('Particle Dynamics')
ylabel('Position, ft')
subplot(3,1,2)
plot(t,v)
ylabel('Speed, ft/s')
subplot(3,1,3)
plot(t,a)
ylabel('Acceleration, ft/s^2')
xlabel('Time, s')
```

Figure Window:

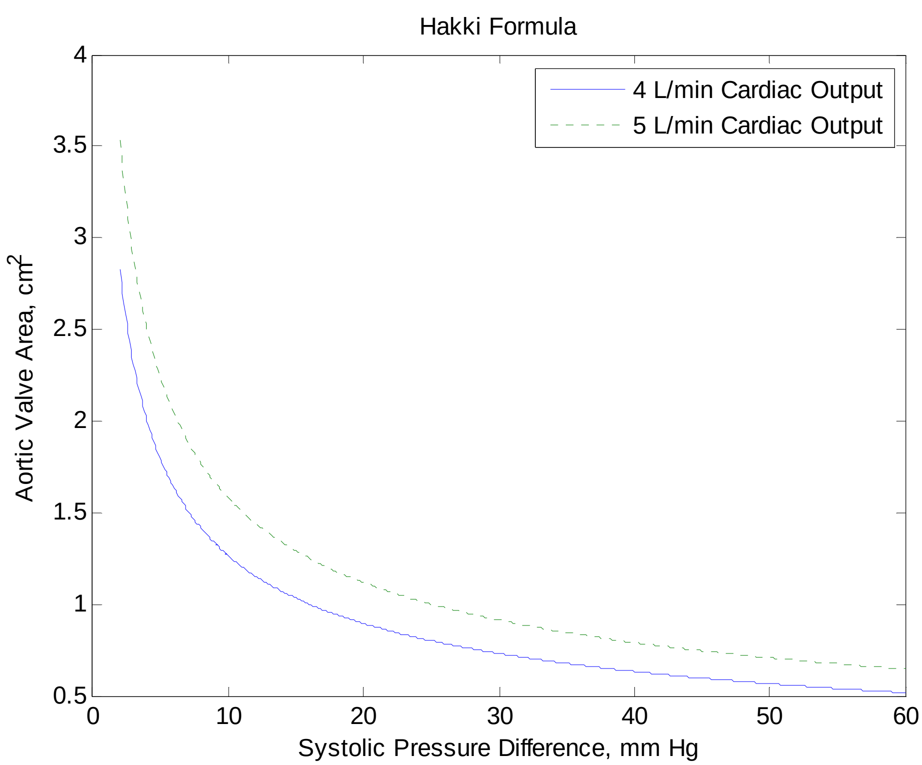


Problem 25

Script file:

```
Q1=4; Q2=5;
PG=2:.1:60;
Av1=Q1./sqrt(PG);
Av2=Q2./sqrt(PG);
plot(PG,Av1,PG,Av2,':')
title('Hakki Formula')
legend('4 L/min Cardiac Output','5 L/min Cardiac Output')
xlabel('Systolic Pressure Difference, mm Hg')
ylabel('Aortic Valve Area, cm^2')
```

Figure Window:

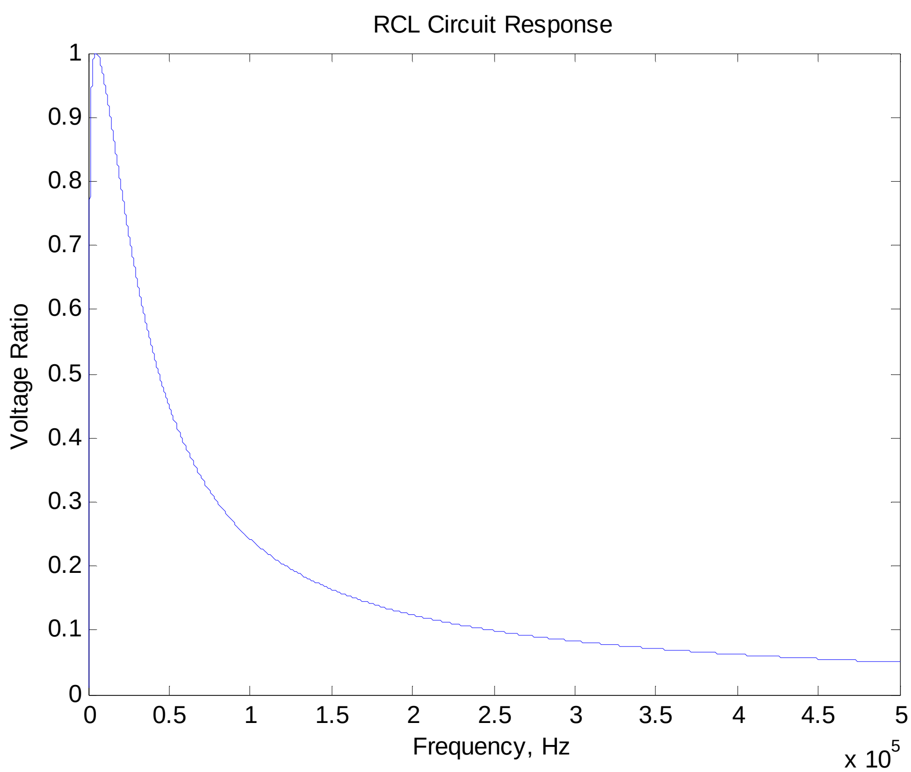


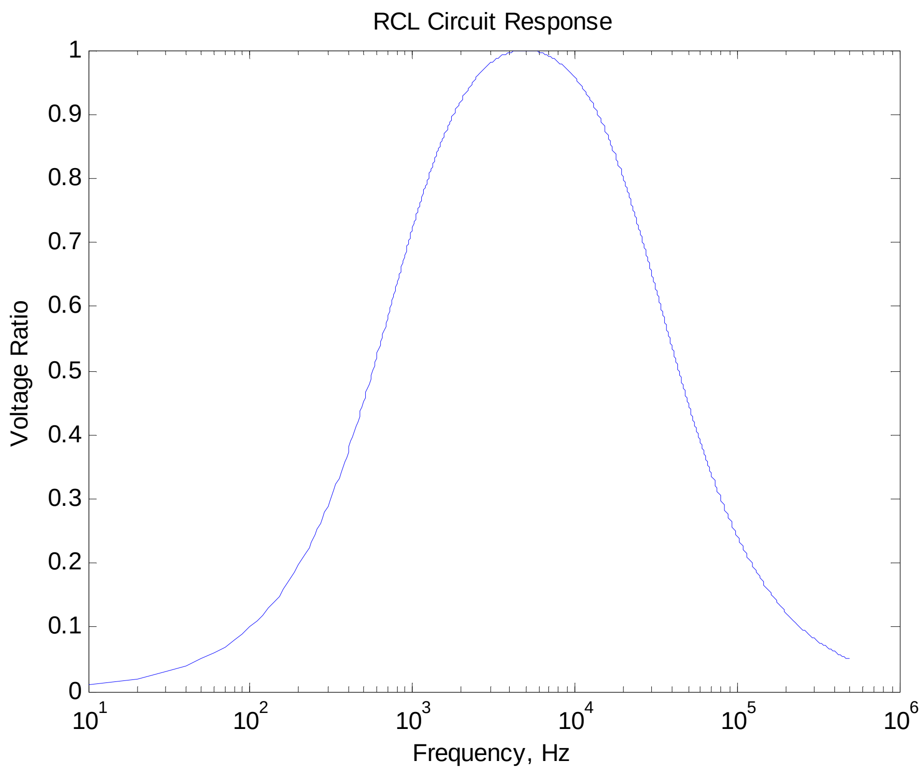
Problem 26

Script file:

```
clear, clc
R=200; L=8e-3; C=5e-6;
omega=10:10:500000;
RV=omega*R*C./sqrt((1-omega.^2*L*C).^2+(omega*R*C).^2);
figure(1)
plot(omega,RV)
title('RCL Circuit Response')
xlabel('Frequency, Hz')
ylabel('Voltage Ratio')
figure(2)
semilogx(omega,RV)
title('RCL Circuit Response')
xlabel('Frequency, Hz')
ylabel('Voltage Ratio')
```

Figure Window:





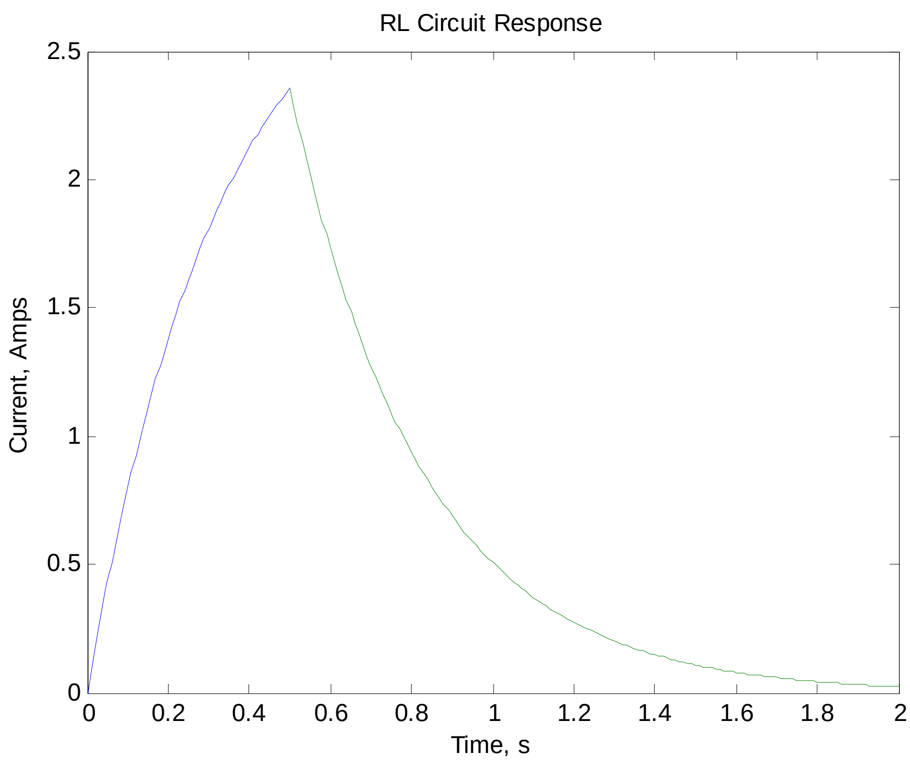
The semi-log plot better shows the response of the filter. The linear plot does not adequately show the suppression of low frequencies.

Problem 27

Script file:

```
clear, clc
V=12; R=4; L=1.3;
t1=0:.01:.5; t2=0.5:.01:2;
i1=V/R*(1-exp(-R*t1/L));
i2=exp(-R*t2/L)*V/R*(exp(0.5*R/L)-1);
plot(t1,i1,t2,i2)
title('RL Circuit Response')
xlabel('Time, s')
ylabel('Current, Amps')
```

Figure Window:

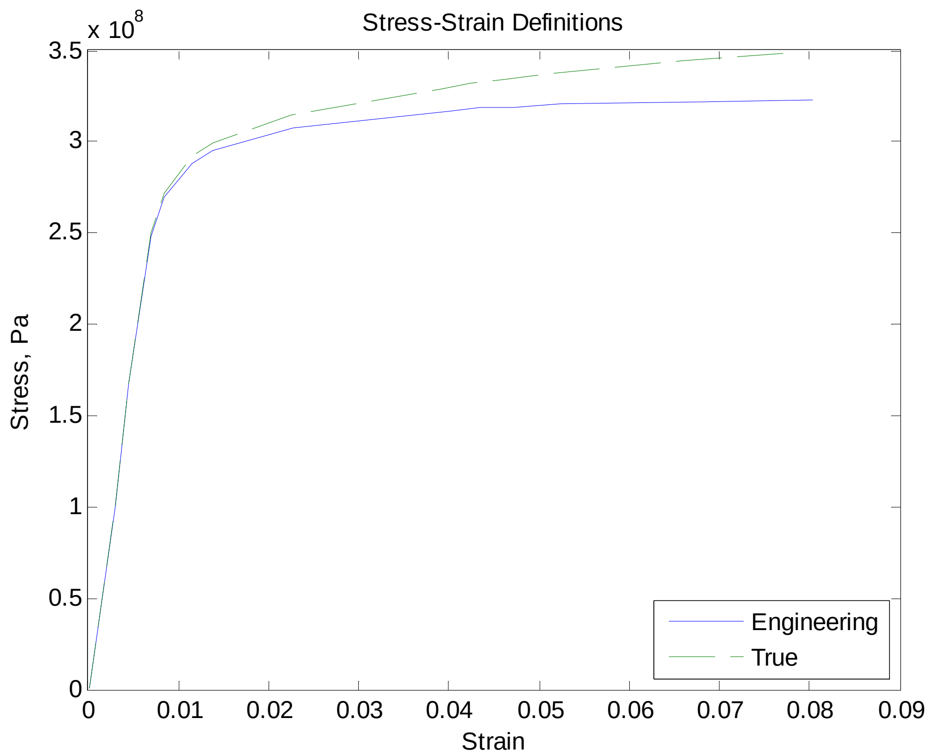


Problem 28

Script file:

```
L0=.0254; r0=.0064; A0=pi*r0^2;
F=[0 13031 21485 31963 34727 37119 37960 39550 ...
    40758 40986 41076 41255 41481 41564];
L=[25.4 25.474 25.515 25.575 25.615 25.693 25.752 25.978 ...
    26.419 26.502 26.600 26.728 27.130 27.441]/1000;
sigmae=F/A0; ee=(L-L0)/L0;
sigmat=F.*L/(A0*L0); et=log(L/L0);
plot(ee,sigmae,et,sigmat,'--')
title('Stress-Strain Definitions')
legend('Engineering','True','location','SouthEast')
xlabel('Strain')
ylabel('Stress, Pa')
```

Figure Window:

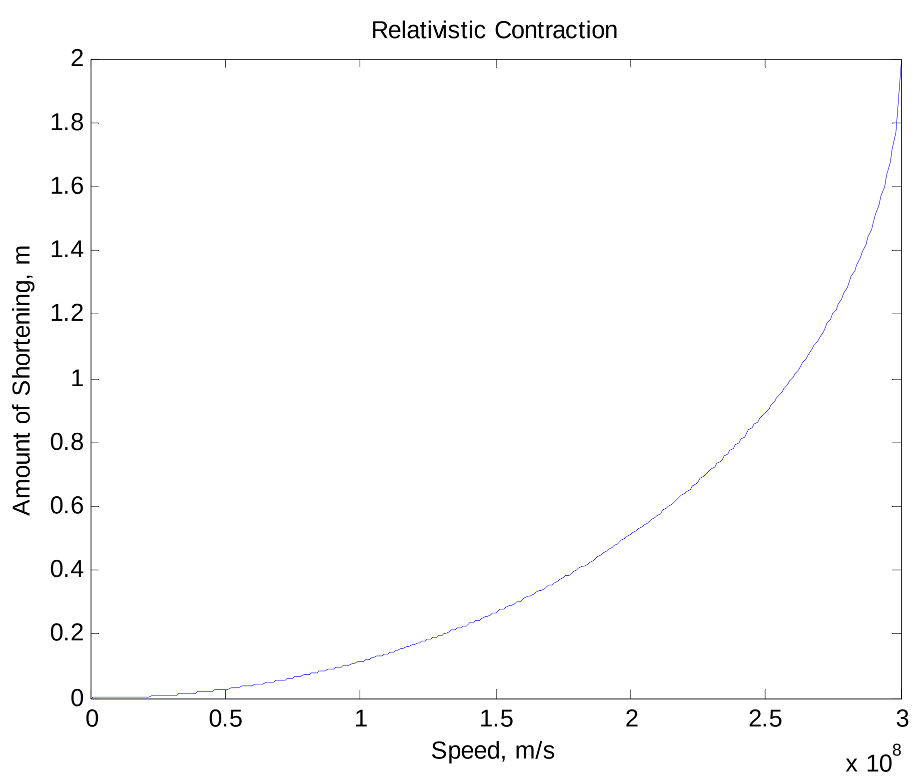


Problem 29

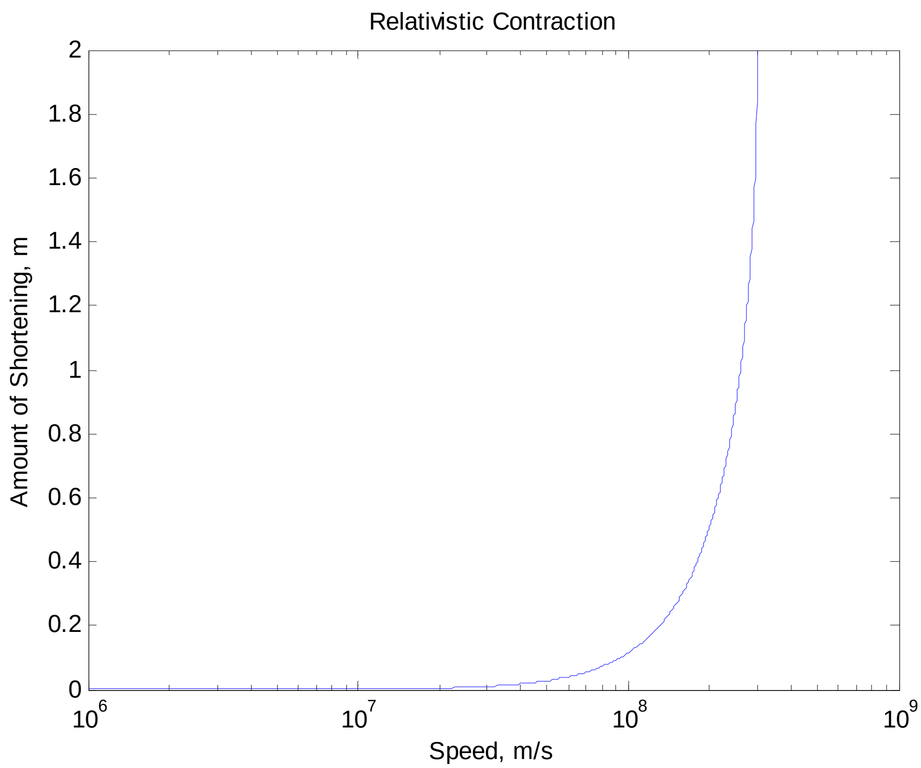
Script file:

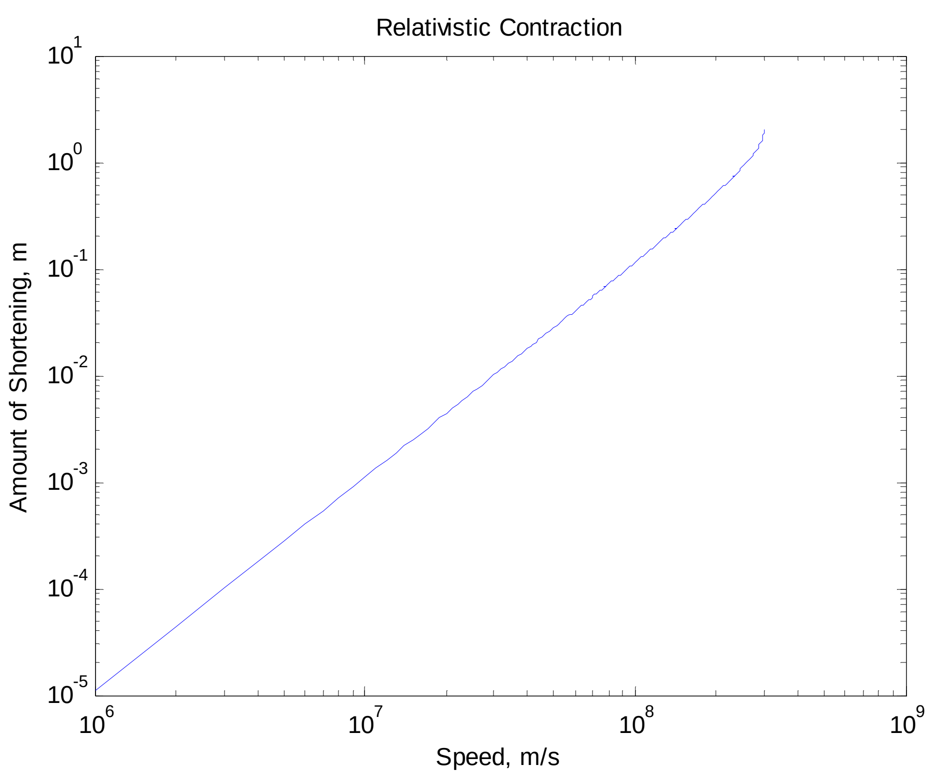
```
L=2; c=300e6; v=0:1.e6:c;
delta=L*(1-sqrt(1-v.^2/c^2));
figure(1)
plot(v,delta)
title('Relativistic Contraction')
xlabel('Speed, m/s')
ylabel('Amount of Shortening, m')
figure(2)
semilogx(v,delta)
title('Relativistic Contraction')
xlabel('Speed, m/s')
ylabel('Amount of Shortening, m')
figure(3)
loglog(v,delta)
title('Relativistic Contraction')
xlabel('Speed, m/s')
ylabel('Amount of Shortening, m')
```

Figure Window:



The linear plot is useful for telling when the level of contraction becomes significant. The log-log plot is useful because the relationship is almost linear when plotted this way.


Relativistic Contraction
Amount of Shortening, m
Speed, m/s
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
10^6
10^7
10^8
10^9

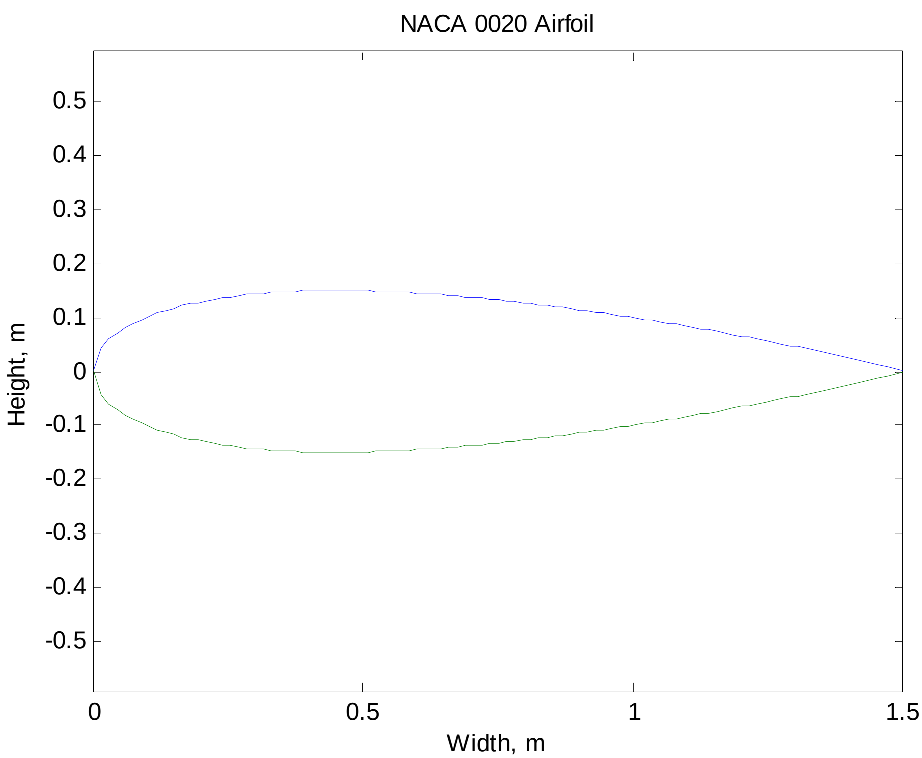

Relativistic Contraction
Amount of Shortening, m
Speed, m/s
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^6
10^7
10^8
10^9

Problem 30

Script file:

```
t=0.2; c=1.5; xc=0:.01:1;
y1=t*c/0.2*(0.2969*sqrt(xc)-0.1260*xc-0.3516*xc.^2+0.2843*xc.^3-
0.1015*xc.^4);
y2=-y1;
plot(xc*c,y1,xc*c,y2)
axis equal
title('NACA 0020 Airfoil')
xlabel('Width, m')
ylabel('Height, m')
```

Figure Window:

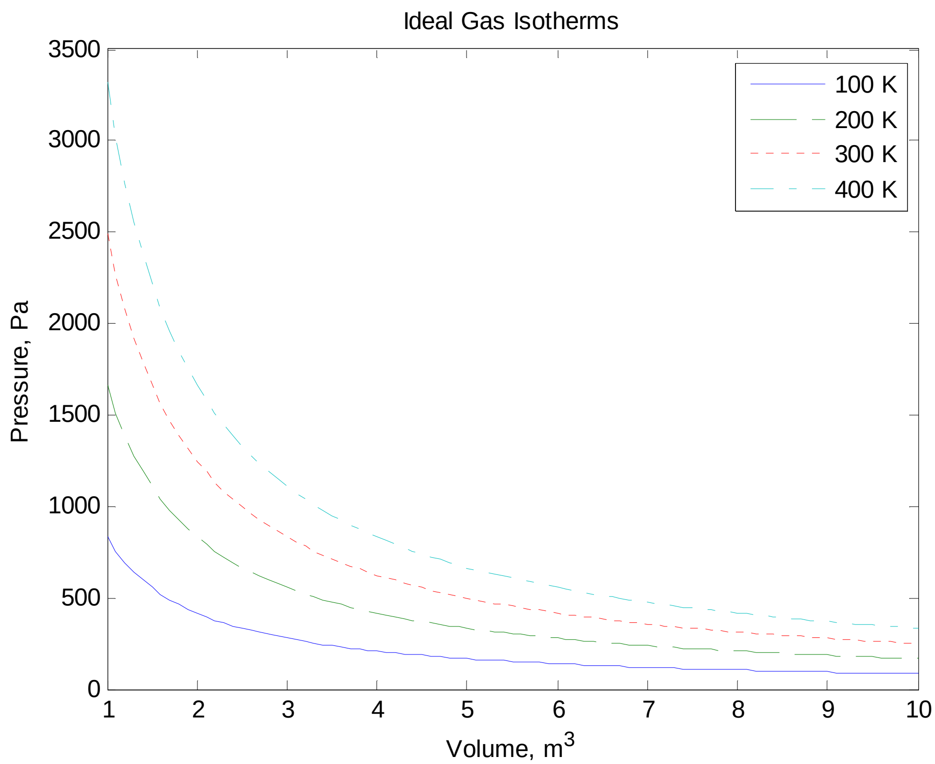


Problem 31

Script file:

```
R=8.3145;
V=1:.1:10;
P1=R*100./V; P2=R*200./V; P3=R*300./V; P4=R*400./V;
plot(V,P1,V,P2,'--',V,P3,':',V,P4,'-.')
title('Ideal Gas Isotherms')
xlabel('Volume, m^3')
ylabel('Pressure, Pa')
legend('100 K','200 K','300 K','400 K')
```

Figure Window:

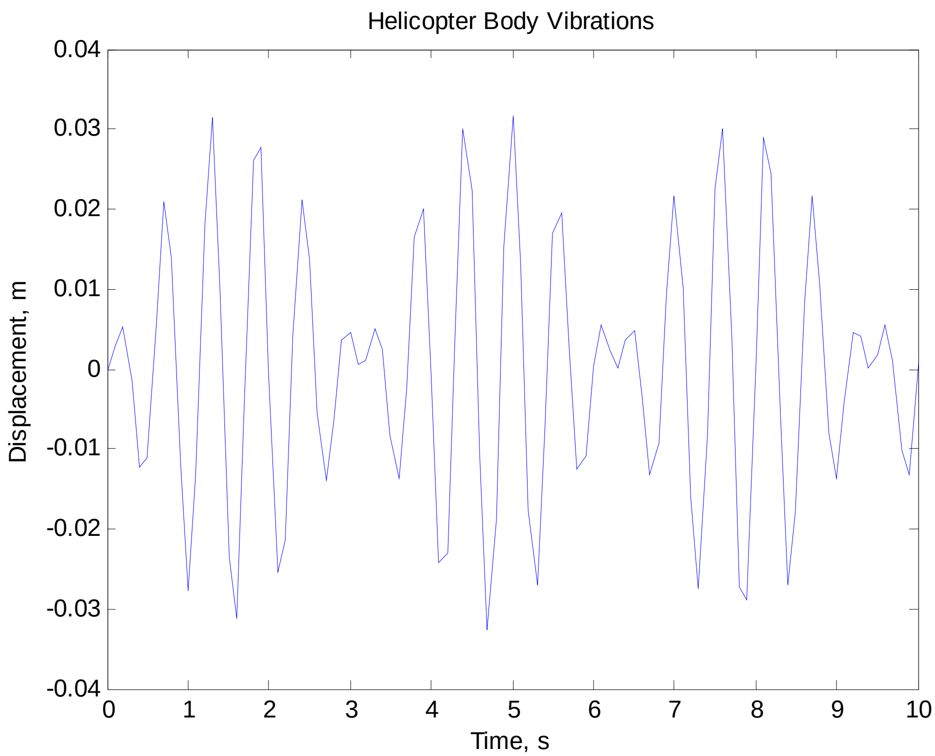


Problem 32

Script file:

```
f0=12; wn=10; w=12;
t=0:.1:10;
x=2*f0/(wn^3-w^3)*sin((wn-w)*t/2).*sin((wn+w)*t/2)
plot(t,x)
title('Helicopter Body Vibrations')
xlabel('Time, s')
ylabel('Displacement, m')
```

Figure Window:

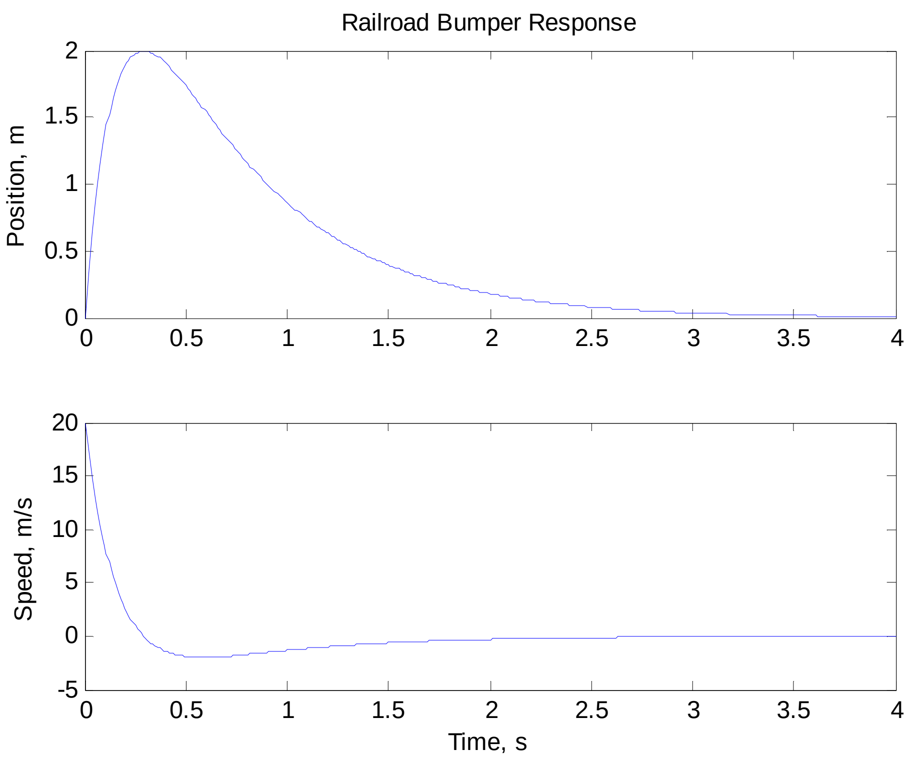


Problem 33

Script file:

```
t=0:.01:4;
x=4.219*(exp(-1.58*t)-exp(-6.32*t));
v=26.67*exp(-6.32*t)-6.67*exp(-1.58*t);
subplot(2,1,1)
plot(t,x)
title('Railroad Bumper Response')
ylabel('Position, m')
subplot(2,1,2)
plot(t,v)
ylabel('Speed, m/s')
xlabel('Time, s')
```

Figure Window:

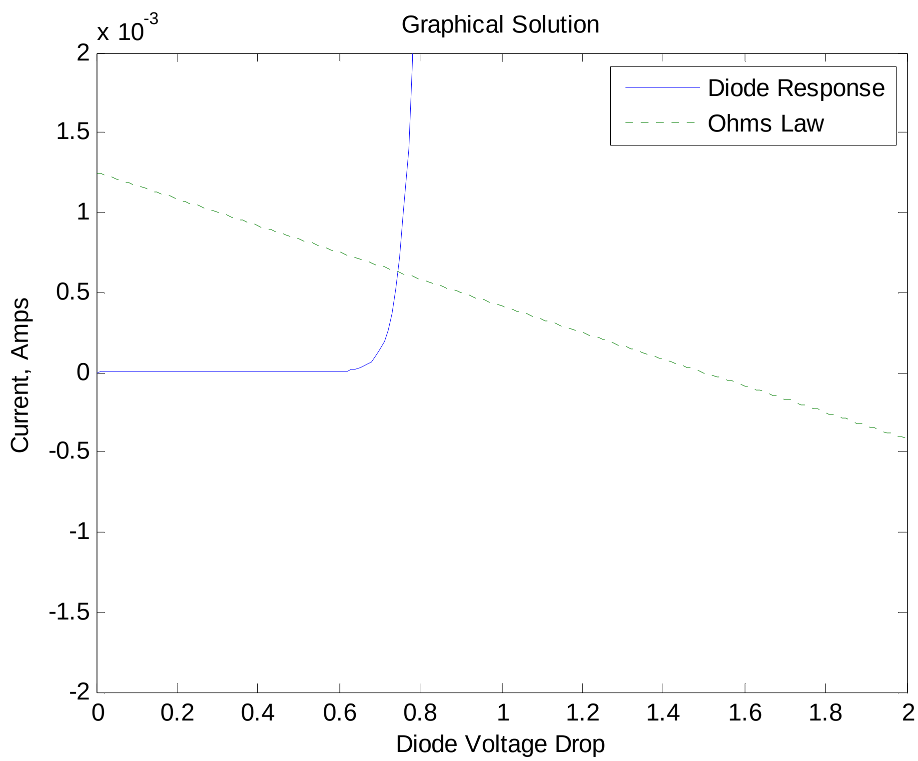


Problem 34

Script file:

```
Io=1.e-14; vs=1.5; R=1200; kt_q=.03;
vd=0:.01:2;
id1=Io*(exp(vd/kt_q)-1);
id2=(vs-vd)/R;
plot(vd,id1,vd,id2,':')
axis([0 2 -.002 .002])
title('Graphical Solution')
xlabel('Diode Voltage Drop')
ylabel('Current, Amps')
legend('Diode Response','Ohms Law')
```

Figure Window:

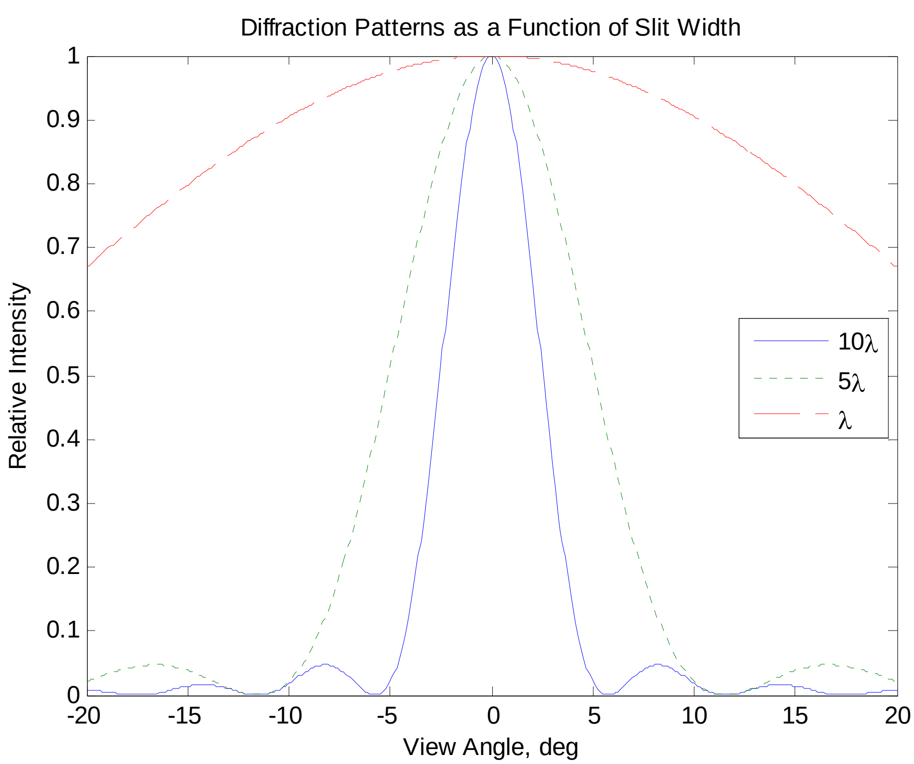


Problem 35

Script file:

```
theta=-20:.1:20;
alpha1=pi*10*sind(theta);
alpha2=pi*5*sind(theta);
alpha3=pi*sind(theta);
Iratio1=(sin(alpha1)./alpha1).^2;
Iratio2=(sin(alpha2)./alpha2).^2;
Iratio3=(sin(alpha3)./alpha3).^2;
plot(theta,Iratio1,theta,Iratio2,':',theta,Iratio3,'--')
title('Diffraction Patterns as a Function of Slit Width')
xlabel('View Angle, deg')
ylabel('Relative Intensity')
legend('10\lambda','5\lambda','\lambda','location','East')
```

Figure Window:

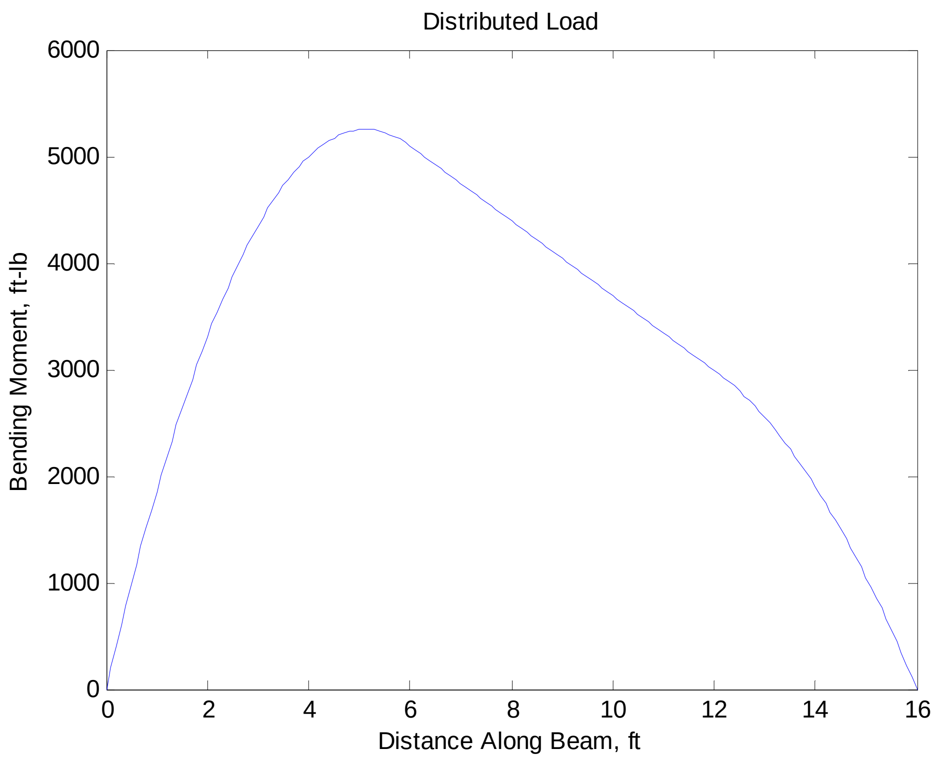


Problem 36

Script file:

```
L=16; a=6; b=6; c=L-a-b; w1=400; w2=200;
RA=(w1*a*(2*L-a)+w2*c^2)/(2*L);
RB=(w2*c*(2*L-c)+w1*a^2)/(2*L);
x1=0:.1:a; x2=a:.1:(a+b); x3=(a+b):.1:L;
M1=RA*x1-w1*x1.^2/2;
M2=RA*x2-w1*a.*(2*x2-a)/2;
M3=RB*(L-x3)-w2*(L-x3).^2/2;
x=[x1 x2 x3]; M=[M1 M2 M3];
plot(x,M)
title('Distributed Load')
xlabel('Distance Along Beam, ft')
ylabel('Bending Moment, ft-lb')
```

Figure Window:

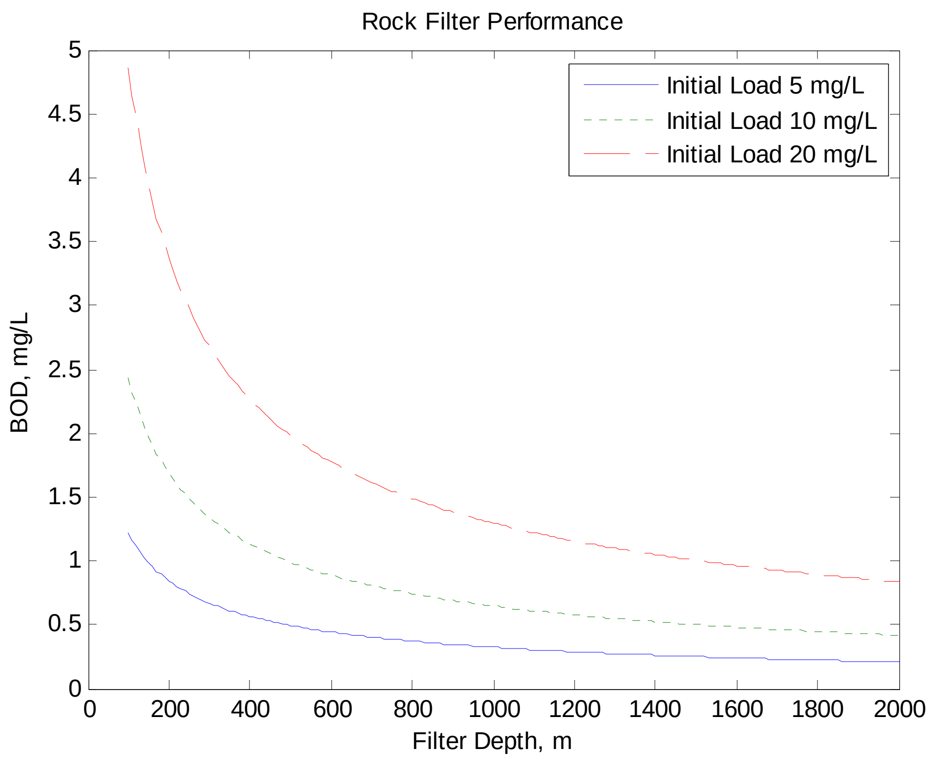


Problem 37

Script file:

```
Q=300; D=100:10:2000; L1=5; L2=10; L3=20;
Lc1=L1./(1+2.5*D.^(2/3)/sqrt(Q));
Lc2=L2./(1+2.5*D.^(2/3)/sqrt(Q));
Lc3=L3./(1+2.5*D.^(2/3)/sqrt(Q));
plot(D,Lc1,D,Lc2,':',D,Lc3,'--')
title('Rock Filter Performance')
xlabel('Filter Depth, m')
ylabel('BOD, mg/L')
legend('Initial Load 5 mg/L','Initial Load 10 mg/L','Initial Load 20 mg/L')
```

Figure Window:

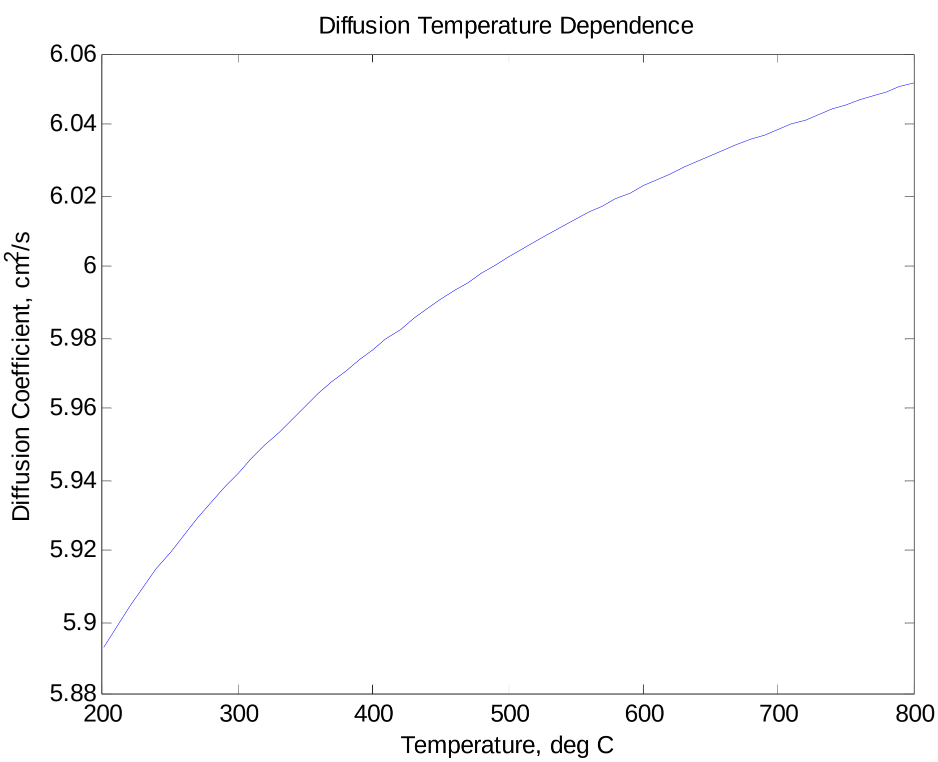


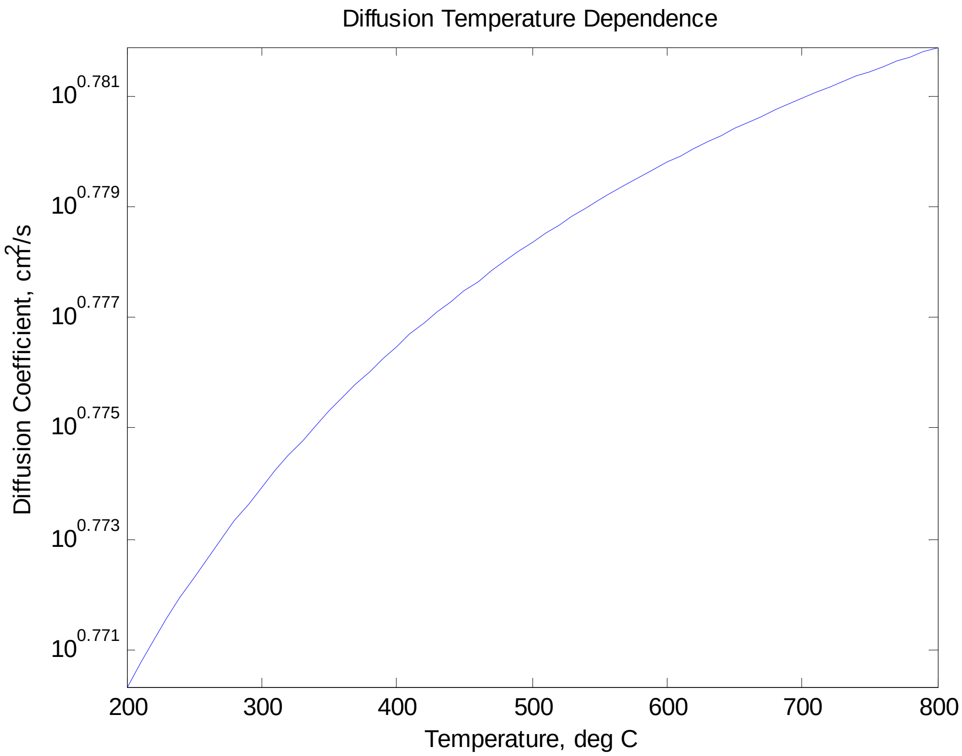
Problem 38

Script file:

```
R=8.31; D0=6.18; Ea=187;
Tc=200:10:800;
T=Tc+273.15;
D=D0*exp(-Ea./(R*T));
figure(1)
plot(Tc,D)
title('Diffusion Temperature Dependence')
xlabel('Temperature, deg C')
ylabel('Diffusion Coefficient, cm^2/s')
figure(2)
semilogy(Tc,D)
title('Diffusion Temperature Dependence')
xlabel('Temperature, deg C')
ylabel('Diffusion Coefficient, cm^2/s')
```

Figure Window:





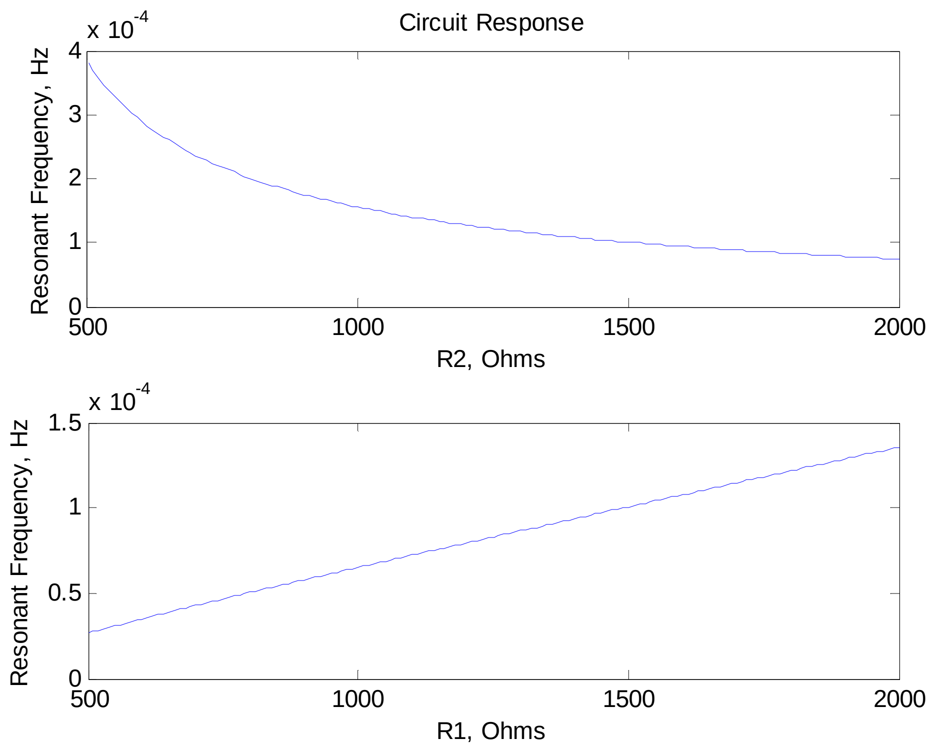
The range of values of D is small, so the linear plot is more useful.

Problem 39

Script file:

```
L=0.2; C=2e-6;
R1=1500; R2=500:10:2000;
f=sqrt(L*C*(R1^2*C-L)./(R2.^2*C-L))/(2*pi);
subplot(2,1,1)
plot(R2,f)
title('Circuit Response')
ylabel('Resonant Frequency, Hz')
xlabel('R2, Ohms')
R2=1500; R1=500:10:2000;
f=sqrt(L*C*(R1.^2*C-L)/(R2^2*C-L))/(2*pi);
subplot(2,1,2)
plot(R1,f)
ylabel('Resonant Frequency, Hz')
xlabel('R1, Ohms')
```

Figure Window:

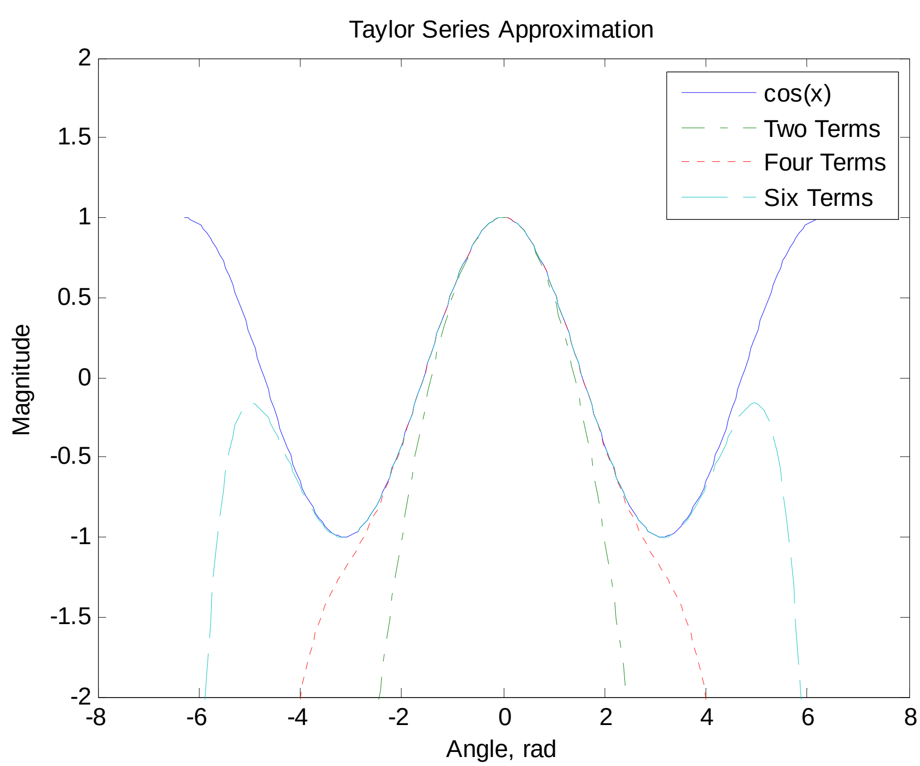


Problem 40

Script file:

```
x=linspace(-2*pi,2*pi,200);
p1=cos(x);
p2=1-x.^2/2;
p3=p2+x.^4/24-x.^6/factorial(6);
p4=p3+x.^8/factorial(8) - x.^10/factorial(10);
plot(x,p1,x,p2,'-.',x,p3,':',x,p4,'--')
axis([-8 8 -2 2])
title('Taylor Series Approximation')
xlabel('Angle, rad')
ylabel('Magnitude')
```

Figure Window:



Chapter 6

Solved Problems

Problem 1

Script file:

```
clear, clc
disp('Part (a)')
12-4<5*3
disp('Part (b)')
y=8/4>6*3-4^2>-3
disp('Part (c)')
y=-3<(8-12)+2*(5>18/6-4)^2
disp('Part (d)')
(~5+~0)*6==3+3*~0
```

Command Window:

```
Part (a)
ans =
     1
Part (b)
y =
     1
Part (c)
y =
     1
Part (d)
ans =
     1
```

Problem 2

Script file:

```
clear, clc
a=-2; b=3; c=5;
disp('Part (a)')
y=a-b>a-c<b
disp('Part (b)')
y=-4<a<0
disp('Part (c)')
y=a-c<=b>a+c
disp('Part (d)')
y=3*(c+a~=a/b-b)==(a+c)~=b
```

Command Window:

```
Part (a)
y =
     1
Part (b)
y =
     0
Part (c)
y =
     0
Part (d)
y =
     1
```

Problem 3

Script file:

```
clear, clc
v=[4 -1 2 3 1 -2 5 0]; u=[5 -1 0 3 -3 2 1 5];
disp('Part (a)')
~~u
disp('Part (b)')
v==~u
disp('Part (c)')
u==abs(v)
disp('Part (d)')
v>=u+v
```

Command Window:

```
Part (a)

ans =

     1     1     0     1     1     1     1     1

Part (b)

ans =

     0     0     0     0     0     0     0     1

Part (c)

ans =

     0     0     0     1     0     1     0     0

Part (d)

ans =

     0     1     1     0     1     0     0     0
```

Problem 4

Script file:

```
clear, clc
v=[4 -1 2 3 1 -2 5 0]; u=[5 -1 0 3 -3 2 1 5];
w=u.*(u<=v)
disp('or')
w=u(u<=v)
```

Command Window:

```
w =
     0    -1     0     3    -3     0     1     0
or
w =
    -1     0     3    -3     1
```

Problem 5

Script file:

```
clear, clc
disp('Part (a)')
-3&3
disp('Part (b)')
~5<4&~0>-3
disp('Part (c)')
-2&2>3|8/3
disp('Part (d)')
-3<-1<~0|5<4<3
```

Command Window:

```
Part (a)
ans =
     1
Part (b)
ans =
     1
Part (c)
ans =
     1
Part (d)
ans =
     1
```

Problem 6

Script file:

```
clear, clc
for j=1:3
    for k=1:5
        matrix(j,k)=j^k/(j+k);
    end
end
matrix
```

Command Window:

```
matrix =
    0.5000    0.3333    0.2500    0.2000    0.1667
    0.6667    1.0000    1.6000    2.6667    4.5714
    0.7500    1.8000    4.5000   11.5714   30.3750
```

Problem 7

Script file:

```
clear
n=input('Please enter the size of the Pascal matrix to be created: ');
for i=1:n
    for j=1:n
        A(i,j)=factorial(i+j-2)/(factorial(i-1)*factorial(j-1));
    end
end
A
```

Command Window:

```
Please enter the size of the Pascal matrix to be created: 4
A =
     1     1     1     1
     1     2     3     4
     1     3     6    10
     1     4    10    20
>> PascalMatrix
Please enter the size of the Pascal matrix to be created: 7
A =
     1     1     1     1     1     1     1
     1     2     3     4     5     6     7
     1     3     6    10    15    21    28
     1     4    10    20    35    56    84
     1     5    15    35    70   126   210
     1     6    21    56   126   252   462
     1     7    28    84   210   462   924
```

Problem 8

Script file:

```
clear, clc
BOS=[2.67 1.00 1.21 3.09 3.43 4.71 3.88 3.08 4.10 2.62 1.01 5.93];
SEA=[6.83 3.63 7.20 2.68 2.05 2.96 1.04 0.00 0.03 6.71 8.28 6.85];
disp('Part (a)')
B_T=sum(BOS);
B_A=mean(BOS);
S_T=sum(SEA);
S_A=mean(SEA);
fprintf('The total precipitation in Boston in 2012 was %.2f in',B_T)
fprintf(' and average %.2f in\n',B_A)
fprintf('The total precipitation in Seattle in 2012 was %.2f in',S_T)
fprintf(' and average %.2f in\n\n',S_A)
disp('Part (b)')
B_D=sum(BOS>B_A);
S_D=sum(SEA>S_A);
fprintf('Boston had %i months above average and Seattle %i
months\n\n',B_D,S_D)
disp('Part (c)')
BltS=sum(BOS<SEA);
m=1:12;
fprintf('The precipitation was lower in Boston in the following %i
months:',BltS)
fprintf(' %i',m(BOS<SEA))
fprintf('\n')
```

Command Window:

```
Part (a)
The total precipitation in Boston in 2012 was 36.73 in and average 3.06 in
The total precipitation in Seattle in 2012 was 48.26 in and average 4.02 in

Part (b)
Boston had 7 months above average and Seattle 5 months

Part (c)
The precipitation was lower in Boston in the following 6 months: 1 2 3 10 11
12
```

Problem 9

Script file:

```
clear, clc
i=0;
s=0;
while s<=120
    i=i+1;
    if rem(i,2)==0 && rem(i,13)==0 && rem(i,16)==0
        s=sqrt(i);
    end
end
fprintf('The required number is: %i\n',i)
```

Command Window:

```
The required number is: 14560
```

Problem 10

Script file:

```
clear, clc
f(1)=0; f(2)=1;
for k=1:18
    f(k+2)=f(k)+f(k+1);
end
fprintf('The first 20 Fibonacci numbers are:\n')
fprintf(' %i',f)
fprintf('\n')
```

Command Window:

```
The first 20 Fibonacci numbers are:

 0 1 1 2 3 5 8 13 21 34 55 89 144 233 377 610 987 1597 2584 4181
```

Problem 11

Script file:

```
clear, clc
n=[10 50 100];
f(1)=1; f(2)=1;
for j=1:3
    S=2;
    for k=3:n(j)
        f(k)=f(k-1)+f(k-2);
        S=S+1/f(k);
    end
    fprintf('The sum after %i terms is: %.12f\n',n(j),S)
end
```

Command Window:

```
The sum after 10 terms is: 3.330469040763
The sum after 50 terms is: 3.359885666115
The sum after 100 terms is: 3.359885666243
```

Problem 12

Script file:

```
clear, clc
for k=1:3
    disp('For the equation ax^2+bx+c')
    a=input('Enter a: ');
    b=input('Enter b: ');
    c=input('Enter c: ');
    D=b^2-4*a*c;
    if D<0
        fprintf('\nThe equation has no real roots.\n\n')
    elseif D==0
        root=-b/(2*a);
        fprintf('\nThe equation has one root,\n')
        fprintf(' %.3f\n\n',root)
    else
        r1=(-b+sqrt(D))/(2*a);
        r2=(-b-sqrt(D))/(2*a);
        fprintf('\nThe equation has two roots,\n')
        fprintf(' %.3f and %.3f\n\n',r1,r2)
    end
end
```

Command Window:

```
For the equation ax^2+bx+c
Enter a: 3
Enter b: 6
Enter c: 3

The equation has one root,
 -1.000

For the equation ax^2+bx+c
Enter a: -3
Enter b: 4
Enter c: -6

The equation has no real roots.

For the equation ax^2+bx+c
Enter a: -3
Enter b: 7
Enter c: 5

The equation has two roots,
 -0.573 and 2.907
```

Problem 13

Script file:

```
clear, clc
format long
n=[100 10000 1000000];
for j=1:3
    S=0;
    for k=1:n(j)
        S=S+1/k^2;
    end
    Est(j)=sqrt(6*S);
end
disp('pi =')
disp(pi)
disp('Sums for 100, 10000, and 1000000 terms are:')
for j=1:3
    disp(Est(j))
end
```

Command Window:

```
pi =
   3.141592653589793
Sums for 100, 10000, and 1000000 terms are:
   3.132076531809105
   3.141497163947215
   3.141591698660509
```

Problem 14

Script file:

```
clear, clc
format long
n=[5 10 40];
for j=1:3
    t(1)=sqrt(2)/2;
    T=t(1);
    for k=2:n(j)
        t(k)=sqrt(2+2*t(k-1))/2;
        T=T*t(k);
    end
    Est(j)=2/T;
end
disp('pi =')
disp(pi)
disp('Results for 5, 10, and 40 terms are:')
for j=1:3
    disp(Est(j))
end
```

Command Window:

```
pi =
   3.141592653589793
Results for 5, 10, and 40 terms are:
   3.140331156954753
   3.141591421511200
   3.141592653589794
```

Problem 15

Script file:

```
clear, clc
vector=20*rand(1,20)-10;
S=0;
for k=1:20
    if(vector(k)>0)
        S=S+vector(k);
    end
end
disp('The sum of the positive elements is: ')
disp(S)
```

Command Window:

```
The sum of the positive elements is:

   52.5755
```

Problem 16

Script file:

```
clear, clc
vector=randi(20,1,20)-10;
iter=0;
N=-1;
while N<0
    N=1;
    for k=1:20
        if vector(k)<0
            N=-1;
            vector(k)=randi(20)-10;
        end
    end
    if N == -1
        iter=iter+1;
    end
end
vector
disp('The number of iterations needed to make all elements of vector
positive')
disp(iter)
```

Command Window:

```
vector =

     3     4     5     6     1     2     5     2     4     7     7     5
8     0     2     6     5     0     4     9

The number of iterations needed to make all elements of vector positive

     4
```

Problem 17

Script file:

```
vector=input('Please enter any array of integers of any length: ')
n=0; np=0; nn3=0;
for k=1:length(vector)
    n=n+1;
    if vector(k)>0
        np=np+1;
    elseif vector(k)<0 & rem(vector(k),3)==0
        nn3=nn3+1;
    end
end
fprintf('The vector has %i elements.  %i elements are positive\n',n,np)
fprintf('and %i elements are negative divisible by 3\n',nn3)
```

Command Window:

```
Please enter any array of integers of any length: randi([-20 20],1,16)
vector =
    15   -16    17   -16     1   -15     2   -20    11    14    17    20
0    -9   -16     0
The vector has 16 elements.  8 elements are positive
and 2 elements are negative divisible by 3
```

Problem 18

Script file:

```
clear, clc
x=[4.5 5 -16.12 21.8 10.1 10 -16.11 5 14 -3 3 2];
for k=1:length(x)-1
    for j=k+1:length(x)
        if x(j)<x(k)
           temp=x(k);
           x(k)=x(j);
           x(j)=temp;
        end
    end
end
x
```

Command Window:

```
x =

  Columns 1 through 8

  -16.1200  -16.1100   -3.0000    2.0000    3.0000    4.5000    5.0000
5.0000

  Columns 9 through 12

   10.0000   10.1000   14.0000   21.8000
```

Problem 19

Script file:

```
clear, clc
id=1;
for k=1:50
    for j=k+1:50
        for i=j+1:50
            if i^2==k^2+j^2
                a(id)=k;
                b(id)=j;
                c(id)=i;
                id=id+1;
            end
        end
    end
end
table=[a' b' c']
```

Command Window:

```
table =
     3     4     5
     5    12    13
     6     8    10
     7    24    25
     8    15    17
     9    12    15
     9    40    41
    10    24    26
    12    16    20
    12    35    37
    14    48    50
    15    20    25
    15    36    39
    16    30    34
    18    24    30
    20    21    29
    21    28    35
    24    32    40
    27    36    45
    30    40    50
```

Problem 20

Script file:

```
clear, clc
id=1;
k=11;
while k<498
    j=3;
    isprime=1;
    while j<=sqrt(k)
        if rem(k,j)==0
            isprime=0;
            break
        end
        j=j+2;
    end
    if isprime
        kp2=k+2;
        j=3;
        isprime2=1;
        while j<=sqrt(kp2)
            if rem(kp2,j)==0
                isprime2=0;
                break
            end
            j=j+2;
        end
        if isprime2
            P(id)=k;
            P2(id)=kp2;
            id=id+1;
        end
    end
    k=k+2;
end
table=[P' P2']
```

Command Window:

```
table =
    11    13
    17    19
    29    31
    41    43
    59    61
    71    73
   101   103
   107   109
   137   139
   149   151
   179   181
   191   193
```

197	199
227	229
239	241
269	271
281	283
311	313
347	349
419	421
431	433
461	463

Problem 21

Script file:

```
clear, clc
id=1;
for k=49:2:101
    j=3;
    isprime=1;
    while j<=sqrt(k)
        if rem(k,j)==0
            isprime=0;
            break
        end
        j=j+2;
    end
    if isprime
        P(id)=k;
        id=id+1;
    end
end
id=1;
for k=2:length(P)-1
    if P(k+1)~=P(k)+2 & P(k-1)~=P(k)-2
        iso(id)=P(k);
        id=id+1;
    end
end
disp('The isolated primes between 50 and 100 are:')
disp(iso)
```

Command Window:

```
The isolated primes between 50 and 100 are:

    67    79    83    89    97
```

Problem 22

Script file:

```
scores=[31 70 92 5 47 88 81 73 51 76 80 90 55 23 43 98 36 ...
    87 22 61 19 69 26 82 89 99 71 59 49 64];
n(1:5)=0;
for k=1:length(scores)
    if scores(k)<20
        n(1)=n(1)+1;
    elseif scores(k)<40
        n(2)=n(2)+1;
    elseif scores(k)<60
        n(3)=n(3)+1;
    elseif scores(k)<80
        n(4)=n(4)+1;
    else
        n(5)=n(5)+1;
    end
end
fprintf('Grades between  0 and  19 %3i students\n',n(1))
fprintf('Grades between 20 and  39 %3i students\n',n(2))
fprintf('Grades between 40 and  59 %3i students\n',n(3))
fprintf('Grades between 60 and  79 %3i students\n',n(4))
fprintf('Grades between 80 and 100 %3i students\n',n(5))
```

Command Window:

```
Grades between  0 and  19   2 students
Grades between 20 and  39   5 students
Grades between 40 and  59   6 students
Grades between 60 and  79   7 students
Grades between 80 and 100  10 students
```

Problem 23

Script file:

```
clear, clc
for j=1:2
    angle=input('Please input an angle in degrees: ');
    x=angle*pi/180;
    E=1; S=0; k=0;
    while E>.000001
        S_old=S;
        S=S+(-1)^k/factorial(2*k)*x^(2*k);
        E=abs((S-S_old)/S_old);
        k=k+1;
    end
    fprintf('\nThe value of cosine of %.0f degrees is %.8f\n\n',angle,S)
end
```

Command Window:

```
Please input an angle in degrees: 35

The value of cosine of 35 degrees is 0.81915205

Please input an angle in degrees: 125

The value of cosine of 125 degrees is -0.57357644
```

Problem 24

Script file:

```
clear, clc
k=1; S=1;
while S<1000
    S=k*(k+1)/2;
    d1=floor(S/100);
    d2=floor((S-d1*100)/10);
    d3=floor(S-d1*100-d2*10);
    if d1==d2 & d2==d3
        break
    end
    k=k+1;
end
fprintf('The desired sum is %i\n', S)
fprintf('This is the sum of the first %i digits\n',k)
```

Command Window:

```
The desired sum is 666

This is the sum of the first 36 digits
```

Problem 25

Script file:

```
clear, clc
for k=1:2
    gender=input('Please input your gender (male or female): ','s');
    age=input('Please input your age: ');
    RHR=input('Please enter your resting heart rate: ');
    fit=input('Please enter your fitness level (low, medium, or high: ','s');
    gender = lower(gender);
    fit = lower(fit);
    switch fit
        case 'low'
            INTEN=0.55;
        case 'medium'
            INTEN=0.65;
        case 'high'
            INTEN=0.8;
    end
    switch gender
        case 'male'
            THR=((220-age)-RHR)*INTEN+RHR;
        case 'female'
            THR=((206-0.88*age)-RHR)*INTEN+RHR;
    end
    fprintf('\nThe recommended training heart rate is %.0f\n\n',THR)
end
```

Command Window:

```
Please input your gender (male or female): male
Please input your age: 21
Please enter your resting heart rate: 62
Please enter your fitness level (low, medium, or high: low

The recommended training heart rate is 137

Please input your gender (male or female): female
Please input your age: 19
Please enter your resting heart rate: 67
Please enter your fitness level (low, medium, or high: high

The recommended training heart rate is 165
```

Problem 26

Script file:

```
clear, clc
for j=1:2
    W=input('Please input your weight in lb: ');
    h=input('Please input your height in in: ');
    BMI=703*W/h^2;
    if BMI<18.5
        fprintf('\nYour BMI value is %.1f, which classifies you as underweight\n\n',BMI)
    elseif BMI<25
        fprintf('\nYour BMI value is %.1f, which classifies you as normal\n\n',BMI)
    elseif BMI<30
        fprintf('\nYour BMI value is %.1f, which classifies you as overweight\n\n',BMI)
    else
        fprintf('\nYour BMI value is %.1f, which classifies you as obese\n\n',BMI)
    end
end
```

Command Window:

```
Please input your weight in lb: 180
Please input your height in in: 74

Your BMI value is 23.1, which classifies you as normal

Please input your weight in lb: 150
Please input your height in in: 61

Your BMI value is 28.3, which classifies you as overweight
```

Problem 27

Script file:

```
clear, clc
for j=1:3
    service=input('Please input the type of service\n G for Ground, E for
Express, O for Overnight: ','s');
    wt=input('Please enter the weight of the package as [lb oz]: ');
    service = lower(service);
    wgt=wt(1)+wt(2)/16;
    switch service
        case 'g'
            if wgt<0.5
                cost=.7+.06*wt(2);
            elseif wgt<5
                u=ceil(2*(wgt-0.5));
                cost=1.18+.42*u;
            else
                cost=4.96+.72*ceil(wgt-5);
            end
        case 'e'
            if wgt<0.5
                cost=2.4+.25*wt(2);
            elseif wgt<5
                u=ceil(2*(wgt-0.5));
                cost=4.40+1.2*u;
            else
                cost=15.2+1.8*ceil(wgt-5);
            end
        case 'o'
            if wgt<0.5
                cost=12.20+.8*wt(2);
            elseif wgt<5
                u=ceil(2*(wgt-0.5));
                cost=18.6+4.8*u;
            else
                cost=61.8+6.4*ceil(wgt-5);
            end
    end
    fprintf('\nThe cost of service will be $%.2f\n\n',cost)
end
```

Command Window:

```
Please input the type of service
 G for Ground,E for Express, O for Overnight: G
Please enter the weight of the package as [lb oz]: [2 7]

The cost of service will be $2.86

Please input the type of service
 G for Ground,E for Express, O for Overnight: E
Please enter the weight of the package as [lb oz]: [0 7]
```

```
The cost of service will be $4.15

Please input the type of service
 G for Ground,E for Express, O for Overnight: O
Please enter the weight of the package as [lb oz]: [5 10]

The cost of service will be $68.20
```

Problem 28

Script file:

```
clear, clc
for j=1:3
    n(1:8)=0;
    cost=randi([1 5000],1,1)/100;
    fprintf('The total charge is $%.2f\n',cost)
    pay=input('Please enter payment (1, 5, 10, 20, or 50): ');
    if pay<cost
        fprintf('Insufficient Payment\n\n')
        continue
    else
        change=pay-cost;
        if change>=20
            n(1)=1;
            change=change-20;
        end
        if change>=10
            n(2)=1;
            change=change-10;
        end
        if change>=5
            n(3)=1;
            change=change-5;
        end
        while change>=1
            n(4)=n(4)+1;
            change=change-1;
        end
        while change>=.25
            n(5)=n(5)+1;
            change=change-.25;
        end
        while change>=.10
            n(6)=n(6)+1;
            change=change-.10;
        end
        if change>=.05
            n(7)=1;
            change=change-.05;
        end
        change=change+.000001;
        while change>=.01
            n(8)=n(8)+1;
            change=change-.01;
        end
    end
    fprintf('\n   $20   $10    $5    $1  $0.25 $0.10 $0.05 $0.01\n')
    fprintf('     %i',n)
    fprintf('\n\n')
end
```

Command Window:

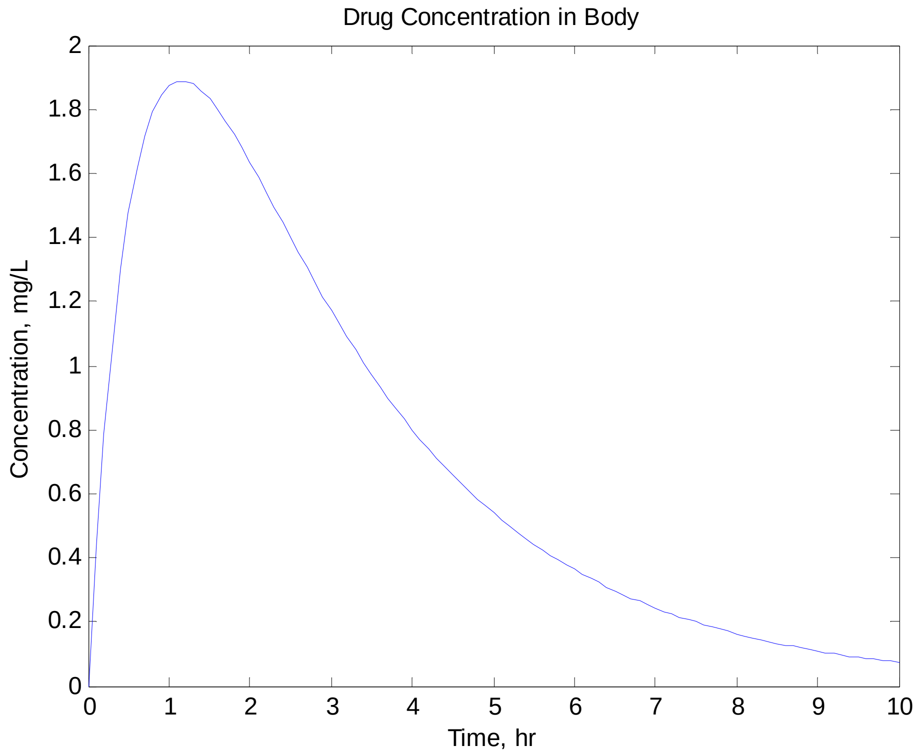
```
The total charge is $44.39
Please enter payment (1, 5, 10, 20, or 50): 50

   $20   $10    $5    $1  $0.25 $0.10 $0.05 $0.01
     0     0     1     0     2     1     0     1

The total charge is $9.94
Please enter payment (1, 5, 10, 20, or 50): 50

   $20   $10    $5    $1  $0.25 $0.10 $0.05 $0.01
     1     1     1     5     0     0     1     1

The total charge is $19.77
Please enter payment (1, 5, 10, 20, or 50): 5
Insufficient Payment
```

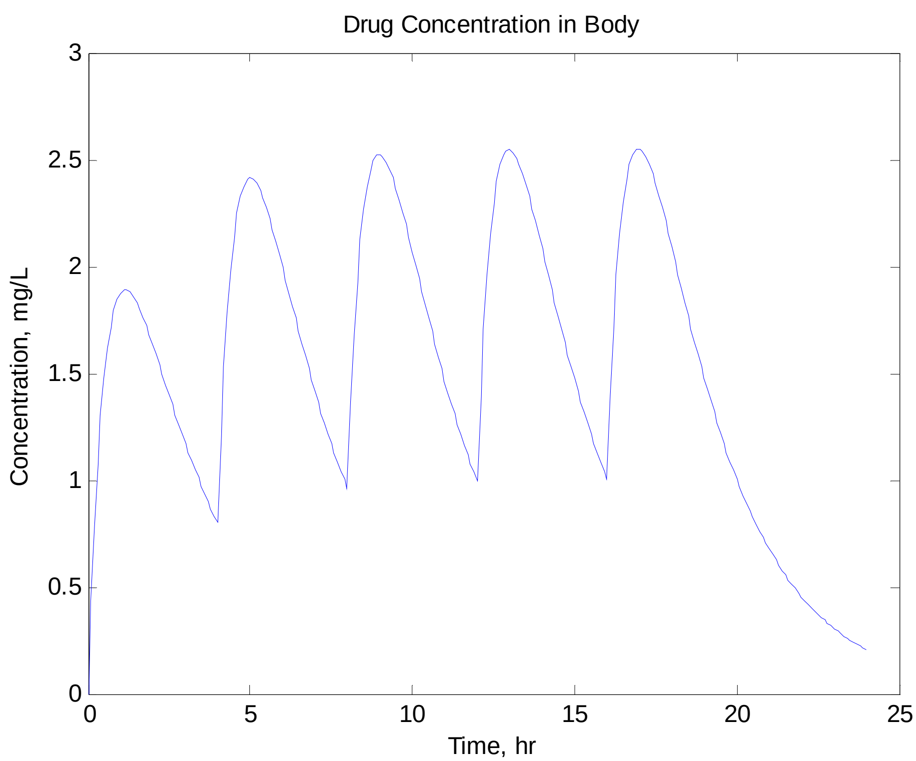
Problem 29

Script file:

```
Dg=150; vd=50; ka=1.6; ke=0.4;
% disp('Part (a)')
figure(1)
t=0:.1:10;
Cp=Dg/vd*ka*(exp(-ke*t)-exp(-ka*t))/(ka-ke);
plot(t,Cp)
title('Drug Concentration in Body')
xlabel('Time, hr')
ylabel('Concentration, mg/L')
% disp('Part (b)')
figure(2)
t=0:.1:24;
Cp=Dg/vd*ka*(exp(-ke*t)-exp(-ka*t))/(ka-ke);
Net(1:40)=Cp(1:40);
Net(41:80)=Cp(41:80)+Cp(1:40);
Net(81:120)=Cp(81:120)+Cp(41:80)+Cp(1:40);
Net(121:160)=Cp(121:160)+Cp(81:120)+Cp(41:80)+Cp(1:40);
Net(161:241)=Cp(161:241)+Cp(121:201)+Cp(81:161)+Cp(41:121)+Cp(1:81);
plot(t,Net)
title('Drug Concentration in Body')
xlabel('Time, hr')
ylabel('Concentration, mg/L')
```

Figure Windows:





Problem 30

Script file:

```
clear, clc
n=[100 53701 19.35];
for j=1:3
    P=n(j);
    x=P;
    E=1;
    while E>.00001
        x_old=x;
        x=(P/x^2+2*x)/3;
        E=abs((x-x_old)/x_old);
    end
    fprintf('The cube root of %.0f is %.1f\n',P,x)
end
```

Command Window:

```
The cube root of 100 is 4.6
The cube root of 53701 is 37.7
The cube root of 19 is 2.7
```

Problem 31

Script file:

```
clear, clc
for j=1:3
    p=input('Please enter the pressure: ');
    old=input('Please enter the units (Pa, psi, atm, or torr): ','s');
    new=input('Please enter the desired units (Pa, psi, atm, or torr):
','s');
    switch old
        case 'Pa'
            temp=p;
        case 'psi'
            temp=6.894757e03*p;
        case 'atm'
            temp=1.01325e05*p;
        case 'torr'
            temp=1.333224e02*p;
    end
    switch new
        case 'Pa'
            pnew=temp;
        case 'psi'
            pnew=temp/6.894757e03;
        case 'atm'
            pnew=temp/1.01325e05;
        case 'torr'
            pnew=temp/1.333224e02;
    end
    fprintf('The converted pressure is %.1f %s\n\n',pnew,new)
end
```

Command Window:

```
Please enter the pressure: 70
Please enter the units (Pa, psi, atm, or torr): psi
Please enter the desired units (Pa, psi, atm, or torr): Pa
The converted pressure is 482633.0 Pa

Please enter the pressure: 120
Please enter the units (Pa, psi, atm, or torr): torr
Please enter the desired units (Pa, psi, atm, or torr): atm
The converted pressure is 0.2 atm

Please enter the pressure: 8000
Please enter the units (Pa, psi, atm, or torr): Pa
Please enter the desired units (Pa, psi, atm, or torr): psi
The converted pressure is 1.2 psi
```

Problem 32

Script file:

```
clear, clc
for k=1:100
    x=0;
    n(k)=0;
    while abs(x)<10
        x=x+randn(1,1);
        n(k)=n(k)+1;
    end
end
fprintf('The average number of steps to reach the boundary are
%.1f\n',mean(n))
```

Command Window:

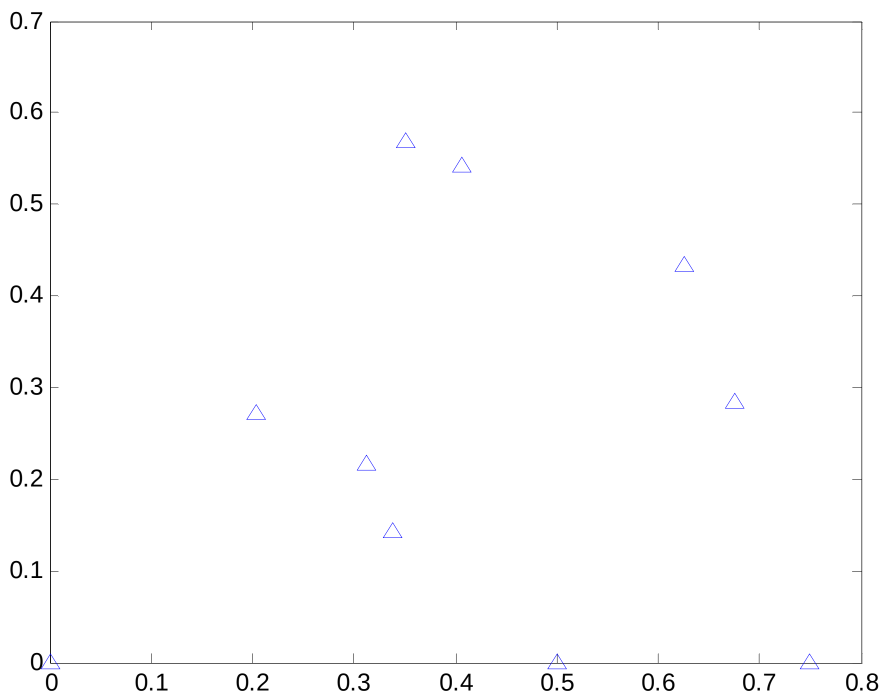
```
The average number of steps to reach the boundary are 119.0
```

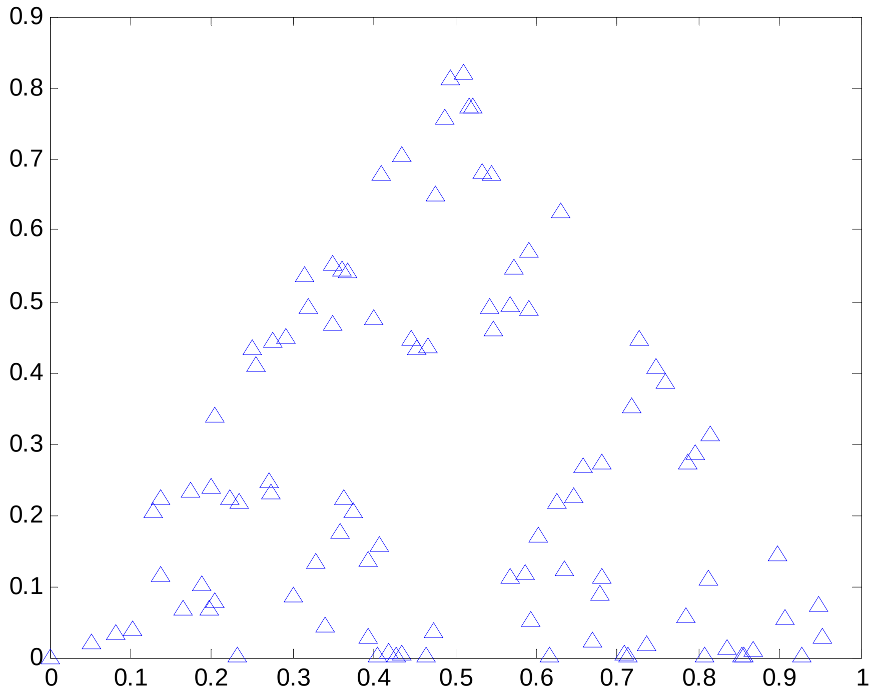
Problem 33

Script file:

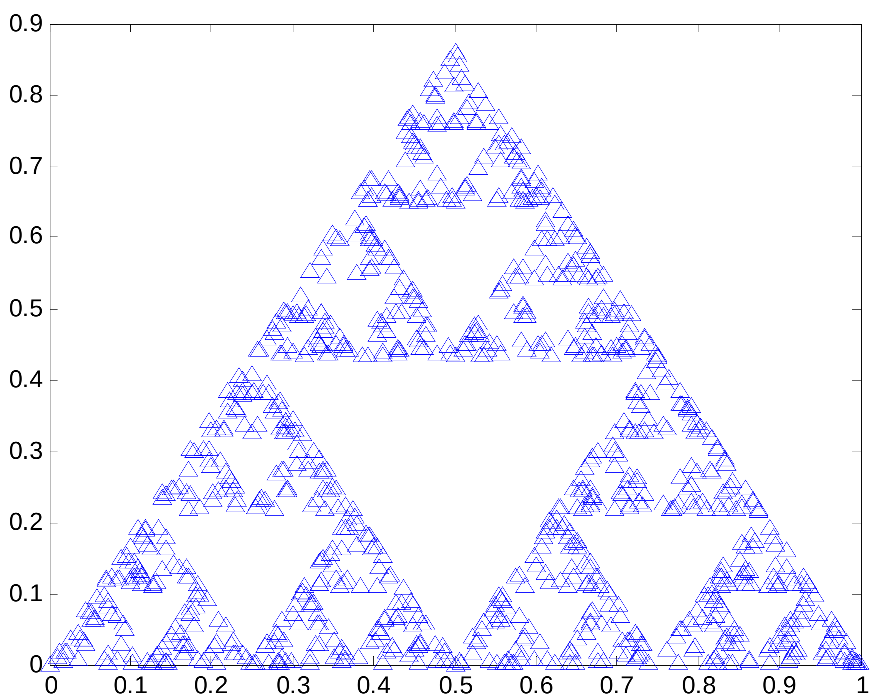
```
n=[10 100 1000 10000];
for j=1:4
    x(1)=0; y(1)=0;
    for k=2:n(j)
        m=randi([1 3],1,1);
        switch m
            case 1
                x(k)=0.5*x(k-1);
                y(k)=0.5*y(k-1);
            case 2
                x(k)=0.5*x(k-1)+0.25;
                y(k)=0.5*y(k-1)+sqrt(3)/4;
            case 3
                x(k)=0.5*x(k-1)+0.5;
                y(k)=0.5*y(k-1);
        end
    end
    figure(j)
    plot(x,y,'^')
end
```

Figure Windows:

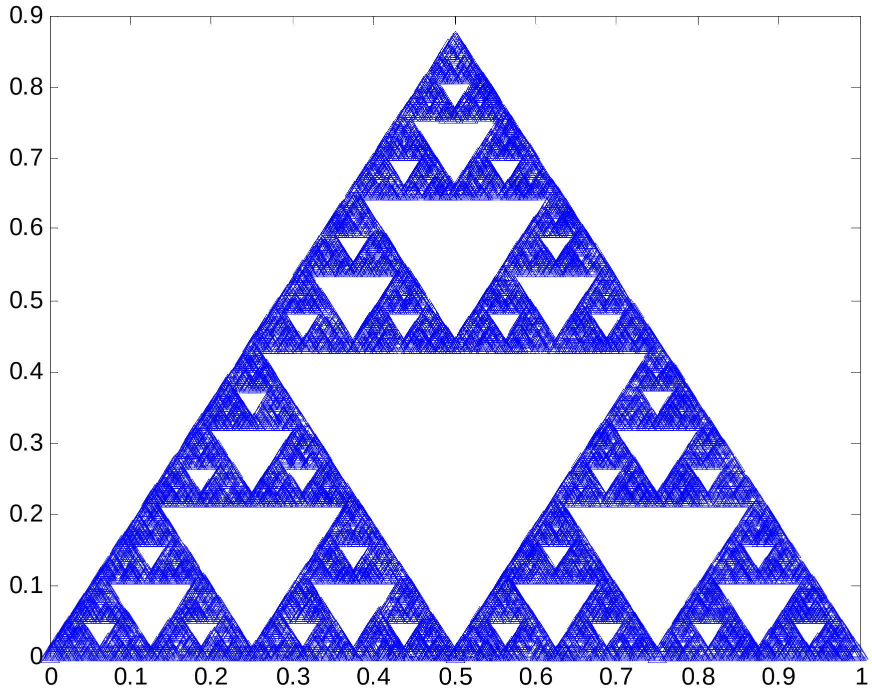




0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1



0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1



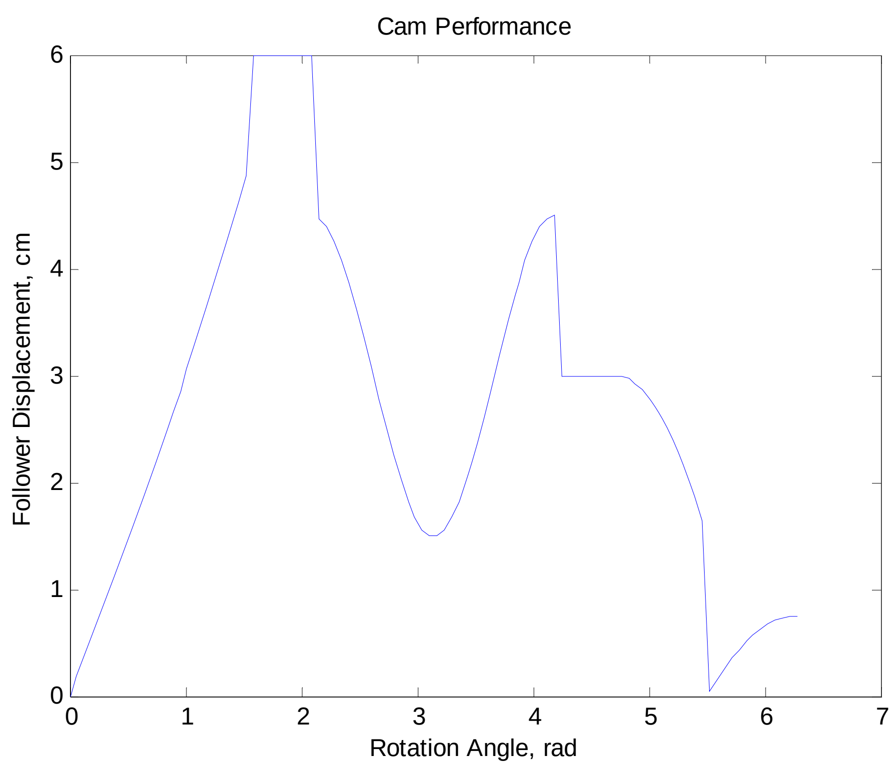
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Problem 34

Script file:

```
theta=linspace(0,2*pi,100)
for k=1:100
    if theta(k)<=pi/2
        y(k)=6*(2*theta(k)-0.5*sin(theta(k)))/pi;
    elseif theta(k)<=2*pi/3
        y(k)=6;
    elseif theta(k)<=4*pi/3
        y(k)=6-3*(1-0.5*cos(3*(theta(k)-2*pi/3)));
    elseif theta(k)<=3*pi/2
        y(k)=3;
    elseif theta(k)<=7*pi/4
        y(k)=3-1.5*((theta(k)-3*pi/2)/(pi/4))^2;
    else
        y(k)=0.75-0.75*(1-(theta(k)-7*pi/4)/(pi/4))^2;
    end
end
plot(theta,y)
title('Cam Performance')
xlabel('Rotation Angle, rad')
ylabel('Follower Displacement, cm')
```

Figure Window:



Problem 35

Script file:

```
clear, clc
for j=1:2
quiz=input('Please enter the quiz grades as a vector [x x x x x x]: ');
mid=input('Please enter the midterm grades as a vector [x x x]: ');
final=input('Please enter the final exam grade: ');
q_c=(sum(quiz)-min(quiz))/5;
if mean(mid)>final
    grade=3*q_c + 0.5*mean(mid) + 0.2*final;
else
    grade=3*q_c + 0.2*mean(mid) + 0.5*final;
end
if grade>=90
    letter='A';
elseif grade>=80
    letter='B';
elseif grade>=70
    letter='C';
elseif grade>=60
    letter='D';
else
    letter='E';
end
fprintf('\nThe overall course grade is %.1f for a letter grade of
%s\n\n',grade,letter)
end
```

Command Window:

```
Please enter the quiz grades as a vector [x x x x x x]: [6 10 6 8 7 8]
Please enter the midterm grades as a vector [x x x]: [82 95 89]
Please enter the final exam grade: 81

The overall course grade is 83.9 for a letter grade of B

Please enter the quiz grades as a vector [x x x x x x]: [9 5 8 8 7 6]
Please enter the midterm grades as a vector [x x x]: [78 82 75]
Please enter the final exam grade: 81

The overall course grade is 79.0 for a letter grade of C
```

Problem 36

Script file:

```
clear, clc
for j=1:2
    disp(' ')
    mat=input('Please enter the golfer''s rounds as a table: ');
    [n,m]=size(mat);
    hcp=113*(mat(:,3)-mat(:,1))./mat(:,2);
    if n>=20
        N=10;
    elseif n==19
        N=9;
    elseif n==18
        N=8;
    elseif n==17
        N=7;
    elseif n>=15
        N=6;
    elseif n>=13
        N=5;
    elseif n>=11
        N=4;
    elseif n>=9
        N=3;
    elseif n>=7
        N=2;
    else
        N=1;
    end
    for k=1:n-N
        [mval id]=max(hcp);
        hcp(id)=[];
    end
    Players_handicap=floor(10*mean(hcp))/10
end
```

Command Window:

```
Please enter the golfer's rounds as a table: [71.6 122 85; 72.8 118 87;
69.7 103 83; 70.3 115 81; 70.9 116 79; 72.3 117 91; 71.6 122 89;
70.3 115 83; 72.8 118 92; 70.9 109 80; 73.1 132 94; 68.2 115 78;
74.2 135 103; 71.9 121 84]
Players_handicap =
    9.7000

Please enter the golfer's rounds as a table: [72.2 119 71; 71.6 122 73;
74 139 78; 68.2 125 69; 70.2 130 74; 69.6 109 69; 66.6 111 74]
Players_handicap =
   -0.9000
```

Chapter 7
Solved Problems

Problem 1

Script file:

```
clear, clc
disp('Part (a)')
x=[-1.5 5];
y=math(x);
disp('The test values for y(x) are:')
disp(y)
%
%part b
x=-2:.1:6;
plot(x,math(x));
title('y(x)=(-0.2x^3 + 7x^2)e^{-0.3x}')
xlabel('x-->')
ylabel('y-->')
```

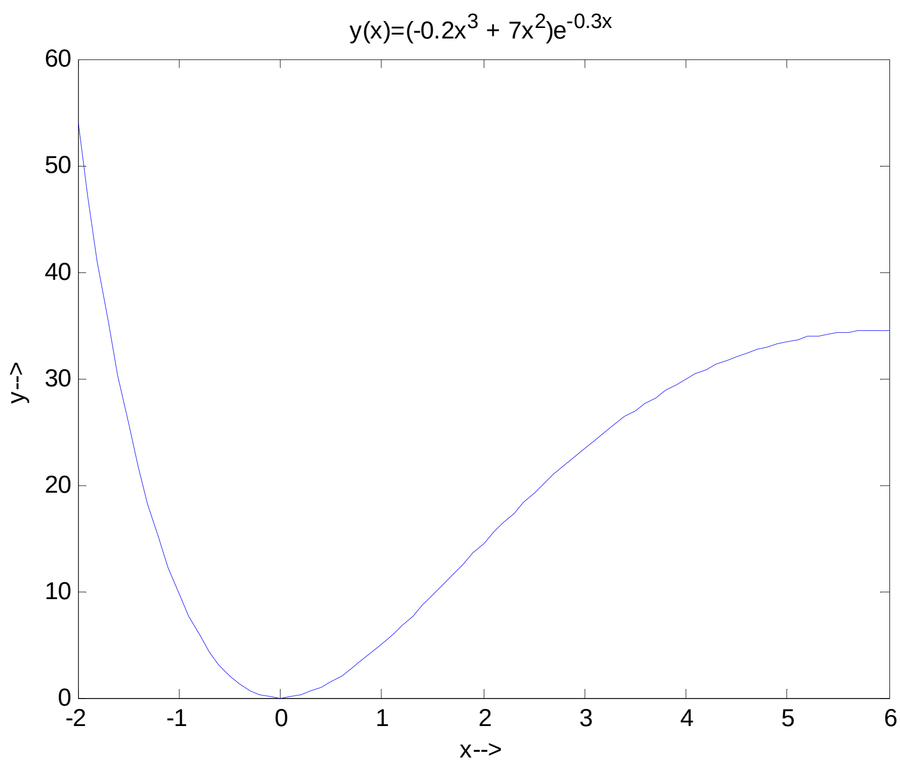
Function file:

```
function y = math(x)
y=(-0.2*x.^3+7*x.^2).*exp(-0.3*x);
```

Command Window:

```
Part (a)
The test values
for y(x) are:
   25.7595
33.4695
```

Figure Window:



Problem 2

Script file:

```
clear, clc
disp('Part (a)')
th=[pi/6, 5*pi/6];
r=polarmath(th);
disp('The test values for r(theta) are:')
disp(r)
%
%part b
th=linspace(0,2*pi,200);
polar(th,polarmath(th));
title('r(\theta)=4cos(4sin(\theta))')
```

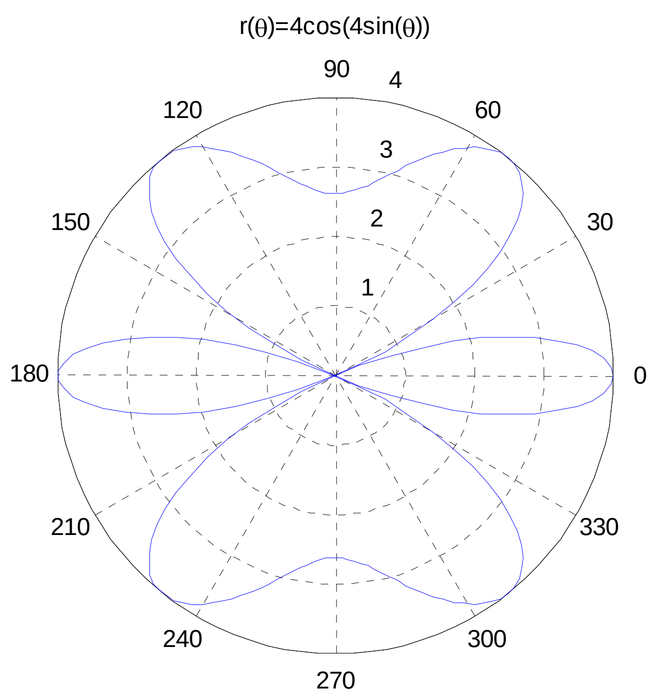
Function file:

```
function r = polarmath(theta)
%angles in radians
r=4*cos(4*sin(theta));
```

Command Window:

```
Part (a)
The test values for r(theta) are:
   -1.6646   -1.6646     1
```

Figure Window:



Problem 3

Script file:

```
clear, clc
disp('Part (a)')
gmi=5;
Lkm = LkmToGalm(gmi);
disp('The fuel consumption of a Boeing 747 in liters/km is:')
disp(Lkm)
disp('Part (b)')
gmi=5.8;
Lkm = LkmToGalm(gmi);
disp('The fuel consumption of a Concorde in liters/km is:')
disp(Lkm)
```

Function file:

```
function Lkm = LkmToGalm(gmi)
Lkm = gmi*4.40488/1.609347;
```

Command Window:

```
Part (a)
The fuel consumption of a Boeing 747 in liters/km is:
   13.6853
Part (b)
The fuel consumption of a Concorde in liters/km is:
   15.8750
```

Problem 4

Script file:

```
clear, clc
disp('Part (a)')
den=7860;
sw = DenTOSw(den);
disp('The specific weight of steel in lb/in^3 is:')
disp(sw)
disp('Part (b)')
den=4730;
sw = DenTOSw(den);
disp('The specific weight of titanium in lb/in^3 is:')
disp(sw)
```

Function file:

```
function sw = DenTOSw(den)
sw=den/2.76799e4;
```

Command Window:

```
Part (a)
The specific weight of steel in lb/in^3 is:
    0.2840
Part (b)
The specific weight of titanium in lb/in^3 is:
    0.1709
```

Problem 5

Script file:

```
kts=400;
fps = ktsTOfps(kts);
fprintf('A speed of 400 kts is %.1f ft/s\n',fps)
```

Function file:

```
function fps = ktsTOfps(kts)
fps=kts*6076.1/3600;
```

Command Window:

```
A speed of 400 kts is 675.1 ft/s
```

Problem 6

Script file:

```
clear, clc
disp('Part (a)')
w=95; h=1.87;
BSA = BodySurA(w,h);
fprintf('The body surface area of a %.0f kg, %.2f m patient is %.3f
m^2\n',w,h,BSA)
disp('Part (b)')
w=61; h=1.58;
BSA = BodySurA(w,h);
fprintf('The body surface area of a %.0f kg, %.2f m patient is %.3f
m^2\n',w,h,BSA)
```

Function file:

```
function BSA = BodySurA(w,h)
BSA = 0.007184*w^0.425*h^0.75;
```

Command Window:

```
Part (a)
The body surface area of a 95 kg, 1.87 m patient is 0.080 m^2
Part (b)
The body surface area of a 61 kg, 1.58 m patient is 0.058 m^2
```

Problem 7

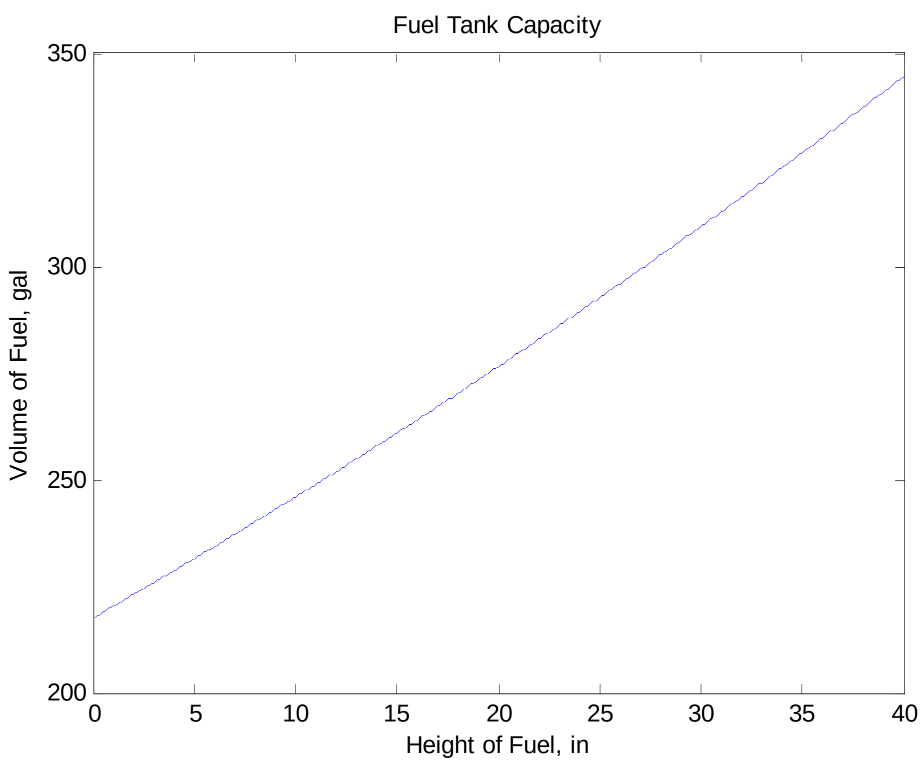
Script file:

```
clear, clc
y=0:.1:40;
plot(y,Volfuel(y))
title('Fuel Tank Capacity')
xlabel('Height of Fuel, in')
ylabel('Volume of Fuel, gal')
```

Function file:

```
function V = Volfuel(y)
r=20; H=2*r;
ry=(1+0.5*y/H)*r;
V=0.004329*pi*H*(r^2+r*ry+ry.^2)/3;
```

Figure Window:



Problem 8

Script file:

```
clear, clc
gamma=0.696; r=0.35; d=0.12; t=0.002;
coat=@(r,d,t,gamma) gamma*t*pi^2*(2*r+d)*d;
weight=coat(r,d,t,gamma);
fprintf('The required weight of gold is %.5f lb\n',weight)
```

Command Window:

```
The required weight of gold is 0.00135 lb
```

Problem 9

Script file:

```
clear, clc
T=35; V=26;
Twc = WindChill(T,V);
fprintf('For conditions of %.0f degF and %.0f mph',T,V)
fprintf(' the wind chill temperature is %.1f degF\n\n',Twc)
disp('Part (b)')
T=10; V=50;
Twc = WindChill(T,V);
fprintf('For conditions of %.0f degF and %.0f mph',T,V)
fprintf(' the wind chill temperature is %.1f degF\n\n',Twc)
```

Function file:

```
function Twc = WindChill(T,V)
C1=35.74; C2=0.6215; C3=-35.75; C4=0.4275;
Twc = C1+C2*T+C3*V^0.16+C4*T*V^0.16;
```

Command Window:

```
Part (a)
For conditions of 35 degF and 26 mph the wind chill temperature is 22.5 degF

Part (b)
For conditions of 10 degF and 50 mph the wind chill temperature is -16.9 degF
```

Problem 10

Script file:

```
clear, clc
g=[3.7 3 3.3 2 0 4 1.3 4];
h=[4 3 3 2 3 4 3 3];
av = GPA(g,h);
fprintf('The student''s grade point average is %.2f\n',av)
```

Function file:

```
function av = GPA(g,h)
av = sum(g.*h)/sum(h);
```

Command Window:

```
The student's grade point average is 2.78
```

Problem 11

Script file:

```
clear, clc
disp('Part (a)')
x=9;
y = fact(x);
if y>0
    fprintf('The factorial of %i is %i\n\n',x,y)
end
disp('Part (b)')
x=8.5;
y = fact(x);
if y>0
    fprintf('The factorial of %i is %i\n\n',x,y)
end
disp('Part (c)')
x=0;
y = fact(x);
if y>0
    fprintf('The factorial of %i is %i\n\n',x,y)
end
disp('Part (d)')
x=-5;
y = fact(x);
if y>0
    fprintf('The factorial of %i is %i\n\n',x,y)
end
```

Function file:

```
function y = fact(x)
if x<0
    y=0;
    fprintf('Error: Negative number inputs are not allowed\n\n')
elseif floor(x)~=x
    y=0;
    fprintf('Error: Non-integer number inputs are not allowed\n\n')
elseif x==0
    y=1;
else
    y=1;
    for k=1:x
        y=y*k;
    end
end
```

Command Window:

```
Part (a)
The factorial of 9 is 362880

Part (b)
```

```
Error: Non-integer number inputs are not allowed

Part (c)
The factorial of 0 is 1

Part (d)
Error: Negative number inputs are not allowed
```

Problem 12

Script file:

```
clear, clc
disp('Part (a)')
A=[-5 -1 6]; B=[2.5 1.5 -3.5]; C=[-2.3 8 1];
th = anglines(A,B,C);
fprintf('The angle between the points is %.1f degrees\n\n',th)
disp('Part (b)')
A=[-5.5 0]; B=[3.5,-6.5]; C=[0,7];
th = anglines(A,B,C);
fprintf('The angle between the points is %.1f degrees\n\n',th)
```

Function file:

```
function th = anglines(A,B,C)
BA = A-B; BC = C-B;
th=acosd(dot(BA,BC)/(sqrt(sum(BA.^2))*sqrt(sum(BC.^2))));
```

Command Window:

```
Part (a)
The angle between the points is 56.9 degrees

Part (b)
The angle between the points is 39.6 degrees
```

Problem 13

Script file:

```
clear, clc
disp('Part (a)')
A=[1.2 3.5]; B=[12 15];
n=unitvec(A,B);
disp('The unit vector is:')
disp(n)
disp('Part (b)')
A=[-6 14.2 3]; B=[6.3 -8 -5.6];
n=unitvec(A,B);
disp('The unit vector is:')
disp(n)
```

Function file:

```
function n=unitvec(A,B)
n=(B-A)/sqrt(sum((B-A).^2));
```

Command Window:

```
Part (a)
The unit vector is:
    0.6846    0.7289
Part (b)
The unit vector is:
    0.4590   -0.8284   -0.3209
```

Problem 14

Script file:

```
clear, clc
disp('Part (a)')
a=[3 11]; b=[14,-7.3];
r=crosspro(a,b);
disp('The cross product vector is:')
disp(r)
disp('Part (b)')
c=[-6 14.2 3]; d=[6.3 -8 -5.6];
s=crosspro(c,d);
disp('The cross product vector is:')
disp(s)
```

Function file:

```
function w = crosspro(u,v)
n=length(u);
if n == 2
    u(3)=0;
    v(3)=0;
end
w(1)=u(2)*v(3)-u(3)*v(2);
w(2)=u(3)*v(1)-u(1)*v(3);
w(3)=u(1)*v(2)-u(2)*v(1);
```

Command Window:

```
Part (a)
The cross product vector is:
         0         0 -175.9000
Part (b)
The cross product vector is:
  -55.5200  -14.7000  -41.4600
```

Problem 15

Script file:

```
clear, clc
disp('Part (a)')
A=[1,2]; B=[10,3]; C=[6,11];
Area = TriArea(A,B,C);
fprintf('The area of the triangle is %.1f\n\n',Area)
disp('Part (b)')
A=[-1.5, -4.2, -3]; B=[-5.1, 6.3, 2]; C=[12.1, 0, -0.5];
Area = TriArea(A,B,C);
fprintf('The area of the triangle is %.1f\n\n',Area)
```

Function files:

```
function Area = TriArea(A,B,C)
[AB AC] = sides(A,B,C);
Area = sqrt(sum(crosspro(AB,AC).^2))/2;
end

function [AB AC] = sides(A,B,C)
AB = B-A; AC = C-A;
end


function w = crosspro(u,v)
n=length(u);
if n == 2
    u(3)=0;
    v(3)=0;
end
w(1)=u(2)*v(3)-u(3)*v(2);
w(2)=u(3)*v(1)-u(1)*v(3);
w(3)=u(1)*v(2)-u(2)*v(1);
end
```

Command Window:

```
Part (a)
The area of the triangle is 38.0

Part (b)
The area of the triangle is 87.9
```

Problem 16

Script file:

```
clear, clc
disp('Part (a)')
A=[1,2]; B=[10,3]; C=[6,11];
cr = cirtriangle(A,B,C);
fprintf('The perimeter of the triangle is %.1f\n\n',cr)
disp('Part (b)')
A=[-1.5, -4.2, -3]; B=[-5.1, 6.3, 2]; C=[12.1, 0, -0.5];
cr = cirtriangle(A,B,C);
fprintf('The perimeter of the triangle is %.1f\n\n',cr)
```

Function file:

```
function cr = cirtriangle(A,B,C)
vlength = @(A,B) sqrt(sum((B-A).^2));
cr=vlength(A,B) + vlength(B,C) + vlength(C,A);
```

Command Window:

```
Part (a)
The perimeter of the triangle is 28.3

Part (b)
The perimeter of the triangle is 45.1
```

Problem 17

Script file:

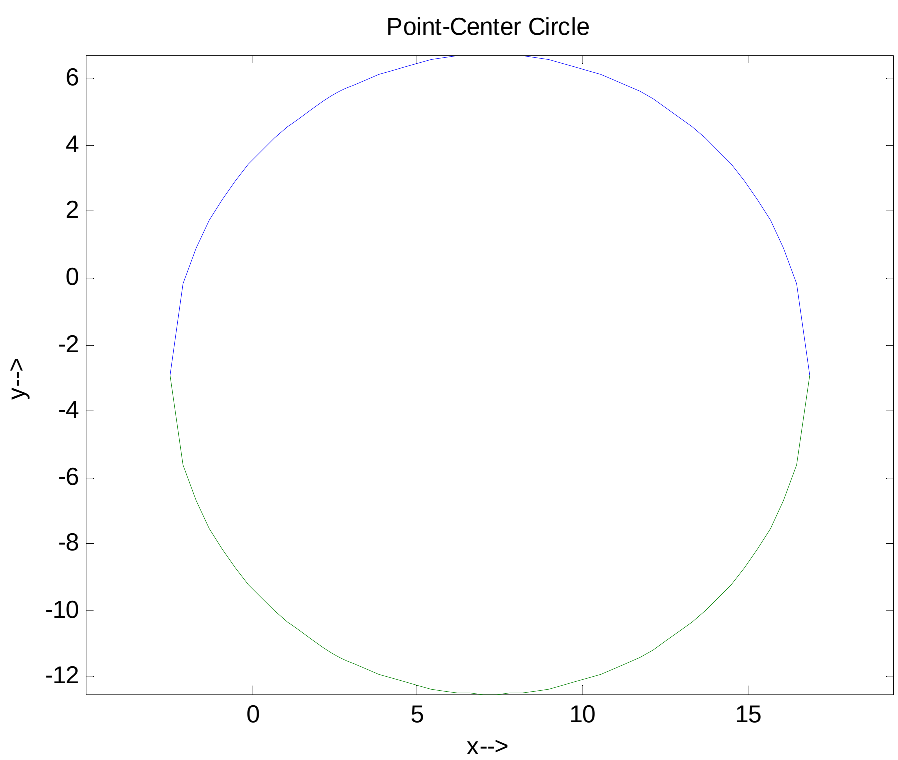
```
clear, clc
disp('Part (a)')
c=[7.2, -2.9]; p=[-1.8, 0.5];
figure(1)
circlePC(c,p)
disp('Part (b)')
c=[-0.9,-3.3]; p=[0,10];
figure(2)
circlePC(c,p)
```

Function file:

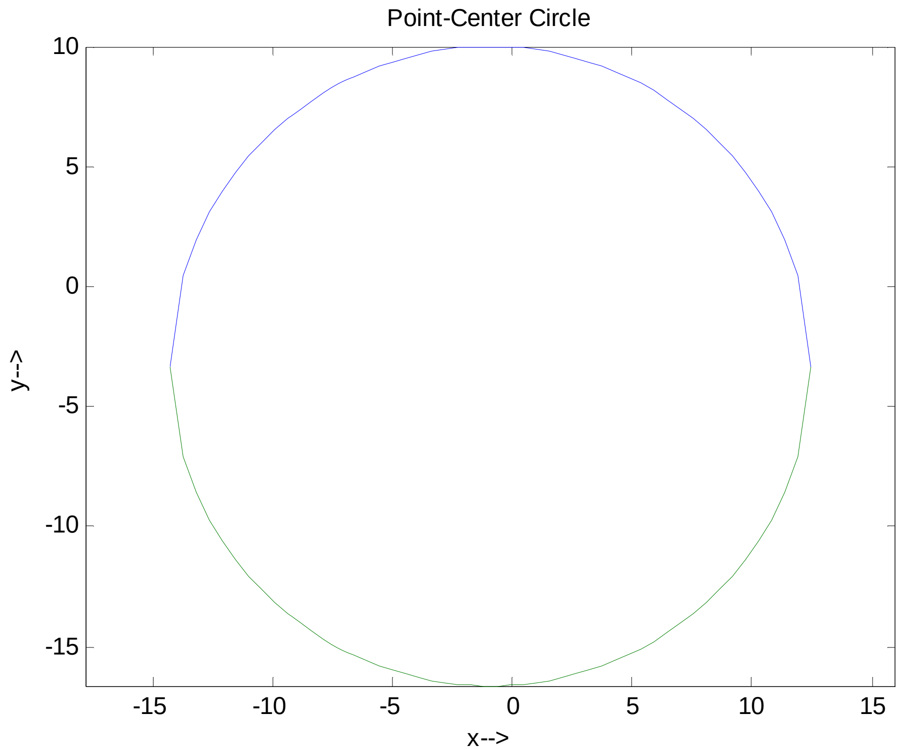
```
function circlePC(c,p)
vlength = @(A,B) sqrt(sum((B-A).^2));
r=vlength(c,p);
x=linspace(c(1)-r,c(1)+r,50);
y1=sqrt(r^2-(x-c(1)).^2)+c(2);
y2=-sqrt(r^2-(x-c(1)).^2)+c(2);
plot(x,y1,x,y2)
title('Point-Center Circle')
axis equal
xlabel('x-->')
ylabel('y-->')
```

Figure Windows:

(a)



(b)



Problem 18

Script file:

```
disp('Part (a)')
d=100;
b = Bina(d);
if b>=0
    disp('The binary decomposition is:')
    disp(b)
end
disp('Part (b)')
d=1002;
b = Bina(d);
if b>=0
    disp('The binary decomposition is:')
    disp(b)
end
disp('Part (c)')
d=52601;
b = Bina(d);
if b>=0
    disp('The binary decomposition is:')
    disp(b)
end




disp('Part (d)')
d=2000090;
b = Bina(d);
if b>=0
    disp('The binary decomposition is:')
    disp(b)
end
```

Function file:

```
function b = Bina(d)
if d>=2^16
    b=-1;
    fprintf('The integer is too large for this routine\n')
else
    n=floor(log(d)/log(2));
    b=[];
    for k=n:-1:0
        p=floor(d/2^k);
        b=[b p];
        d=d-p*2^k;
    end
end
```

Command Window:

```
Part (a)
The binary decomposition is:
     1     1     0     0     1     0     0
Part (b)
The binary decomposition is:
     1     1     1     1     1     0     1     0     1     0
Part (c)
The binary decomposition is:
  Columns 1 through 13
     1     1     0     0     1     1     0     1     0     1     1     1
1
  Columns 14 through 16
     0     0     1
Part (d)
The integer is too large for this routine
```

Problem 19

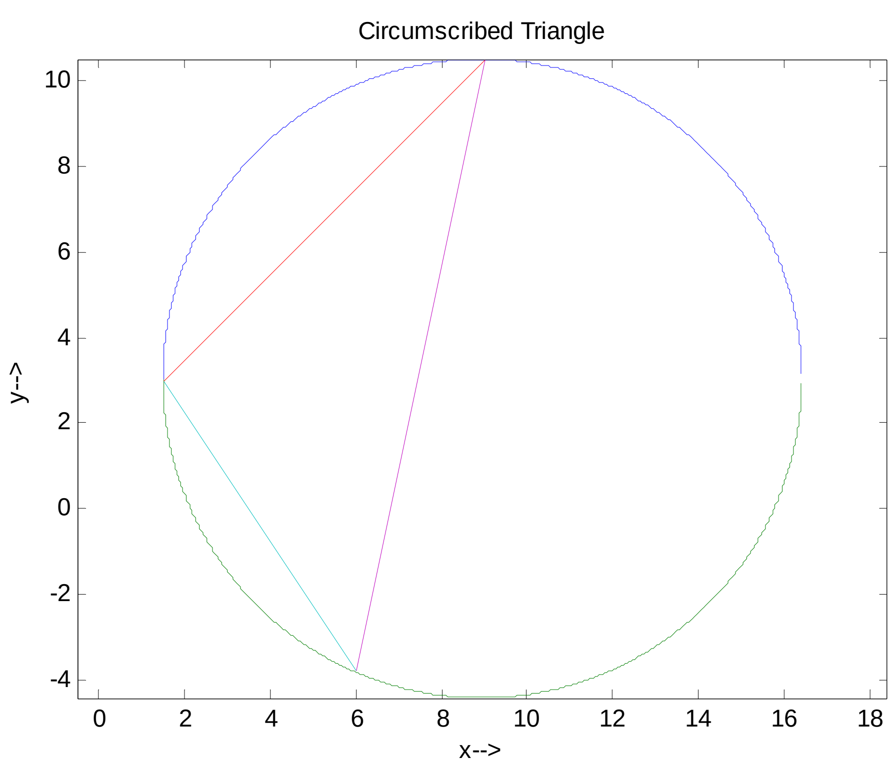
Script file:

```
A=[1.5, 3]; B=[9,10.5]; C=[6,-3.8];
TriCirc(A,B,C)
```

Function file:

```
function TriCirc(A,B,C)
%note - ignoring possibility of vertical/horizontal edges
midAB=(A+B)/2;
abisectorAB=-(A(1)-B(1))/(A(2)-B(2));
bbisectorAB=midAB(2)-abisectorAB*midAB(1);
midBC=(B+C)/2;
abisectorBC=-(B(1)-C(1))/(B(2)-C(2));
bbisectorBC=midBC(2)-abisectorBC*midBC(1);
mat=[-abisectorAB 1; -abisectorBC 1]; col=[bbisectorAB; bbisectorBC];
center=mat\col; r=sqrt((A(1)-center(1))^2 + (A(2)-center(2))^2)
x=center(1)-r:.01:center(1)+r;
y1=center(2)+sqrt(r^2 - (x-center(1)).^2);
y2=center(2)-sqrt(r^2 - (x-center(1)).^2);
plot(x,y1,x,y2,[A(1) B(1)],[A(2) B(2)],[A(1) C(1)],[A(2) C(2)],...
    [B(1) C(1)],[B(2) C(2)])
axis equal
title('Circumscribed Triangle')
xlabel('x-->')
ylabel('y-->')
```

Figure Window:



Problem 20

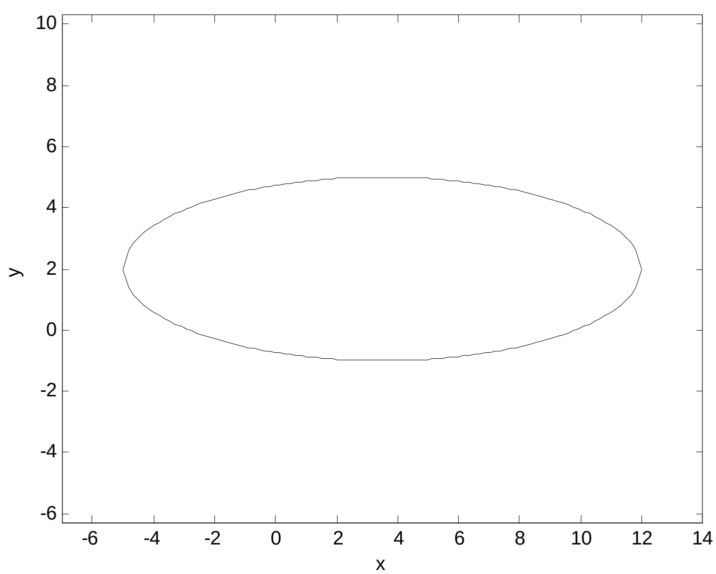
Script file:

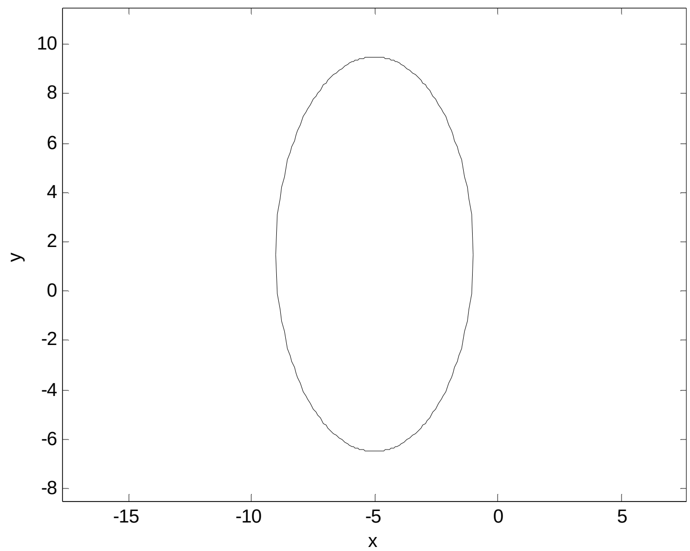
```
figure(1)
xc=3.5; yc=2.0; a=8.5; b=3;
ellipseplot(xc,yc,a,b)
figure(2)
xc=-5; yc=1.5; a=4; b=8;
ellipseplot(xc,yc,a,b)
```

Function file:

```
function ellipseplot(xc,yc,a,b)
x=linspace(-a,a,100);
y=sqrt(b^2*(1-x.^2/a^2));
xp=x+xc;
ypp=y+yc;
ypm=-y+yc;
plot(xp,ypp,'k',xp,ypm,'k')
%axis square
axis([xc-a-2,xc+a+2,yc-b-2,yc+b+2])
axis equal
xlabel('x'), ylabel('y')
```

Figure Windows





10
8
6
4
2
0
-2
-4
-6
-8
y
-15
-10
-5
0
5
x

Problem 21

Script file:

```
disp('Part (a)')
r1=5; th1=23; r2=12; th2=40;
[r th] = AddVecPol(r1,th1,r2,th2)
disp('Part (b)')
r1=6; th1=80; r2=15; th2=125;
[r th] = AddVecPol(r1,th1,r2,th2)
```

Function file:

```
function [r th] = AddVecPol(r1,th1,r2,th2)
x1=r1*cosd(th1); y1=r1*sind(th1);
x2=r2*cosd(th2); y2=r2*sind(th2);
x=x1+x2; y=y1+y2;
r=sqrt(x^2+y^2); th=atan2d(y,x);
```

Command Window:

```
Part (a)
r =
   16.8451
th =
   35.0215
Part (b)
r =
   19.7048
th =
  112.5663
```

Problem 22

User-defined function:

```
function pr=prime(m,n)
% prime determines all the prime numbers between m and n.
% Input argument:
% m  An interger.
% n  An interger (n>m).
% Output argument:
% pr  A vector whose elements are the prime numbers between 1 and n.
if n<=0
    pr='Error';
    disp('ERROR: Input argument must be a positive integer')
elseif round(n)~=n | round(m)~=m
    pr='Error';
    disp('ERROR: Input argument must be positive integer')
elseif n <= m
    pr='Error';
    disp('ERROR: n must be greater than m')
else
    k=1;
    for i=m:n
        c=0;
        for j=2:i-1
            if rem(i,j)==0
                c=1;
                break
            end
        end
        if c==0
            pr(k)=i;
            k=k+1;
        end
     end
end
```

Command Window:

22.*a*

```
>> pr=prime(12,80)
pr =
  Columns 1 through 9
    13    17    19    23    29    31    37    41    43
  Columns 10 through 17
    47    53    59    61    67    71    73    79
```

22.*b*

```
>> pr=prime(21,63.5)
ERROR: Input argument must be positive integer
```

```
pr =
Error
```

22.*c*

```
>> pr=prime(100,200)
pr =
  Columns 1 through 9
   101   103   107   109   113   127   131   137   139
  Columns 10 through 18
   149   151   157   163   167   173   179   181   191
  Columns 19 through 21
   193   197   199
```

22.*d*

```
>> pr=prime(90,50)
ERROR: n must be greater than m
pr =
Error
```

Problem 23

Script file:

```
year=1978:1987;
Infl=[1.076 1.113 1.135 1.103 1.062 1.032 1.043 1.036 1.019 1.036];
GeometricMeanInflation = Geomean(Infl)
```

Function file:

```
function GM = Geomean(x)
GM = prod(x)^(1/length(x));
end
```

Command Window:

```
GeometricMeanInflation =
    1.0648
```

Problem 24

User-defined function:

```
function [theta, radius]=CartesianToPolar(x,y)
radius= sqrt(x^2+y^2);
theta=acos(abs(x)/radius)*180/pi;
if (x<0)&(y>0)
    theta=180-theta;
end
if (x>0)&(y<0)
    theta=-theta;
end
if (x<=0)&(y<0)
    theta=theta-180;
end
```

Command Window:

```
>> [th_a, radius_a]=CartesianToPolar(14,9)
th_a =
   32.7352
radius_a =
   16.6433
>> [th_b, radius_b]=CartesianToPolar(-11,-20)
th_b =
 -118.8108
radius_b =
   22.8254
>> [th_c, radius_c]=CartesianToPolar(-15,4)
th_c =
  165.0686
radius_c =
   15.5242
>> [th_d, radius_d]=CartesianToPolar(13.5,-23.5)
th_d =
  -60.1240
radius_d =
   27.1017
```

Problem 25

Function file:

```
function m=mostfrq(x)
n=length(x);
a=x==x(1);
av=x(a);
b(1,1)=av(1);
b(1,2)=length(av);
j=2;
for i=2:n
    flag=1;
    for k=1:j-1
        if x(i)==b(k,1)
            flag=0;
        end
    end
        if flag==1
            a=x==x(i);
            av=x(a);
            b(j,1)=av(1);
            b(j,2)=length(av);
            j=j+1;
        end
end
[tmax ni]=max(b(:,2));
tmaxi=b==tmax;
tmaxtot=sum(tmaxi(:,2));
if tmaxtot > 1
    m=('There in more than one value for the mode.');
else
m(1,1)=b(ni,1);
m(1,2)=tmax;
end
```

Command Window:

```
>> d=randi(10,1,20)
d =
     1     3     9     1    10     8     5     6     3     5    10     6
6     3     5     7     7     4     4    10
>> m=mostfrq(d)
m =
There in more than one value for the mode.
>> d=randi(10,1,20)
d =
     1     9    10     8     1     3     4     7     2     8     2     7
5     8     8    10     9     4     7     2
>> m=mostfrq(d)
m =
     8     4
>> d=randi(10,1,20)
```

```
d =
     1     8     6     5    10     7     7     9     9     6     2     3
9     1     5     2    10     8     6     5
>> m=mostfrq(d)
m =
There in more than one value for the mode.
```

Problem 26

Script file:

```
x=randi([-30 30],1,14)
y=downsort(x)
```

Function file:

```
function y=downsort(x)
y=x;
n=length(y);
for k=1:n-1
    for j=k+1:n
        if y(k)<y(j)
            temp=y(k);
            y(k)=y(j);
            y(j)=temp;
        end
    end
end
```

Command Window:

```
x =
    4   -2  -30  -10  -21   18  -12    2  -20    6  -14    9   12   15
y =
   18   15   12    9    6    4    2   -2  -10  -12  -14  -20  -21  -30
```

Problem 27

Script file:

```
A=randi([-30 30], 4, 7)
B=matrixsort(A)
```

Function files:

```
function B = matrixsort(A)
[n,m]=size(A); ntm=n*m;
C=reshape(A',1,ntm);
D=downsort(C);
B=reshape(D,m,n)';

function y=downsort(x)
y=x;
n=length(y);
for k=1:n-1
    for j=k+1:n
        if y(k)<y(j)
            temp=y(k);
            y(k)=y(j);
            y(j)=temp;
        end
    end
end
```

Command Window:

```
A =
    27  -16  -28    9   15   -8   26
    28   -9  -20   -3  -19    8   17
     5   20    9    3   11   17   -1
   -27  -30   14  -12  -19  -26   -4
B =
    28   27   26   20   17   17   15
    14   11    9    9    8    5    3
    -1   -3   -4   -8   -9  -12  -16
   -19  -19  -20  -26  -27  -28  -30
```

Problem 28

Script file:

```
x=randi([-20 100],4,6)
[Em,rc] = matrixmax(x)
```

Function file:

```
function [Em,rc] = matrixmax(A)
[n,m]=size(A);
Em = A(1,1)-1;
for j=1:n
    for k=1:m
        if A(j,k)>Em
            Em=A(j,k);
            rc=[j k];
        end
    end
end
```

Command Window:

```
x =
    78     3    22    90    26    44
     9    10    80    14    48    74
    92    54    50    71   -11    93
    22    37    46    71   -14    -5
Em =
    93
rc =
     3     6
```

Problem 29

Script file:

```
disp('Part (a)')
A=[1 3 2; 6 5 4; 7 8 9];
d3 = det3by3(A)
disp('Part (b)')
A=[-2.5 7 1; 5 -3 -2.6; 4 2 -1];
d3 = det3by3(A)
```

Function files:

```
function d3 = det3by3(A)
d3=A(1,1)*det2by2(A(2:3,2:3)) - A(1,2)*det2by2(A(2:3,[1 3])) + ...
    A(1,3)*det2by2(A(2:3,1:2));
function d2 = det2by2(B)
d2=B(1,1)*B(2,2)-B(1,2)*B(2,1);
```

Command Window:

```
Part (a)
d3 =
   -39
Part (b)
d3 =
  -36.3000
```

Problem 30

Script file:

```
disp('Part (a)')
S=[160, -40, 60]; th=20;
disp('Stress in x''-y'' coordinate system in MPa')
Stran = StressTrans(S,th)
disp('Part (b)')
S=[-18, 10, -8]; th=20;
disp('Stress in x''-y'' coordinate system in ksi')
Stran = StressTrans(S,65)
```

Function file:

```
function Stran = StressTrans(S,th)
Stran(1)=0.5*(S(1)+S(2)) + 0.5*(S(1)-S(2))*cosd(2*th) + S(3)*sind(2*th);
Stran(2)=S(1)+S(2)-Stran(1);
Stran(3)=-0.5*(S(1)-S(2))*sind(2*th) + S(3)*cosd(2*th);
end
```

Command Window:

```
Part (a)
Stress in x'-y' coordinate system in MPa
Stran =
  175.1717  -55.1717  -18.3161
Part (b)
Stress in x'-y' coordinate system in ksi
Stran =
   -1.1293   -6.8707   15.8669
```

Problem 31

Script file:

```
disp('Part (a)')
T=78; Tw=66; BP=29.09;
[Td,RH] = DewptRhum(T,Tw,BP)
disp('Part (b)')
T=97; Tw=88; BP=30.12;
[Td,RH] = DewptRhum(T,Tw,BP)
```

Function file:

```
function [Td,RH] = DewptRhum(T,Tw,BP)
TC = @(T) (T-32)*5/9;
TF = @(T) 9*T/5 +32;
PM = @(BP) 33.863886667*BP;
T=TC(T); Tw=TC(Tw);
es=6.112*exp(17.67*T/(T+243.5));
ew=6.112*exp(17.67*Tw/(Tw+243.5));
e=ew-PM(BP)*(T-Tw)*0.00066*(1+0.00115*Tw);
RH=100*e/es;
Td=243.5*log(e/6.112)/(17.67-log(e/6.112));
Td=TF(Td);
Td=round(10*Td)/10;
RH=round(10*RH)/10;
```

Command Window:

```
Part (a)
Td =
    59.6
RH =
    53.1
Part (b)
Td =
    85.5
RH =
    69.7
```

Problem 32

Script file:

```
disp('Part (a)')
x=lotto(1,59,7)
disp('Part (b)')
x=lotto(50,65,8)
disp('Part (c)')
x=lotto(-25,-2,9)
```

Function file:

```
function x=lotto(a,b,n)
v=rand(1,n);
list=a:b;
x=[];
for k=1:n
    index=round(v(k)*(length(list)-1)+1.5);
    x(k)=list(index);
    list(index)=[];
end
```

Command Window:

```
Part (a)
x =
   45   23   34    6    4   33   48
Part (b)
x =
   65   52   59   57   51   56   54   63
Part (c)
x =
  -17  -12  -21   -9  -19   -8   -7   -6  -15
```

Problem 33

Script file:

```
format short g
disp('Part (a)')
cos67=cosTay(67)
diff=abs(cosd(67)-cos67)
disp('Part (b)')
cos200=cosTay(200)
diff=abs(cosd(200)-cos200)
disp('Part (c)')
cos_neg_80=cosTay(-80)
diff=abs(cosd(-80)-cos_neg_80)
disp('Part (d)')
cos794=cosTay(794)
diff=abs(cosd(794)-cos794)
disp('Part (e)')
cos20000=cosTay(20000)
diff=abs(cosd(20000)-cos20000)
disp('Part (f)')
cos_neg_738=cosTay(-738)
diff=abs(cosd(-738)-cos_neg_738)
```

Function file:

```
function y=cosTay(x)
format long
if abs(x/360) >= 1
    x=x-fix(x/360)*360;
end
xrad=x*pi/180; sum=0;
for i=1:1000
    n=i-1;
    sum=sum+(((-1)^n)*(xrad^(2*n))/factorial(2*n));
    S(i)=sum;
    if i>=2
    E=abs((S(i)-S(i-1))/S(i-1));
        if E<=0.0000001
        break
        end
    end
end
y=sum;
```

Command Window:

```
Part (a)
cos67 =
   0.390731128591239
diff =
     1.019652695610773e-10
Part (b)
cos200 =
```

```
  -0.939692620020872
diff =
     7.650369227008014e-10
Part (c)
cos_neg_80 =
   0.173648177657020
diff =
     9.910405829316460e-12
Part (d)
cos794 =
   0.275637355814150
diff =
     2.849442903851696e-12
Part (e)
cos20000 =
  -0.939692620020872
diff =
     7.650369227008014e-10
Part (f)
cos_neg_738 =
   0.951056516297732
diff =
     2.578826041599314e-12
```

Problem 34

Script file:

```
w=10; h=7; d=1.75; t=0.5;
yc=centroidU(w,h,t,d)
```

Function file:

```
function yc = centroidU(w,h,t,d)
yc=(d*(w-2*t)*(h-d/2)+t*h^2)/(2*h*t+d*(w-2*t));
```

Command Window:

```
yc =

    5.3173
```

Problem 35

Script file:

```
w=12; h=8; d=2; t=0.75;
Ixc=IxcTBeam(w,h,t,d)
```

Function files:

```
function Ixc = IxcTBeam(w,h,t,d)
yc = centroidU(w,h,t,d);
Ixc = 2*(t*h^3/12+t*h*(h/2-yc)^2) + (w-2*t)*d^3+(w-2*t)*d*(h-d/2-yc)^2;
```

```
function yc = centroidU(w,h,t,d)
yc=(d*(w-2*t)*(h-d/2)+t*h^2)/(2*h*t+d*(w-2*t));
```

Command Window:

```
Ixc =

  216.7273
```

Problem 36

Script file:

```
R=input('Please input the size of the resistor: ');
L=input('Please input the size of the inductor: ');
%can use logspace or explicitly create an appropriate array for w
power=1:.01:6;
w=10.^power;
RV=LRFilt(R,L,w);
semilogx(w,RV)
title('LR Circuit Response')
xlabel('Frequency, rad/s')
ylabel('Throughput')
```

Function file:

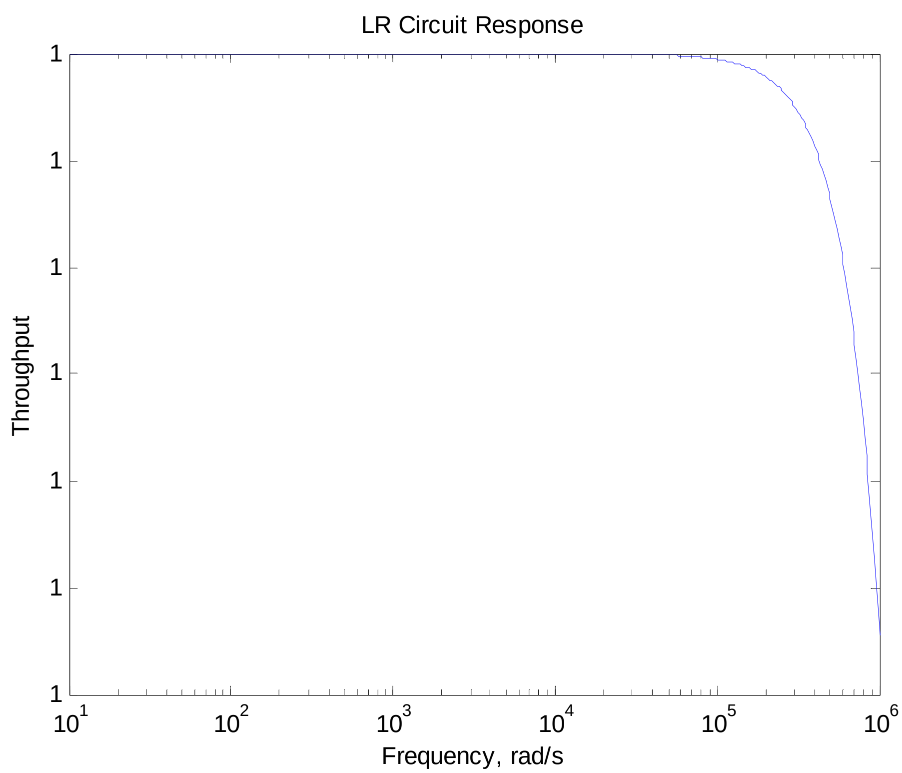
```
function RV=LRFilt(R,L,w)
RV=1./sqrt(1+(w*L/R).^2);
```

Command Window:

Please input the size of the resistor: 600

Please input the size of the inductor: 0.14e-6

Figure Window:



Problem 37

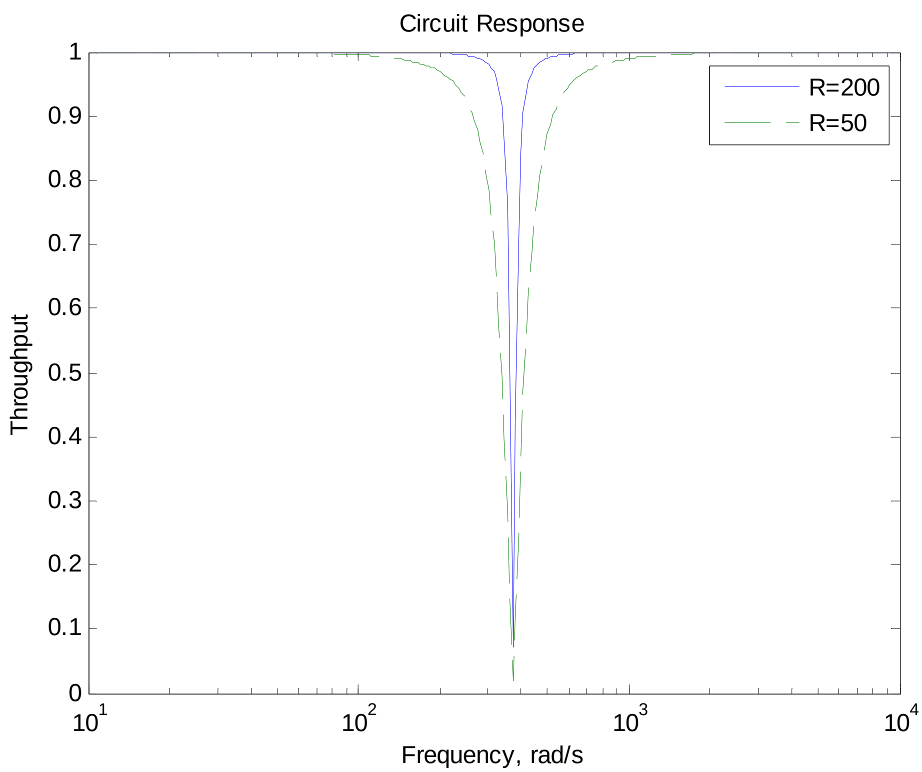
Script file:

```
C=160*10^-6; L=.045; R=200;
%note can use logspace or explicitly create appropriate array of w
power=1:.01:4;
w=10.^power;
RV1=filtfreq(R,C,L,w);
R=50;
RV2=filtfreq(R,C,L,w);
semilogx(w,RV1,w,RV2,'--')
title('Circuit Response')
xlabel('Frequency, rad/s')
ylabel('Throughput')
legend('R=200','R=50')
```

Function file:

```
function RV = filtfreq(R,C,L,w)
RV= abs(R*(1-w.^2*L*C))./sqrt((R-R*w.^2*L*C).^2 + (w*L).^2);
```

Figure Window:



Problem 38

Script file:

```
disp(' ')
disp('Part (a)')
Func=@(x) x^3*exp(2*x);
dxdy=Funder(Func,0.6)
disp(' ')
disp('Part (b)')
Func=@(x) 3^x/x^2;
dxdy=Funder(Func,2.5)
```

Function file:

```
function dfdx = Funder(Fun,x0)
dfdx=(Fun(x0*1.01)-Fun(x0*.99))/(2*x0/100);
```

Command Window:

```
Part (a)
dxdy =
   5.0209

Part (b)
dxdy =
   0.7448
```

Problem 39

Script file:

```
disp('Part (a)')
[xnew,ynew] = rotation(6.5,2.1,25)
disp(' ')
disp('Part (b)')
x=5:.1:9;
y=(x-7).^2+1.5;
[xnew,ynew]=rotation(x,y,25);
plot(x,y,xnew,ynew,':')
title('rotation test')
legend('y=(x-7)^2+1.5','25 degree rotation')
xlabel('x-->')
ylabel('y-->')
axis([0 10 0 10])
```

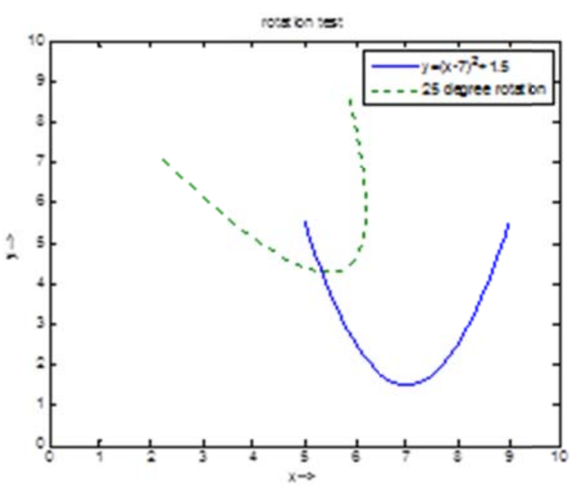
Function file:

```
function [xr,yr] = rotation(x,y,q)
xr=x*cosd(q) -y*sind(q);
yr=x*sind(q) + y*cosd(q);
```

Command Window:

```
Part (a)

xnew =

    5.0035

ynew =

    4.6503
```

Figure Window:



Problem 40

Script file:

```
disp('Part (a)')
prob3of6 = ProbLottery(3,6,49)
disp(' ')
disp('Part (b)')
num=0:6;
odds=ProbLottery(num,6,49);
tbl=[num;odds];
disp(' ')
disp(' Number')
disp(' Correct      Odds')
fprintf('   %1i      %.9f\n',tbl)
fprintf('\nCheck:  The sum of the probabilities is %.9f\n',sum(odd
```

Function files:

```
function P = ProbLottery(m,r,n)
P=Cxy(r,m).*Cxy(n-r,r-m)./Cxy(n,r);

function C = Cxy(x,y)
C=factorial(x)./(factorial(y).*factorial(x-y));
```

Command Window:

```
Part (a)
prob3of6 =
    0.0177

Part (b)

 Number
 Correct      Odds
   0      0.435964976
   1      0.413019450
   2      0.132378029
   3      0.017650404
   4      0.000968620
   5      0.000018450
   6      0.000000072

Check:  The sum of the probabilities is 1.000000000
```

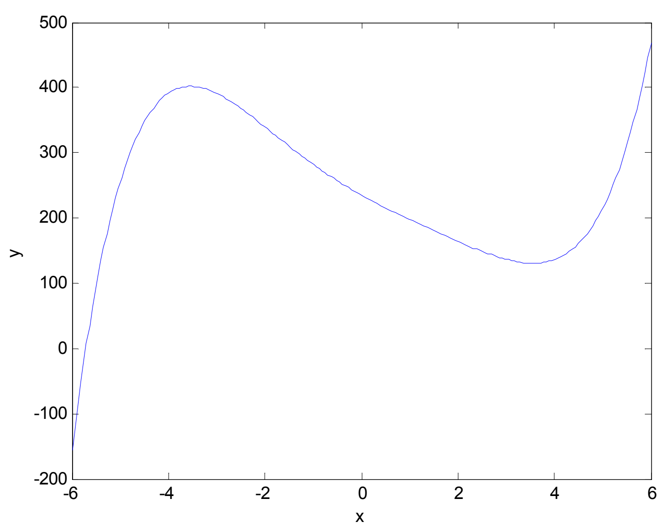
Chapter 8
Solved Problems

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:

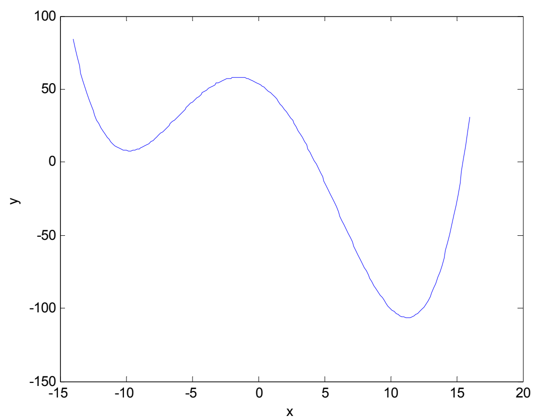


Problem 2

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:

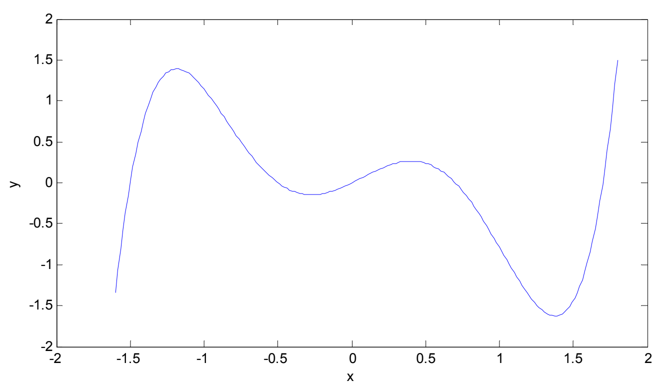
```
clear, clc
p1=[1 -1.7]; p2=[1 0.5]; p3=[1 -0.7]; p4=[1 1.5]; p5=[1 0];
p12=conv(p1,p2);
p34=conv(p3,p4);
p14=conv(p12,p34);
p=conv(p14,p5)
x=linspace(-1.6,1.8,200);
y=polyval(p,x);
plot(x,y)
xlabel('x')
ylabel('y')
```

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*)

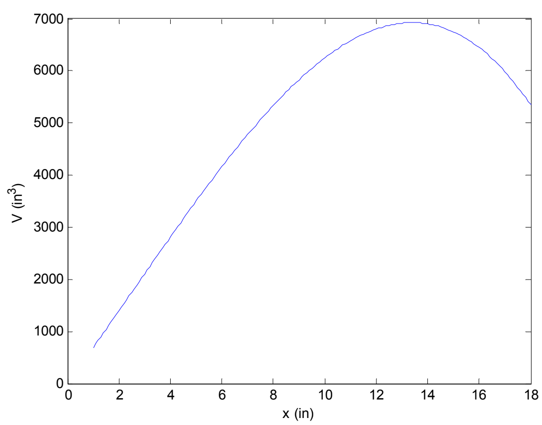
$$V = x(x+15)\frac{(20\cdot 12 - 8x - 60)}{4} = x(x+15)(45-2x)$$

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

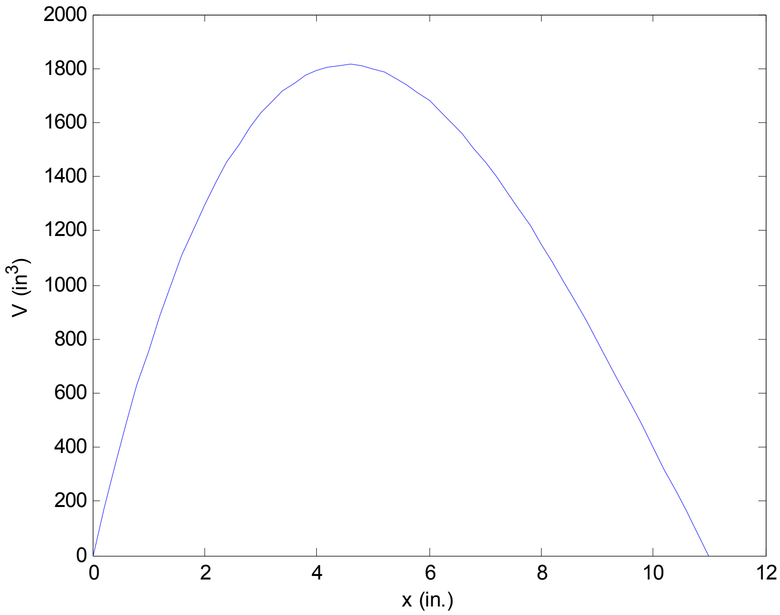
Script File:

```
% 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:

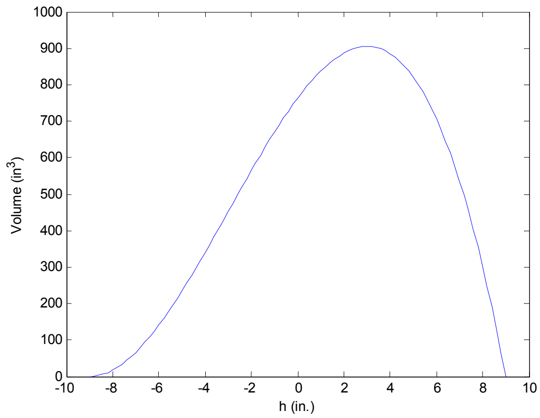
$$V = \frac{\pi}{3}(R^2 - h^2)(R + h) = \frac{\pi}{3}(-h^3 - Rh^2 + R^2h + R^3)$$

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
-10
-8
-6
-4
-2
0
2
4
6
8
10
Volume (in^3)
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)))
```

<u>Command Window:</u>

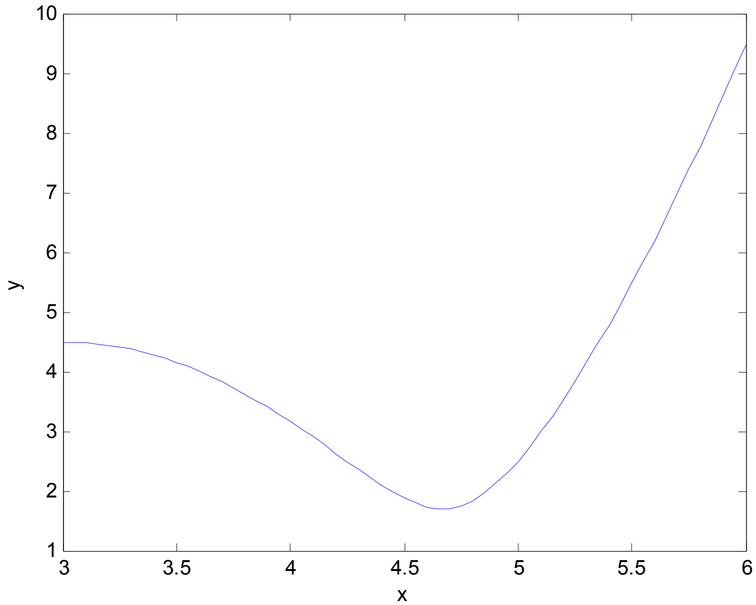
```
Part (c)
xQd28 =
   7.6271 + 0.0000i
   3.0000 + 3.9818i
   3.0000 - 3.9818i
  -1.6271 + 0.0000i
yQd28 =
   33.1150
yQd28 =
   33.1150
Part (d)
xQdmin =
    4.6667
    3.0000
    1.3333
yQmin1 =
    5.1667
yQmin2 =
    5.1667
Qdmin1 =
    1.6997
Qdmin2 =
    1.6997
```

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:

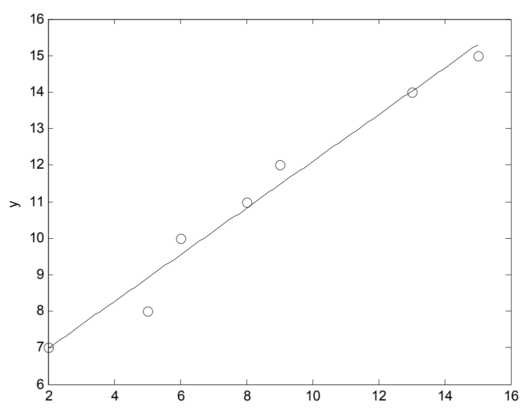
```
x=[2 5 6 8 9 13 15];
y=[7 8 10 11 12 14 15];
p1=polyfit(x,y,1)
xplot=linspace(2,15,100);
yplot=polyval(p1,xplot);
plot(x,y,'ok',xplot,yplot,'k')
xlabel('x')
ylabel('y')
```

Command Window:

```
p1 =
    0.6400    5.6968
```

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

Figure:



Problem 19

Script file:

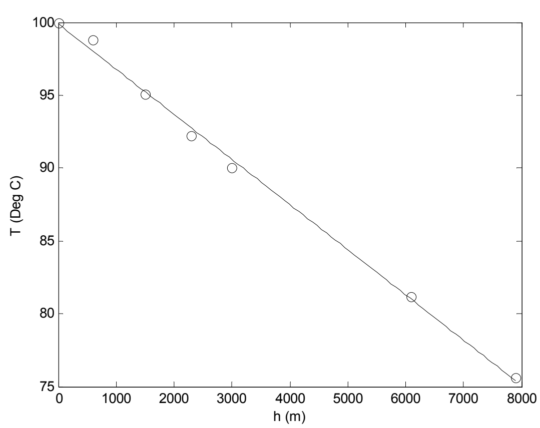
```
hsi=[0 600 1500 2300 3000 6100 7900];
Tsi=[100 98.8 95.1 92.2 90 81.2 75.6];
p=polyfit(hsi,Tsi,1)
T5000=polyval(p,5000)
xplot=linspace(0,7900,100);
yplot=polyval(p,xplot);
plot(hsi,Tsi,'ok',xplot,yplot,'k')
xlabel('h (m)')
ylabel('T (Deg C)')
```

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:

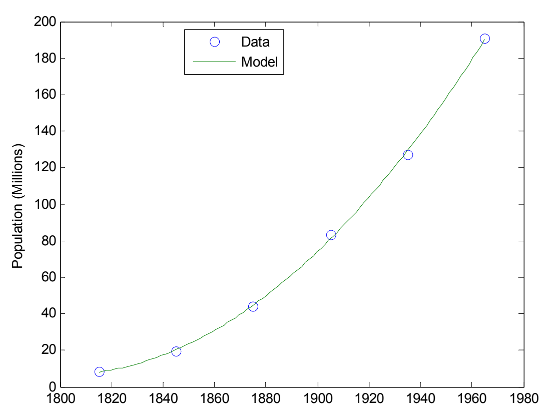
```
Y=[1815 1845 1875 1905 1935 1965];
t=Y-1800;
Pop=[8.3 19.7 44.4 83.3 127.1 190.9];
p=polyfit(t,Pop,2)
tp=linspace(1815,1965,100);
Pplot=polyval(p,tp-1800);
plot(Y,Pop,'o',tp,Pplot)
xlabel('Year')
ylabel('Population (Millions)')
legend('Data','Model',0)
Pop1915=polyval(p,1915-1800)
```

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:

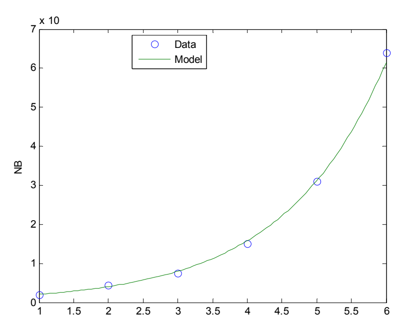
```
t=[1:6];
NB = [2 4.5 7.5 15 31 64]*1000;
p=polyfit(t,log(NB),1);
m=p(1)
b=exp(p(2))
tp=linspace(1,6,100);
F=@ (x) b*exp(m*x);
NBp=F(tp);
plot(t,NB,'o',tp,NBp)
xlabel('t (hr)')
ylabel('NB')
legend('Data','Model',0)
NB45=F(4.5)
```

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:

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

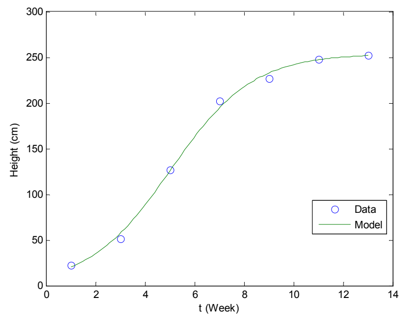
Script file:

```
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:


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

Problem 23

Script file:

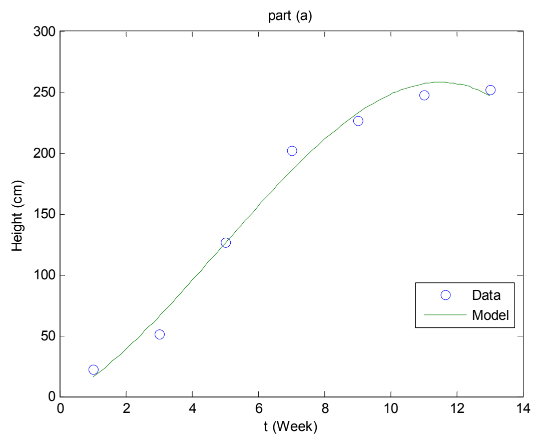
```
w=[1:2:13];
H = [22 51 127 202 227 248 252];
% Part (a)
disp('Part (a)')
p=polyfit(w,H,3);
wp=linspace(1,13,100);
Hp=polyval(p,wp);
plot(w,H,'o',wp,Hp)
xlabel('t (Week)')
ylabel('Height (cm)')
legend('Data','Model',0)
title('part (a)')
H6_Part_a=polyval(p,6)
% Part (b)
disp('Part (b)')
wp=linspace(1,13,100);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

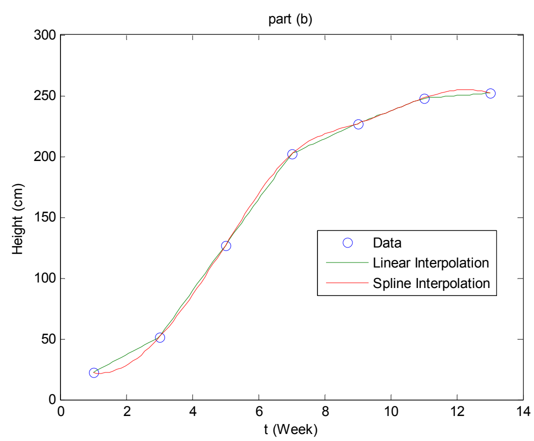
Command Window:

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

```
  164.5000
H6_Part_bSpline =
  169.1451
```

Figures:



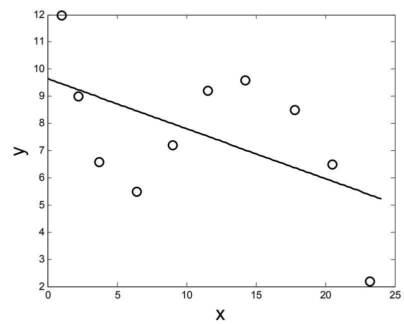


Problem 24

24.*a*

Script File:

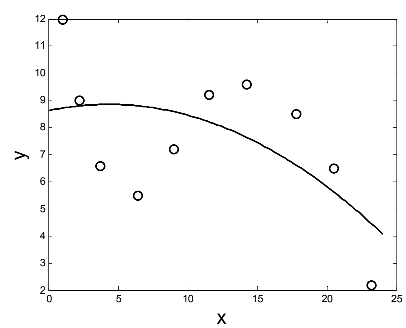
```
x=[1 2.2 3.7 6.4 9 11.5 14.2
17.8 20.5 23.2];
y=[12 9 6.6 5.5 7.2 9.2 9.6 8.5
6.5 2.2];
p1=polyfit(x,y,1);
xplot=linspace(0,24,100);
yplot=polyval(p1,xplot);
plot(x,y,'ok',xplot,yplot,'k',
'linewidth',2,'markersize',8)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
```



24.*b*

Script File:

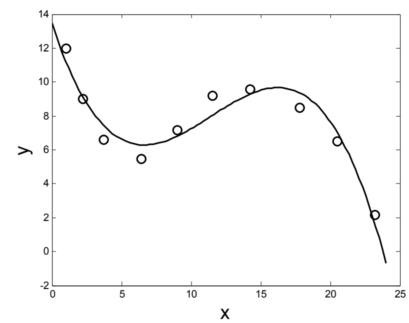
```
x=[1 2.2 3.7 6.4 9 11.5 14.2
17.8 20.5 23.2];
y=[12 9 6.6 5.5 7.2 9.2 9.6 8.5
6.5 2.2];
p1=polyfit(x,y,2);
xplot=linspace(0,24,100);
yplot=polyval(p1,xplot);
plot(x,y,'ok',xplot,yplot,'k',
'linewidth',2,'markersize',8)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
```



24.*c*

Script File:

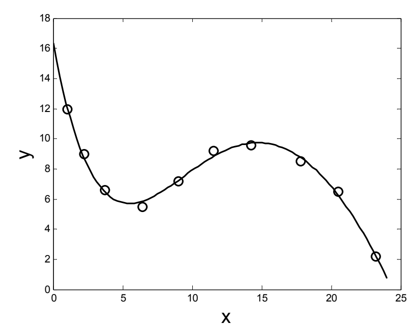
```
x=[1 2.2 3.7 6.4 9 11.5 14.2
17.8 20.5 23.2];
y=[12 9 6.6 5.5 7.2 9.2 9.6 8.5
6.5 2.2];
p1=polyfit(x,y,3);
xplot=linspace(0,24,100);
yplot=polyval(p1,xplot);
plot(x,y,'ok',xplot,yplot,'k',
'linewidth',2,'markersize',8)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
```



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)
```



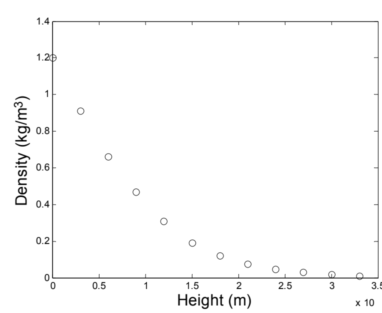
Problem 25

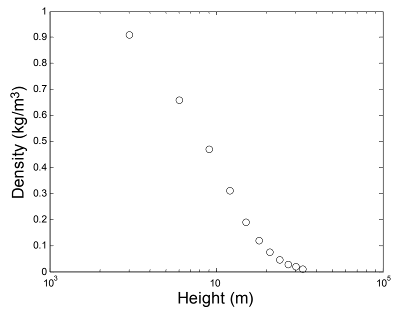
(*a*)

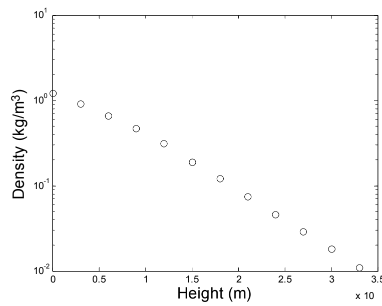
Script file :

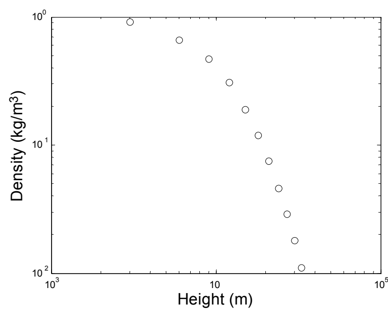
```
h=0:3000:33000;
Den=[1.2 0.91 0.66 0.47 0.31 0.19 0.12 0.075 0.046 0.029
0.018 0.011];
plot(h, Den,'ok')
xlabel('\fontsize{16}Height (m)')
ylabel('\fontsize{16}Density (kg/m^3)')
figure
semilogx(h, Den,'ok')
xlabel('\fontsize{16}Height (m)')
ylabel('\fontsize{16}Density (kg/m^3)')
figure
semilogy(h,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

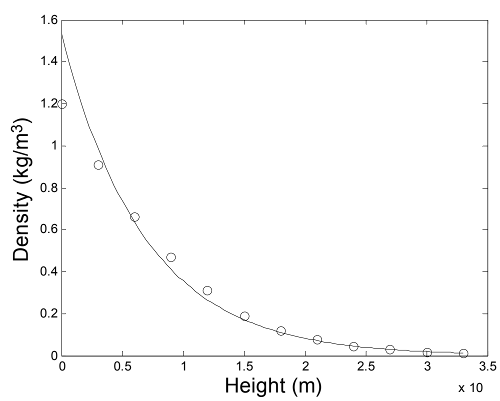
```
b=exp(p(2))
heq=linspace(0,33000,100);
Deq=b*exp(m*heq);
plot(h, Den,'ok',heq,Deq,'k')
xlabel('\fontsize{16}Height (m)')
ylabel('\fontsize{16}Density (kg/m^3)')
```

Command Window:

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

The function is: $D = 1.5302e^{(-1.4584 \times 10^{-4})h}$

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));
```

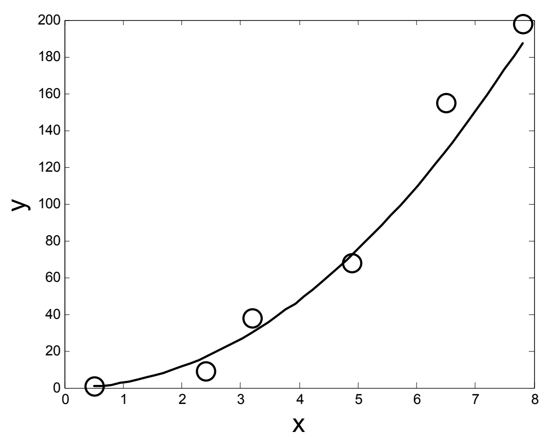
Script File:

```
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:



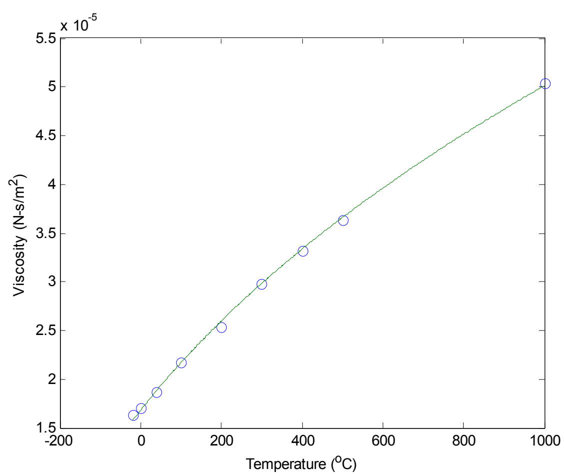
Problem 27

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*)

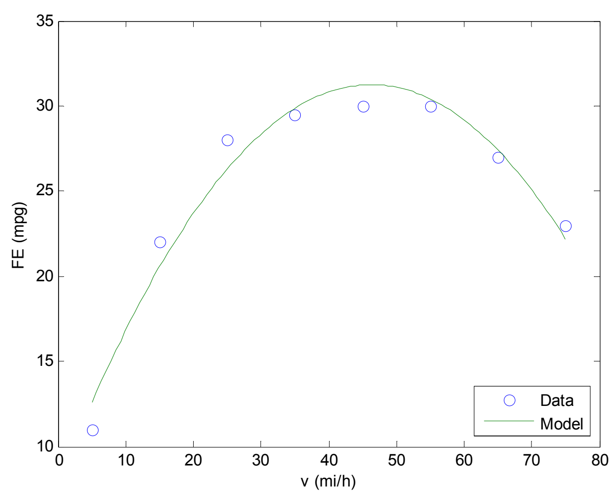
Script File:

```
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:



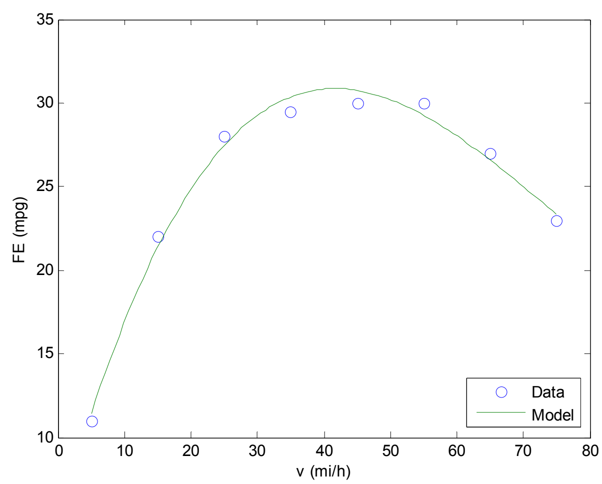
(*b*)
Script File:

```
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:



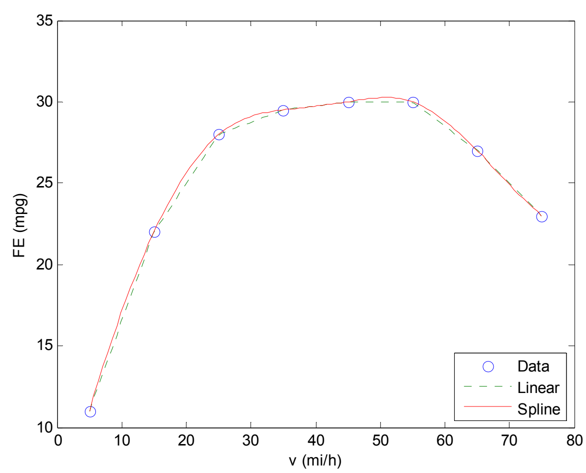
(*c*)
Script File:

```
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

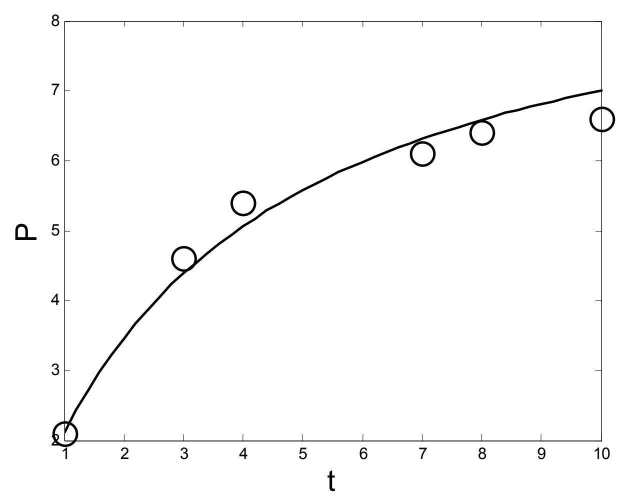
Script File:

```
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

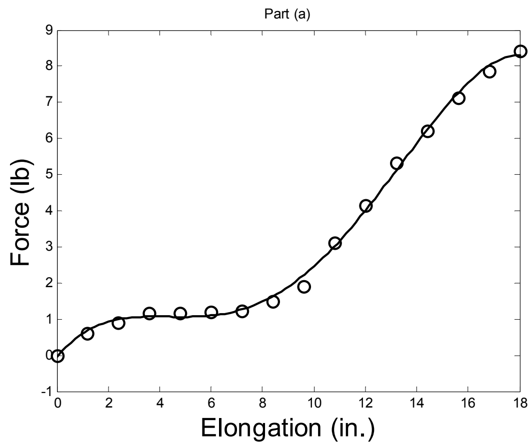
Script File:

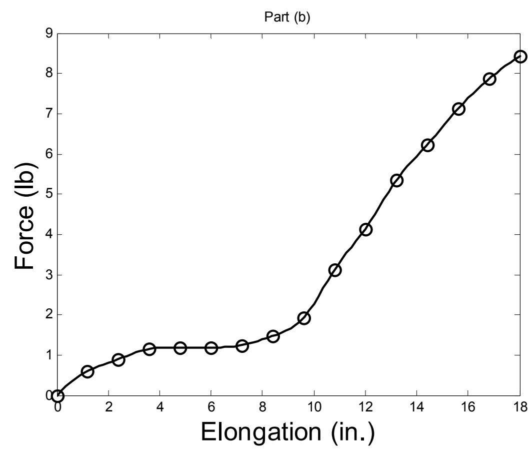
```
F=[0 0.6 0.9 1.16 1.18 1.19 1.24 1.48 1.92 3.12 4.14 5.34
6.22 7.12 7.86 8.42];
E=0:1.2:18;
%Part (a)
disp('Part (a)')
p1=polyfit(E,F,4);
Eplot=linspace(0,18,100);
Fplot=polyval(p1,Eplot);
plot(E,F,'ok',Eplot,Fplot,'k','linewidth',2,'markersize',8)
xlabel('Elongation (in.)','fontsize',18)
ylabel('Force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





Problem 31

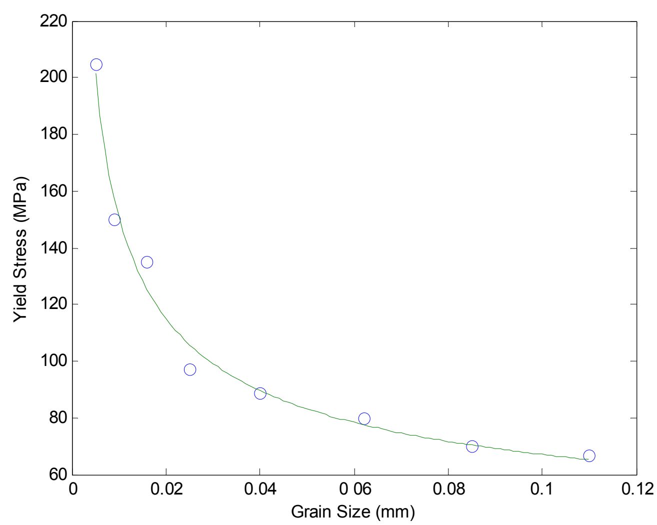
Part *a*

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
```



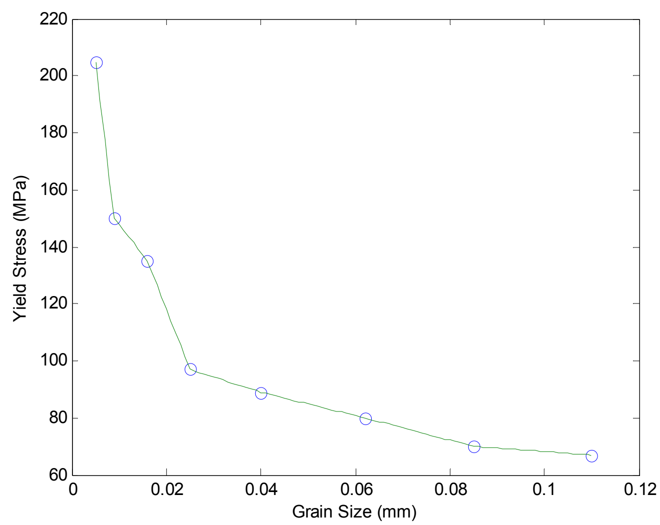
Part *b*

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
```



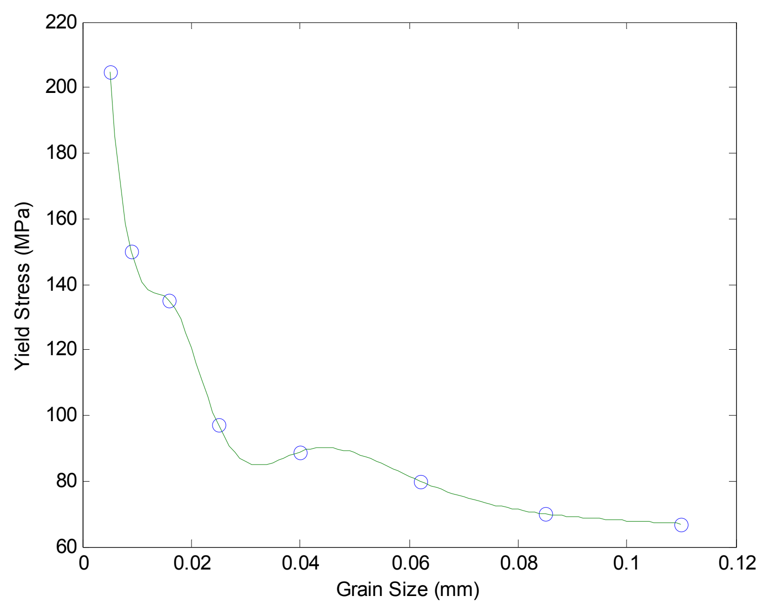
Part *c*

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

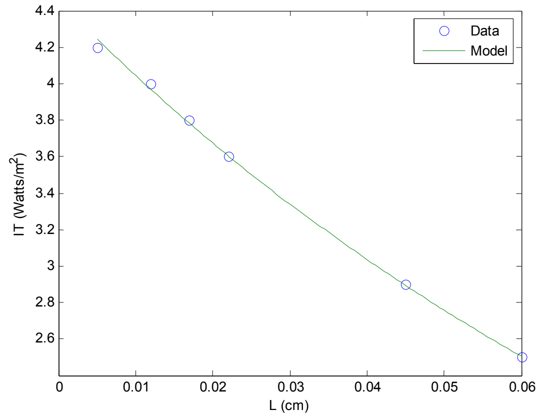
Script file:

```
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
```

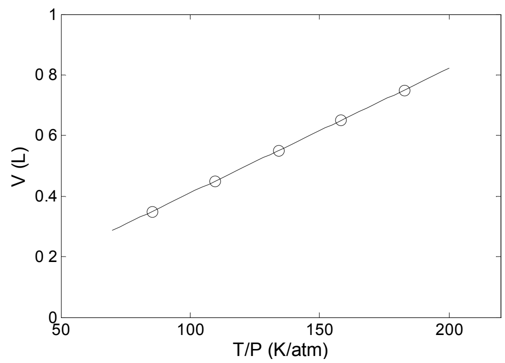
Figure



Data
Model
IT (Watts/m^2)
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:

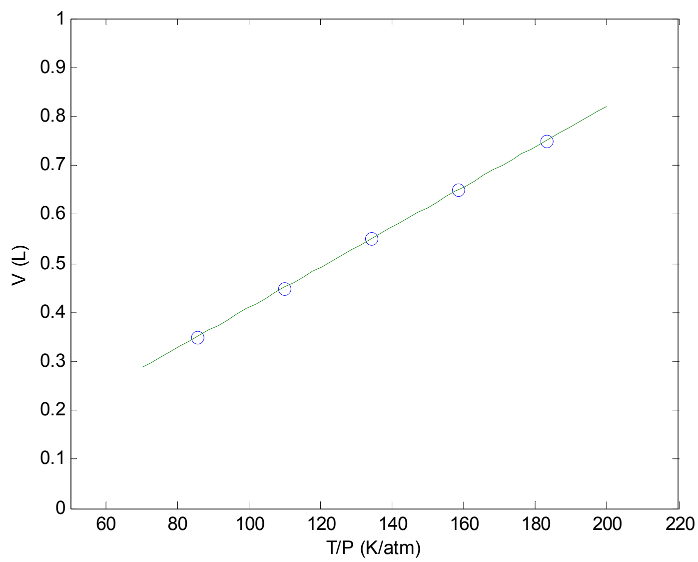



```
n=0.05;
V=[0.75 0.65 0.55 0.45 0.35
T=[25 37 45 56 65];
P=[1.63 1.96 2.37 3 3.96];
TdP=(T+273)./P;
p=polyfit(TdP,V,1);
R=p(1)/n
TdPplot=linspace(200,70,50)
Vplot=p(1)*TdPplot+p(2);
plot(TdP,V,'o',TdPplot,Vplot)
axis([50 220 0 1])
xlabel('T/P (K/atm)')
ylabel('V (L)')
```

Command Window:

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

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



Chapter 9
Solved Problems

Problem 1

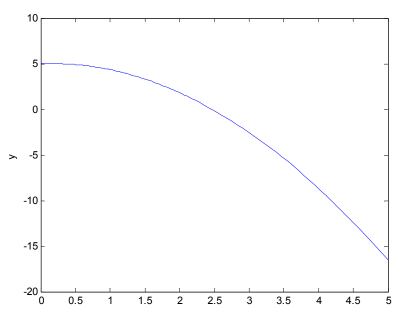
Script file:

```
F=@ (x) exp(0.3*x)-x^2+4;
fplot(F,[0 5])
xlabel('x')
ylabel('y')
r=fzero(F,3)
```

Command Window:

```
r =
    2.4693
```

Figure:



Problem 2

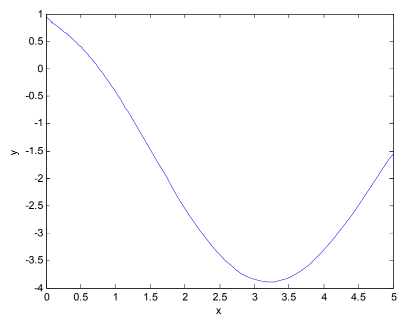
Script file:

```
F=@ (x) 2*cos(x)-0.5*sqrt(x)-1;
fplot(F,[0 5])
xlabel('x')
ylabel('y')
r=fzero(F,3)
```

Command Window:

```
r =
    0.7683
```

Figure:



Problem 3

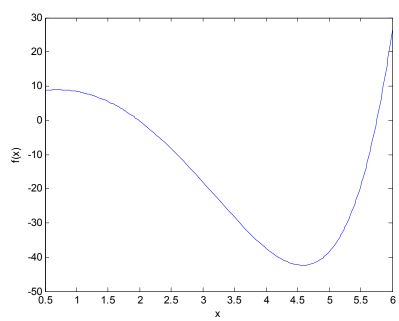
Script file:

```
F=@ (x) x^3-5*x^2.5+exp(0.9*x)+4*(x+1)+2;
fplot(F,[0.5 6])
xlabel('x')
ylabel('f(x)')
x1=fzero(F,2)
x2=fzero(F,5)
```

Command Window:

```
x1 =
    1.9830
x2 =
    5.7555
```

Figure:



Problem 4

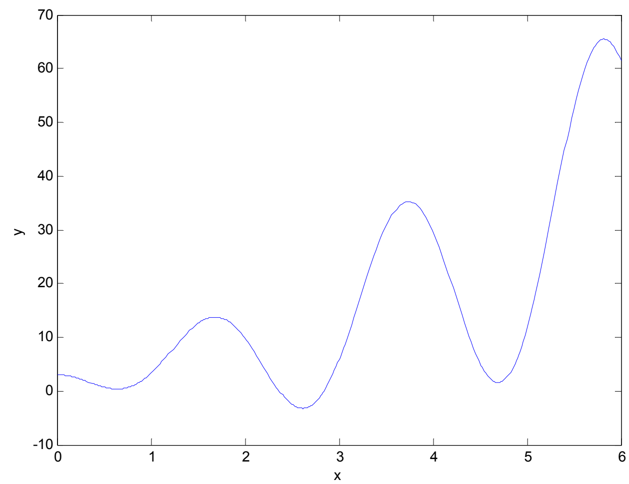
Script file:

```
F=@ (x) x^2-5*x*sin(3*x)+3;
fplot(F,[0 6])
xlabel('x')
ylabel('y')
r1=fzero(F,2)
r2=fzero(F,3)
```

Command Window:

```
r1 =
    2.3656
r2 =
    2.8435
```

Figure:



Problem 5

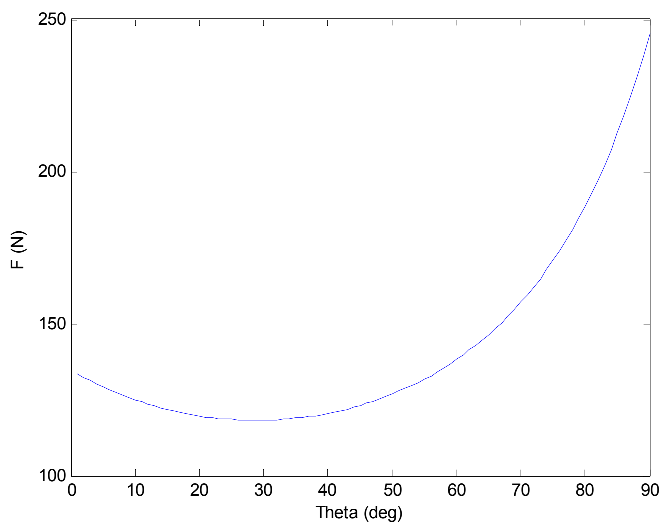
Script file:

```
mu=0.55; g=9.81; m=25;
Fun=@ (x) mu*m*g./(cosd(x)+mu*sind(x));
x=1:90;
F=Fun(x);
plot(x,F)
xlabel('Theta (deg)')
ylabel('F (N)')
Fs=150;
Funs=@ (x) mu*m*g./(cosd(x)+mu*sind(x))-Fs;
ths=fzero(Funs,70)
```

Command Window:

```
ths =
   66.8176
```

Figure:



Problem 6

Script file:

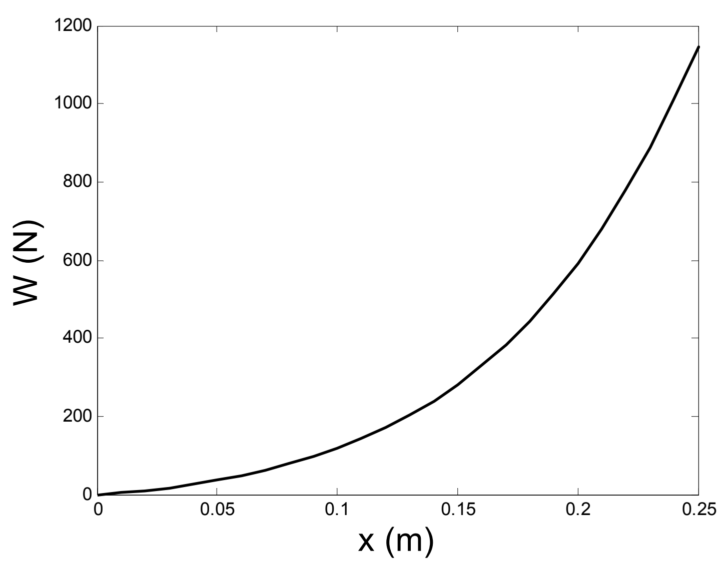
```
a=0.22; b=0.08; K=1600; W=400; K2=100000;
L0=sqrt(a^2+b^2);
L=@ (x) sqrt(a^2+(b+x).^2);
F=@ (x) (L(x)-L0)*K+(L(x)-L0).^3*K2;
xp=0:0.01:0.25;
Fp=2*F(xp).*(b+xp)./L(xp);
plot(xp,Fp,'k','linewidth',2)
xlabel('x (m)','fontsize',18)
ylabel('W (N)','fontsize',18)
f=@(x) 2*F(x).*(b+x)./L(x)-W;
d=fzero(f,0.1)
```

Command Window:

```
d =
    0.1729
```

Answer: $x = 0.1729$m.

Figure:



Problem 7

Script file:

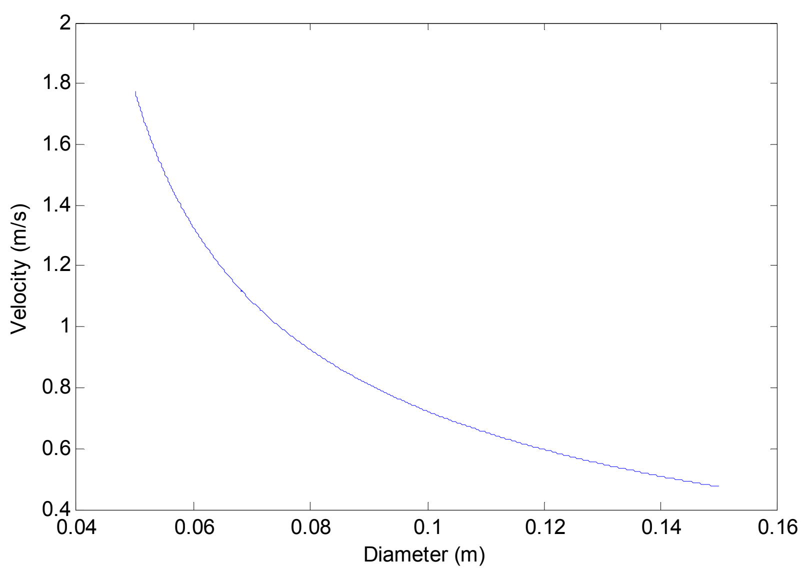
```
M=0.1; g=9.81; C=1;row=1000; beta=10; tet=10;
%d=0.1
F=@(x) sqrt(16*M*g./(pi*C*row*x.^2))./(sqrt(1-
(8*M*tand(beta)^2)./(pi*x.^3*C*row*sind(tet))))-0.8;
dia=fzero(F,0.12)
Fp=@(x) sqrt(16*M*g./(pi*C*row*x.^2))./(sqrt(1-
(8*M*tand(beta)^2)./(pi*x.^3*C*row*sind(tet))));
xp=0.05:0.0001:0.15;
Velp=Fp(xp);
plot(xp,Velp)
xlabel('Diameter (m)')
ylabel('Velocity (m/s)')
```

Command Window:

```
dia =
    0.0911
```

Answer: *diameter* = `0.0911`m.

Figure:



Problem 8

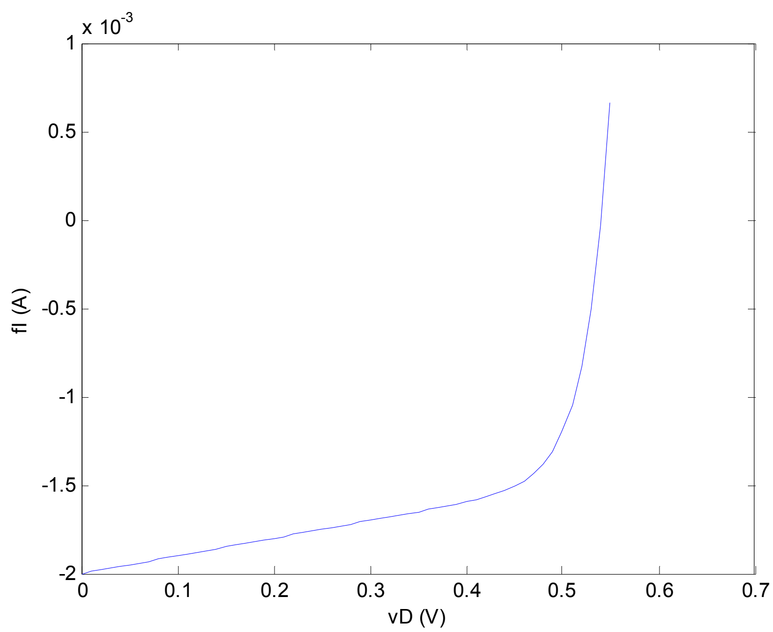
Script File:

```
Is=1E-12; q=1.6E-19; k=1.38E-23;
Vs=2; R=1000;
T=297;
fI=@(vD) Is*(exp((vD*q)./(k*T))-1)-(Vs-vD)./R;
vD=0:0.01:0.55;
Ip=fI(vD);
plot(vD,Ip)
xlabel('vD (V)')
ylabel('fI (A)')
vDSol=fzero(fI, 0.5)
```

Command Window:

```
vDSol =
  0.5405
```

Figure:



Problem 9

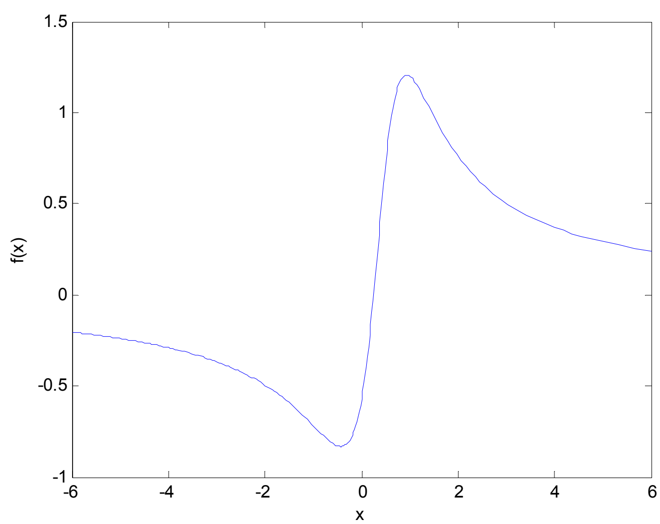
Script file:

```
F = @ (x) 3*(x-0.25)/(1+3.5*(0.8*x-0.3)^2);
Finv = @ (x) -3*(x-0.25)/(1+3.5*(0.8*x-0.3)^2);
fplot(F,[-6 6])
xlabel('x')
ylabel('f(x)')
[xmin, fmin]=fminbnd(F,-2,0)
[xmmax, fmax]=fminbnd(Finv,0,3))
```

Command Window:

```
xmin =
   -0.4298
fmin =
   -0.8321
xmmax =
    0.9297
fmax =
   -1.2071
```

Figure:



Problem 10

Script file:

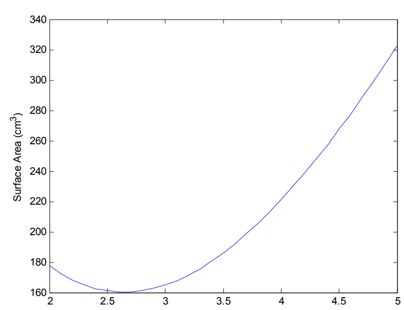
```
V=250;
R1=2:0.1:5;
R2=2*R1;
h=3*V./(pi*(R1.^2+R2.^2+R1.*R2));
S=pi*(R1+R2).*sqrt((R2-R1).^2+h.^2)+pi*R1.^2;
plot(R1,S)
xlabel('R1 (cm)')
ylabel('Surface Area (cm^3)')
SUR=@ (x) pi*(x+2*x)*sqrt((2*x-x)^2+(3*V/
(pi*(x^2+(2*x).^2+x.*2*x))).^2)+pi*x.^2;
R1min=fminbnd(SUR,1,5)
R2min=2*R1min
H=3*V./(pi*(R1min.^2+R2min.^2+R1min.*R2min))
```

Command Window:

```
R1min =
    2.6448
R2min =
    5.2897
H =
    4.8755
```

Answer: $R_1 = 2.6448$ cm, $R_2 = 5.2897$ cm, and $h = 4.8755$ cm.

Figure:



Problem 11

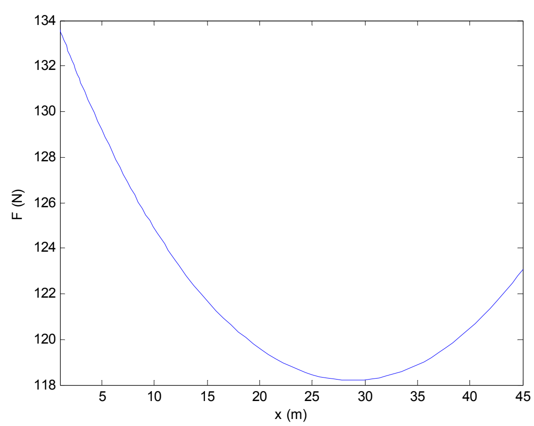
Script file:

```
mu=0.55; g=9.81; m=25;
Fun=@ (x) mu*m*g./(cosd(x)+mu*sind(x));
fplot(Fun,[1,45])
xlabel('x (m)')
ylabel('F (N)')
[xmin Fmin]=fminbnd(Fun, 10, 30)
```

Command Window:

```
xmin =
   28.8108
Fmin =
  118.1906
```

Figure:



Problem 12

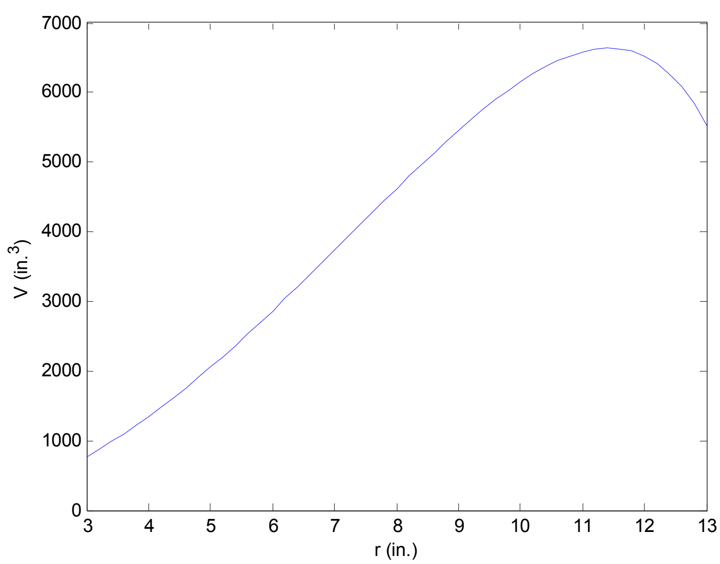
Script file:

```
R=14;
r=3:0.2:13;
h=2*sqrt(R^2-r.^2);
V=pi*r.^2.*h;
plot(r,V)
xlabel('r (in.)')
ylabel('V (in.^3)')
VOL=@ (x) -pi*x^2*2*sqrt(R^2-x^2);
rVmax=fminbnd(VOL,10,13)
hVmax=2*sqrt(R^2-rVmax^2)
```

Command Window:

```
rVmax =
   11.4309
hVmax =
   16.1658
```

Figure:



Problem 13

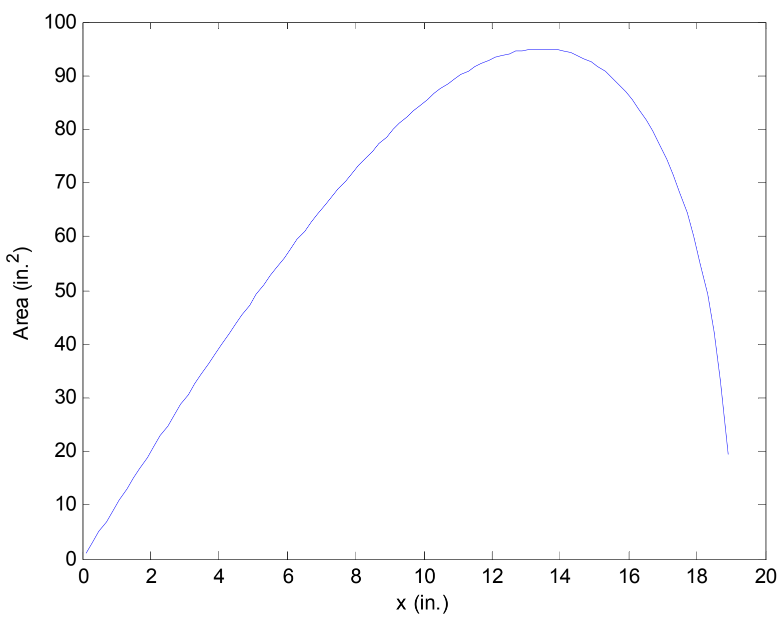
Script file:

```
F=@ (x) x.*sqrt(5^2*(1-x.^2/19^2));
Fneg=@ (x) -x.*sqrt(5^2*(1-x.^2/19^2));
x=0.1:0.2:18.9;
Ap=2*F(x);
plot(x,Ap)
xlabel('x (in.)')
ylabel('Area (in.^2)')
[xAmax]=fminbnd(Fneg,12,16);
aAmax=2*xAmax
bAmax=2*sqrt(5^2*(1-xAmax.^2/19^2))
```

Command Window:

```
aAmax =
   26.8701
bAmax =
     7.0711
```

Figure:



Problem 14

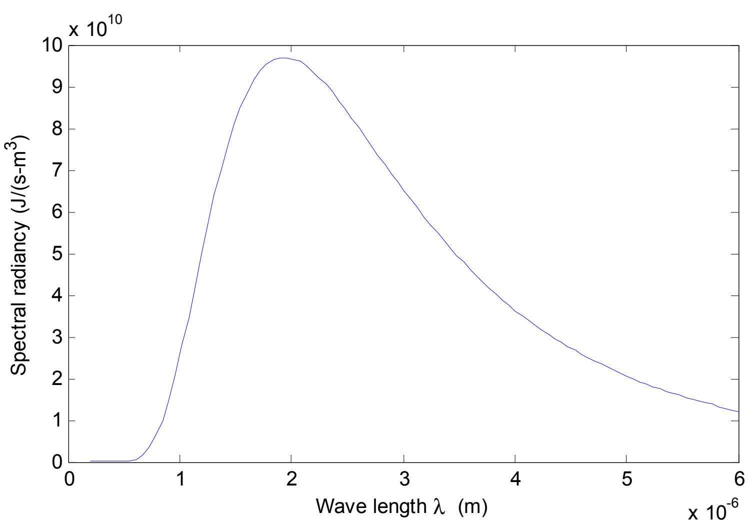
Script file:

```
c=3.0e8; h=6.63e-34; k=1.38e-23; T=1500;
KA=2*pi*c^2*h;  KB=h*c/(k*T);
lmda=linspace(0.2e-6,6e-6,100);
R=(2*pi*c^2*h)./(lmda.^5.*(exp(h*c./(lmda*k*T))-1));
plot(lmda,R)
xlabel('Wave length \lambda  (m)')
ylabel('Spectral radiancy (J/(s-m^3)')
[lmdamax rmax]=fminbnd('(-2*pi*(3.0e8)^2*6.63e-34)/
(x^5*(exp((6.63e-34*3.0e8)/(x*1.38e-23*1500))-1))',1.9e-
6,2e-6)
```

Command Window:

```
lmdamax =
  1.9382e-006
rmax =
 -9.7046e+010
```

Figure:



Answer: Max R at $\lambda = 1.9382\text{e-}006$ m

Problem 15

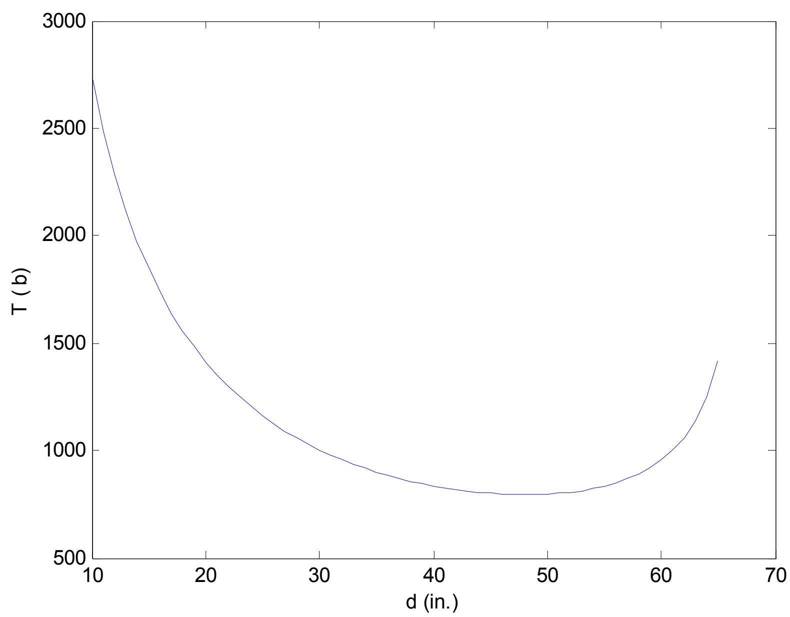
Script file:

```
L=108; Lc=68; W=250;
F= @ (d) W*L*Lc./(sqrt(Lc^2-d.^2).*d);
d=10:65;
T=F(d);
plot(d,T)
xlabel('d (in.)')
ylabel('T (lb)')
[dTmin]=fminbnd(F,40,60)
```

Command Window:

```
dTmin =
   48.0833
```

Figure:



Problem 16

Script file:

```
clear, clc
disp('part (a)')
Fa= @ (x) 0.5*x.^3./(1+2*sqrt(x));
qa=quadl(Fa,2,10)
disp('part (b)')
Fb= @ (x) 0.5+cos(1.2*x)./(x+2).^2;
qa=quadl(Fb,0,9)
```

Command Window:

```
part (a)
qa =
  190.2484
part (b)
qa =
    4.5757
```

Problem 17

Script file:

```
clear, clc
disp('part (a)')
Fa= @ (x) exp(x)./x.^3;
qa=quadl(Fa,1,8)
disp('part (b)')
Fb= @ (x) cos(x).*exp(sqrt(x));
qa=quadl(Fb,0,4*pi)
```

Command Window:

```
part (a)
qa =
   12.3621
part (b)
qa =
    3.5934
```

Problem 18

Script file:

```
t=[0:7];
v=[0 14 39 69 95 114 129 139];
vfps=v*5280/3600;
xft=trapz(t,vfps)
```

Command Window:

```
xft =
  776.6000
```

Problem 19

$$\frac{df(x)}{dx} = -\frac{68.8}{99.7}\sinh\left(\frac{x}{99.7}\right)$$

Script file:

```
a=299.25;
F=@ (x) sqrt(1+(-68.8/99.7*sinh(x/99.7)).^2);
Larch=quadl(F,-a,a)
```

Command Window:

```
Larch =
   1.4800e+03
```

Problem 20

Script file:

```
vmax=80; R=0.25; n=7;
F=@ (x) 2*pi*vmax*(1-x/R).^(1/n).*x;
Q=quad(F,0,R)
```

Command Window:

```
Q =
    12.8282
```

Problem 21

Script file:

```
seg=300e-6; eps=8.85e-12; z=0.05;
K=seg*z/(4*eps);
E=K*quad('(0.05^2+r.^2).^(-3/2)*2.*r',0,0.06)
```

Command Window:

```
E =
  6.0986e+006
```

Answer: E = 6.0986e+006 N/C.

Problem 22

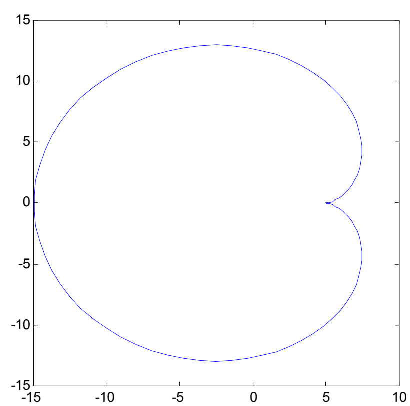
Script file:

```
clear, clc
t=linspace(0,2*pi,100);
b=5;
x=2*b*cos(t)-b*cos(2*t);
y=2*b*sin(t)-b*sin(2*t);
plot (x,y)
axis square
xd=-2*b*sin(t)+2*b*sin(2*t);
yd=2*b*cos(t)-2*b*sin(2*t);
F= @ (x) sqrt((-2*b*sin(x)+2*b*sin(2*x)).^2+(2*b*cos(x)-
2*b*sin(2*x)).^2);
L=quadl(F,0,2*pi)
```

Command Window:

```
L =
   80.6566
```

Figure:



Problem 23

Command Window:

```
>> U=quad('500*6371000^2*9.81./(6371000+x).^2',0,800000)
U =
  3.4862e+009
```

Problem 24

Script file:

```
x=0:40:440;
d=[0 40 96 140 147 121 117 139 140 62 18 0];
A=trapz(x,d)
```

Command Window:

```
A =
       40800
```

Problem 25

The coordinates of the border *y* at 50-mile increments of *x* are as follows:

x	0	50	100	150	200	250	300	350	400	450	500
above	0	0	0	0	0	300	300	300	175	150	125
below	0	50	100	175	200	150	150	200	300	375	400

x	550	600	650	700	750
above	125	125	125	125	0
below	400	250	225	150	150

<u>Script file:</u>

```
clear, clc
x=0:50:750;
y_above=[0 0 0 0 0 300 300 300 175 150 125 125 125 125 125
0];
y_below=[0 50 100 175 200 150 150 200 300 375 400 400 250 225
150 150];
A=trapz(x,y_above)+trapz(x,y_below)
```

<u>Command Window:</u>

```
A =
      252500
```

Answer: Area is 252,500 square miles. (Actual area 261,797 square miles)

Problem 26

Script file:

```
a=40; b=15;
F=@ (x) x.*sqrt(1-(x.^2/a^2));
A=pi*a*b/2;
My=2*b*quad(F,0,a);
xcent=My/A
```

Command Window:

```
xcent =
   16.9765
```

Problem 27

Script file:

```
a=5.9065e9; b=5.7208e9;
k=sqrt(a^2-b^2)/a;
F=@ (x) sqrt(1-k^2*sin(x).^2);
q=quad(F,0, pi/2);
P=4*a*q;
% Number of hours in 248 years.
hrs=24*365*248
vAve=P/hrs
```

Command Window:

```
vAve =
  1.6815e+004
```

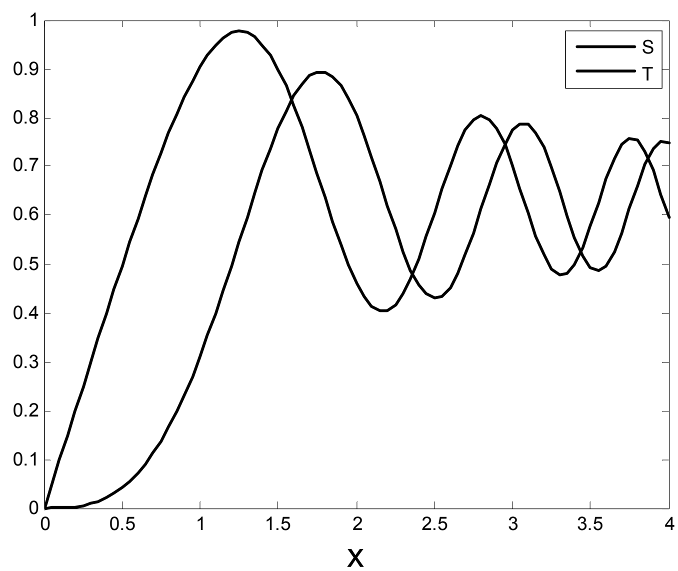
Answer: Average speed 1.6815e+004 km/h

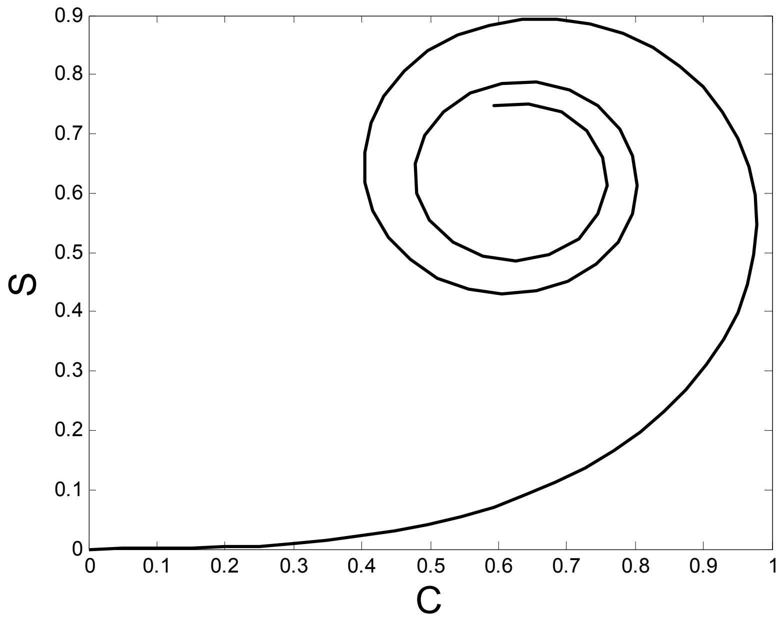
Problem 28

Script file:

```
si=@(x) sin(x.^2);
co=@ (x) cos(x.^2);
x=0:0.05:4;
n=length(x);
for i=1:n
    S(i)=quad(si,0,x(i));
    C(i)=quad(co,0,x(i));
end
plot(x,S,'k-',x,C,'k--','linewidth',2)
%legend('S','T','fontsize',18)
legend('S','T')
xlabel('x','fontsize',18)
figure
plot(C,S,'k','linewidth',2)
xlabel('C','fontsize',18)
ylabel('S','fontsize',18)
```

Figures:



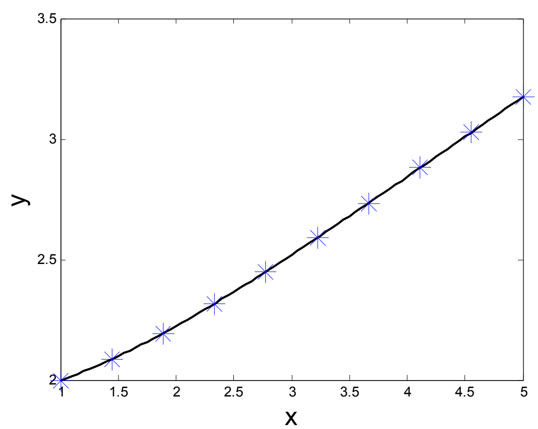

0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
S
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
C

Problem 29

<u>Script file:</u>

```
a=1; b=5;
ya=2;
F=@(x,y) 2*x/(3*y^2);
[x y]=ode45(F,[a:0.05:b],ya);
plot(x,y,'k','linewidth',2)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
xp=linspace(a,b,10);
Fsol=@ (x) (x.^2+7).^(1/3);
yp=Fsol(xp);
hold on
plot(xp,yp,'*','markersize',15)
hold off
```

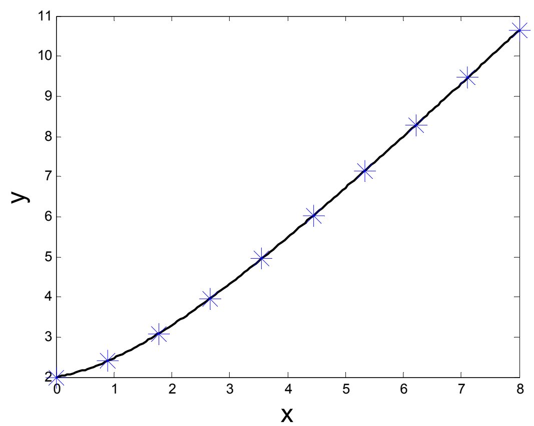
<u>Figure:</u>



Problem 30

<u>Script file:</u>

```
F=@(x,y) (2*x+1)/(y+2);
[x y]=ode45(F,[0:0.05:8],2);
plot(x,y,'k','linewidth',2)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
xp=linspace(0,8,10);
Fsol=@ (x) sqrt(2*x.^2+2*x+16)-2;
yp=Fsol(xp);
hold on
plot(xp,yp,'*','markersize',15)
hold off
```

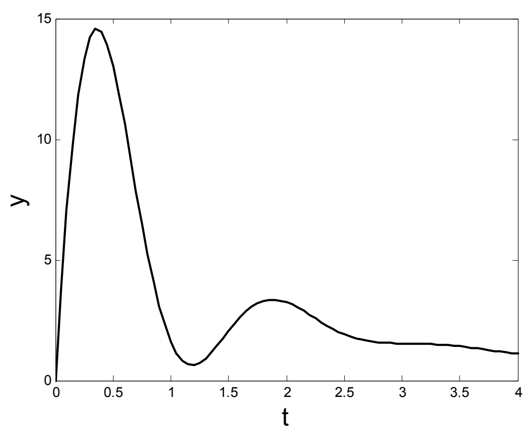


Problem 31

Script file:

```
a=0; b=4;
ya=0;
F=@(t,y) 80*exp(-1.6*t)*cos(4*t)-0.4*y;
[x y]=ode45(F,[a:0.05:b],ya);
plot(x,y,'k','linewidth',2)
xlabel('t','fontsize',18)
ylabel('y','fontsize',18)
```

Figure:

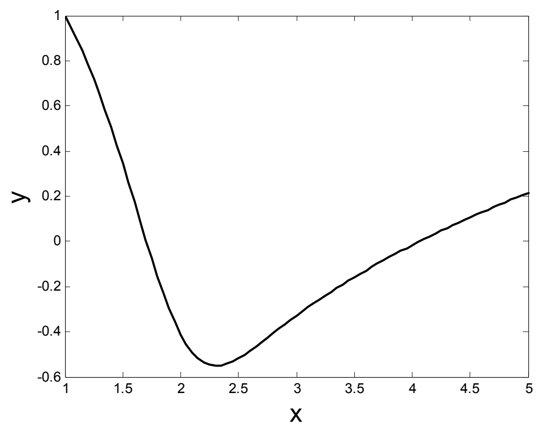


Problem 32

Script file:

```
F=@(x,y) -x^2+x^3*exp(-y)/4;
[x y]=ode45(F,[1:0.05:5],1);
plot(x,y,'k','linewidth',2)
xlabel('x','fontsize',18)
ylabel('y','fontsize',18)
```

Figure:

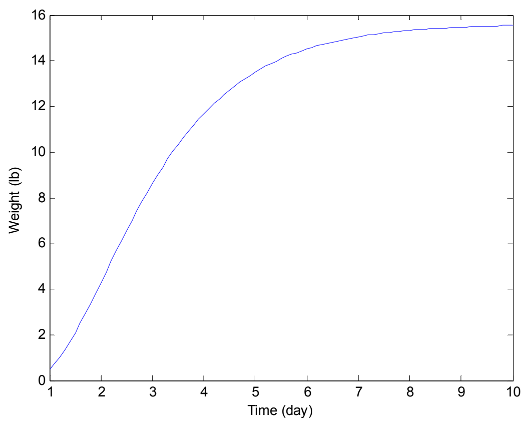


Problem 33

Script file:

```
clear, clc
a=5; b=2;
dwdt=@ (t,w) a*w^(2/3)-b*w;
wa=0.5;
[t w]=ode45(dwdt,[1:0.1:10],wa);
plot(t,w)
xlabel('Time (day)')
ylabel('Weight (lb)')
```

Figure:



Problem 34

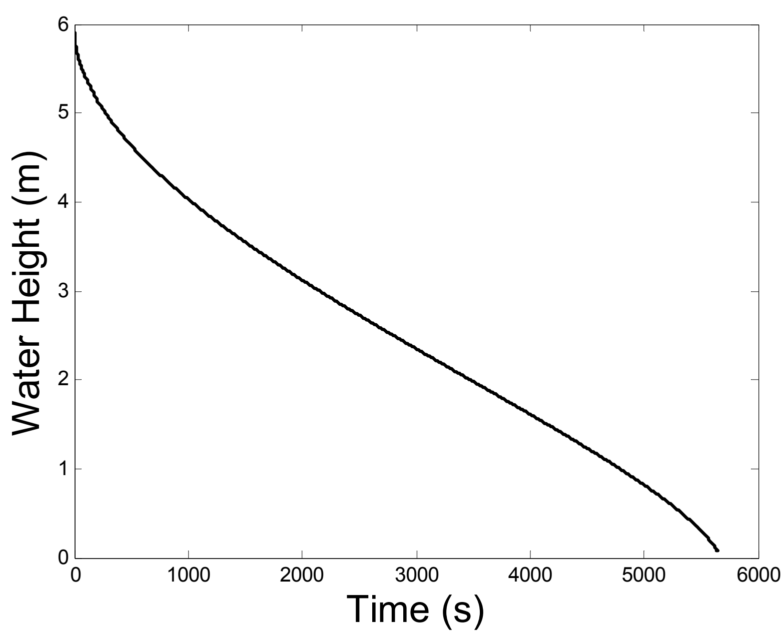
Script file:

```
a=1.5; b=4; c=3; g=9.81; r=0.025;
rsq=r^2;
dhdt=@ (t,h) sqrt(2*g*h)*rsq/(a*b*(-1+(h-c)^2/c^2));
[t y]=ode45(dhdt,[0:0.1:5642.5],5.9);
plot(t,y,'k','linewidth',2)
xlabel('Time (s)','fontsize',18)
ylabel('Water Height (m)','fontsize',18)
tlast=t(length(t))
ylast=y(length(t))
```

Command Window:

```
tlast =
  5.6425e+003
ylast =
    0.0714
```

Figure:



Problem 35

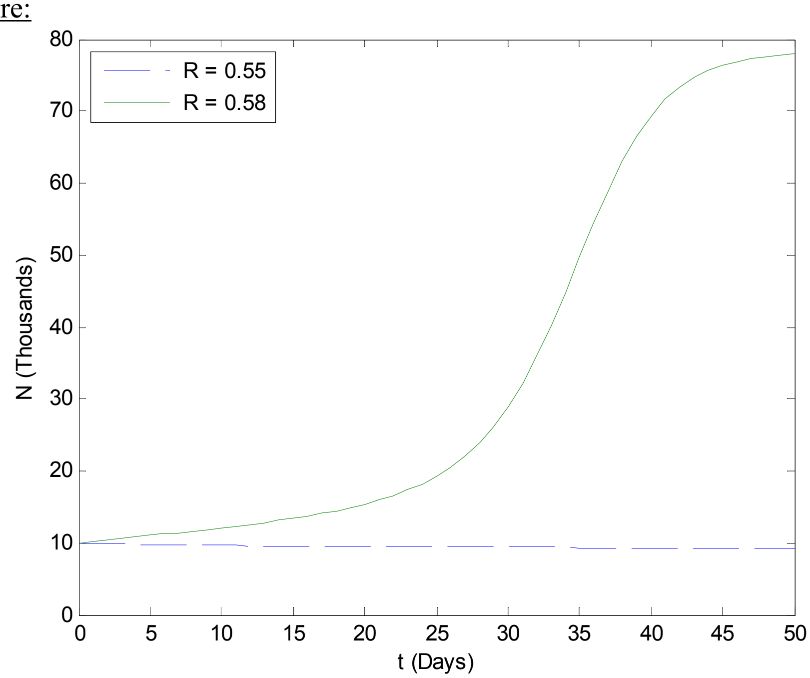
User-defined function:

```
function dNdt=ODEHW9_35_5ed(t,N)
global R
C=100; Nc=10; r=10;
dNdt=R*N*(1-N/C)-r*N^2/(Nc^2+N^2);
```

Script File:

```
global R
R=0.55;
[t1 N1]=ode45(@ODEHW9_35_5ed,[0:1:50],10);
R=0.58;
[t2 N2]=ode45(@ODEHW9_35_5ed,[0:1:50],10);
plot(t1,N1,'--',t2,N2,'-')
xlabel('t (Days)')
ylabel('N (Thousands)')
legend(' R = 0.55',' R = 0.58',2)
```

Figure:

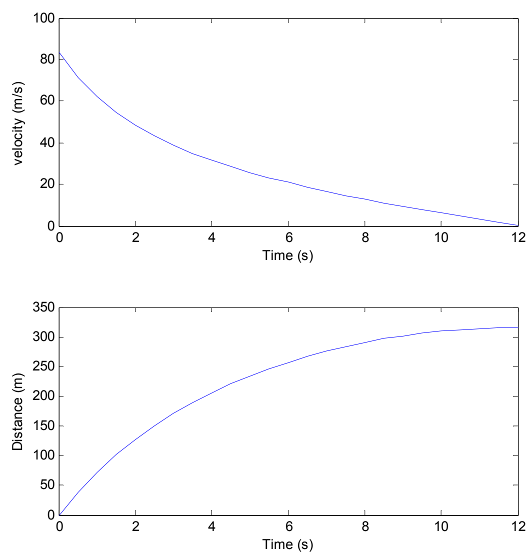


Problem 36

Script file:

```
dvdt= @ (t,v)-0.0035*v^2-3;
[t v]=ode45(dvdt,[0:0.5:12],83.33);
subplot(2,1,1)
plot(t,v)
xlabel('Time (s)')
ylabel('velocity (m/s)')
n=length(t);
x(1)=0;
for i=2:n
    ti=t(1:i);
    vi=v(1:i);
x(i)=trapz(ti,vi);
end
subplot(2,1,2)
plot(t,x)
xlabel('Time (s)')
ylabel('Distance (m)')
```

Figure:

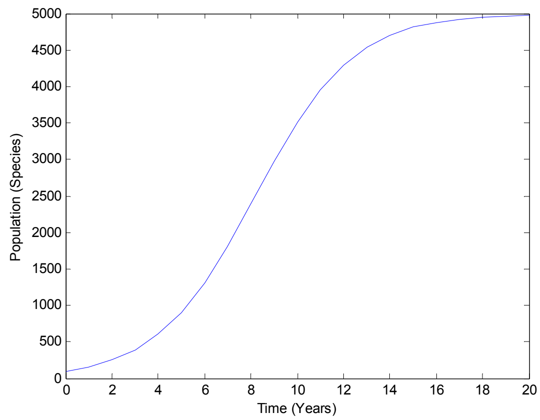


Problem 37

Script file:

```
mu=0.000095; Nm=5000;
dNdt=@ (t,N) mu*N*(Nm-N);
[t N]=ode45(dNdt,[0:20],100);
plot(t,N)
xlabel('Time (Years)')
ylabel('Population (Species)')
```

Figure:

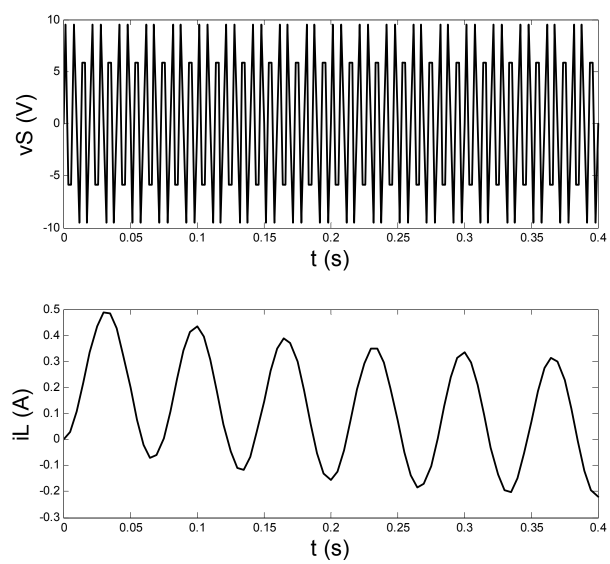


Problem 38

(*a*)
Script file:

```
R=1.80; L=0.4;
FvS=@ (t) 10*sin(3*pi*t/0.01);
dydt=@ (t,y) (10*sin(3*pi*t/0.1)-y*R)/L;
[t iL]=ode45(dydt,[0:0.005:0.4],0);
tp=0:0.002:0.4;
vs=FvS(tp);
subplot(2,1,1)
plot(tp,vs,'k','linewidth',2)
xlabel('t (s)','fontsize',18)
ylabel('vS (V)','fontsize',18)
subplot(2,1,2)
plot(t,iL,'k','linewidth',2)
xlabel('t (s)','fontsize',18)
ylabel('iL (A)','fontsize',18)
```

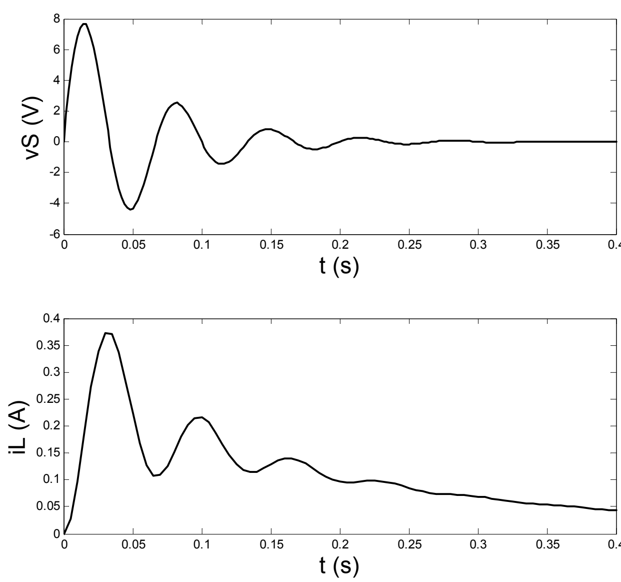
Figure:



(*b*)
Script file:

```
R=1.80; L=0.4;
FvS=@ (t) 10*exp(-t/0.06).*sin(3*pi*t/0.1);
dydt=@ (t,y) (10*exp(-t/0.06)*sin(3*pi*t/0.1)-y*R)/L;
[t iL]=ode45(dydt,[0:0.005:0.4],0);
tp=0:0.002:0.4;
vs=FvS(tp);
subplot(2,1,1)
plot(tp,vs,'k','linewidth',2)
xlabel('t (s)','fontsize',18)
ylabel('vS (V)','fontsize',18)
subplot(2,1,2)
plot(t,iL,'k','linewidth',2)
xlabel('t (s)','fontsize',18)
ylabel('iL (A)','fontsize',18)
```

Figure:

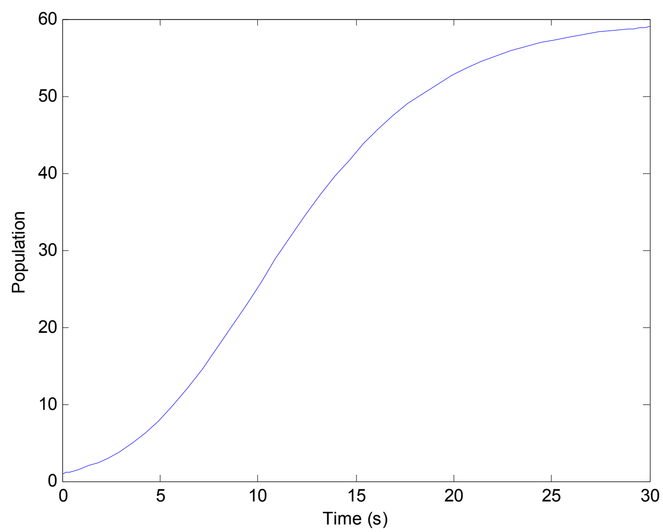


Problem 39

Script file:

```
a=0.8; k=60;
dNdt=@ (t,N) a*N*(1-(N/k)^0.25);
[t N]=ode45(dNdt,[0 30],1);
plot(t,N)
xlabel('Time (s)')
ylabel('Population')
```

Figure:

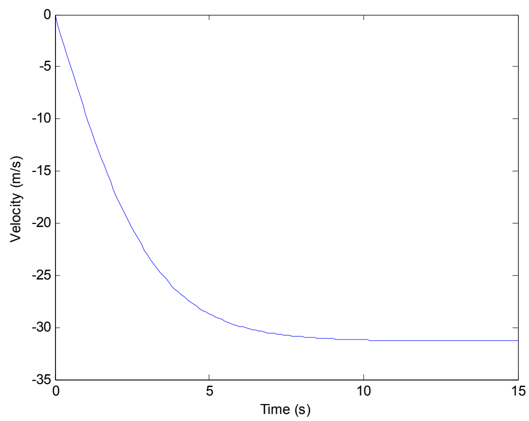


Problem 40

Script file:

```
m=5; g=9.81;
dvdt=@ (t,v) -g+0.05*v^2/m;
[t v]=ode45(dvdt,[0:0.1:15],0);
plot(t,v)
xlabel('Time (s)')
ylabel('Velocity (m/s)')
```

Figure:



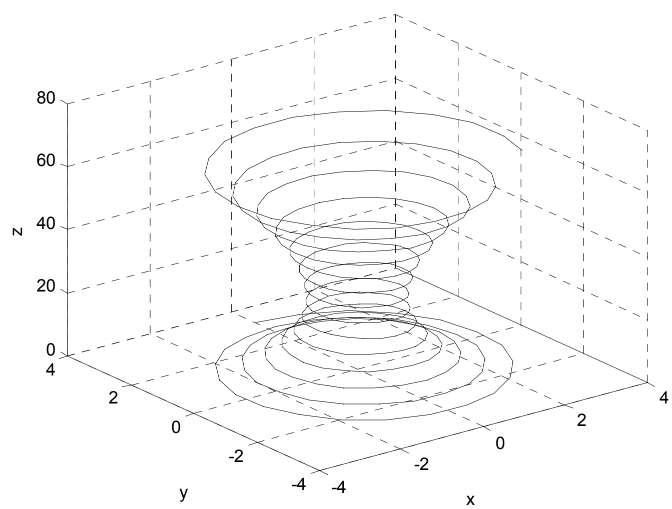
Chapter 10
Solved Problems

Problem 1

Script file:

```
t=0:0.1:30;
r=0.01*(t-15).^2+1;
x=r.*sin(3*t);
y=r.*cos(3*t);
z=0.4.*t.^(3/2);
plot3(x,y,z,'k','linewidth',1)
grid on
xlabel('x'); ylabel('y'); zlabel('z')
```

Figure:

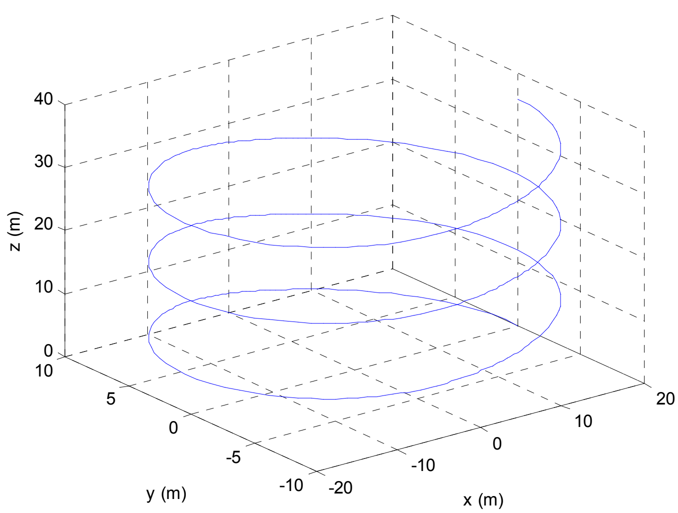


Problem 2

Script file:

```
aa=20; b=10; h=18;
n=3;
t=linspace(0,2*pi*n,400);
r=a*b./sqrt((b*cos(t)).^2+(a*sin(t)).^2);
x=r.*cos(1*t);
y=r.*sin(1*t);
z=h*t/(1*pi*n);
plot3(x,y,z)
grid on
xlabel('x (m)'); ylabel('y (m)'); zlabel('z (m)')
```

Figure:

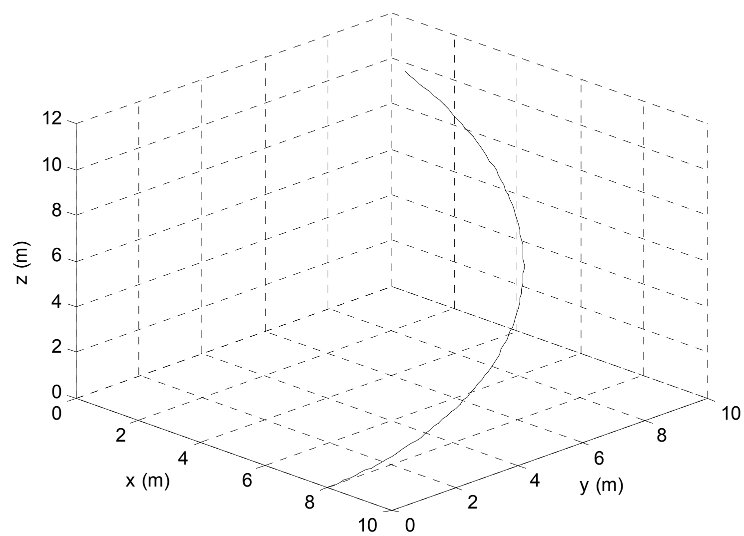


Problem 3

Script file:

```
t=linspace(0,10,100);
r=8+0.6*t;
phi=5*pi*t/180;
theta=8*pi*t/180;
x=r.*cos(phi).*cos(theta);
y=r.*cos(phi).*sin(theta);
z=r.*sin(phi);
plot3(x,y,z,'k','linewidth',1)
grid on
xlabel('x (m)'); ylabel('y (m)'); zlabel('z (m)')
view(45,30)
```

Figure:

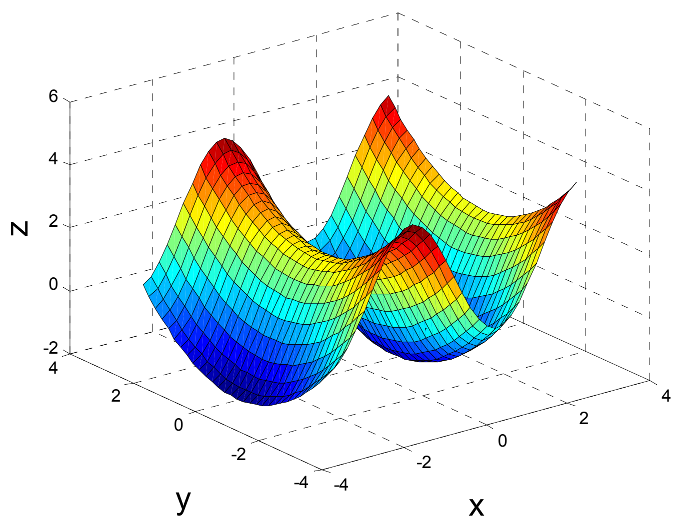


Problem 4

Script file:

```
x=-3:0.2:3;
y=-3:0.2:3;
[X,Y]=meshgrid(x,y);
Z=Y.^2/4-2*sin(1.5*X);
surf(X,Y,Z)
xlabel('x','fontsize',18);
ylabel('y','fontsize',18);
zlabel('z','fontsize',18)
```

Figure:

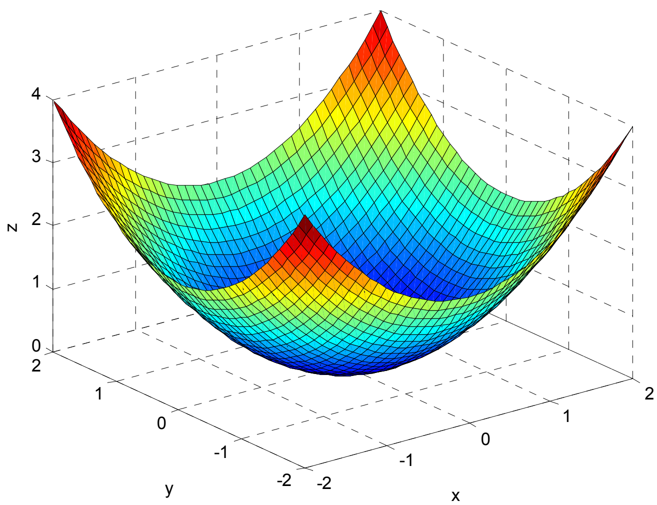


Problem 5

Script file:

```
x=-2:0.1:2;
y=-2:0.1:2;
[X,Y]=meshgrid(x,y);
Z=0.5*X.^2+0.5*Y.^2;
surf(X,Y,Z)
xlabel('x'); ylabel('y'); zlabel('z')
```

Figure:

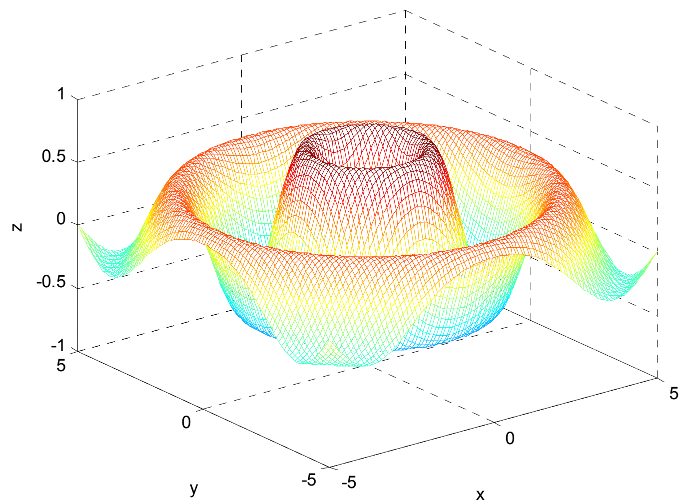


Problem 6

Script file:

```
x=-5:0.1:5;
y=-5:0.1:5;
[X,Y]=meshgrid(x,y);
R=sqrt(X.^2+Y.^2);
Z=-cos(2*R)./exp(0.2*R);
mesh(X,Y,Z)
xlabel('x'); ylabel('y'); zlabel('z')
```

Figure:

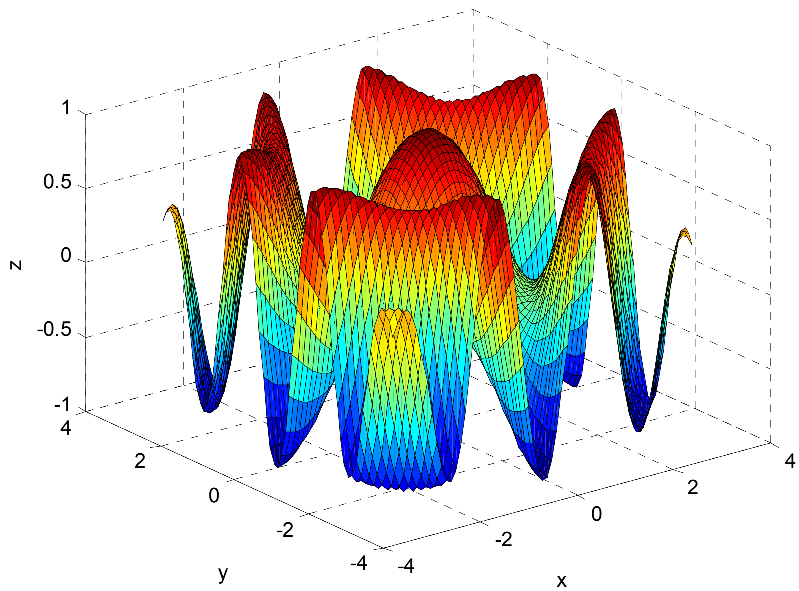


Problem 7

Script file:

```
x=-pi:0.1:pi;
y=-pi:0.1:pi;
[X,Y]=meshgrid(x,y);
R=sqrt(X.^2+Y.^2);
Z=cos(X.*Y).*cos(R);
surf(X,Y,Z)
xlabel('x'); ylabel('y'); zlabel('z')
```

Figure:

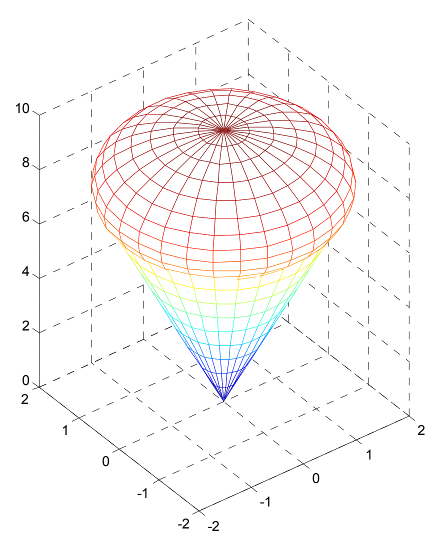


Problem 8

Script file:

```
r=[0:0.2:2];
theta=[0:pi/15:2*pi];
[R,THETA]=meshgrid(r,theta)
X=R.*cos(THETA);
Y=R.*sin(THETA);
Z=4*R;
mesh(X,Y,Z)
clear
theta=[0:pi/15:2*pi];
phi=[0:pi/16:pi];
hold on
[THETA,PHI]=meshgrid(theta,phi);
radius=2;
X=radius*sin(PHI).*cos(THETA);
Y=radius*sin(PHI).*sin(THETA);
Z=radius*1*cos(PHI)+8;
mesh(X,Y,Z)
hold off
```

Figure:

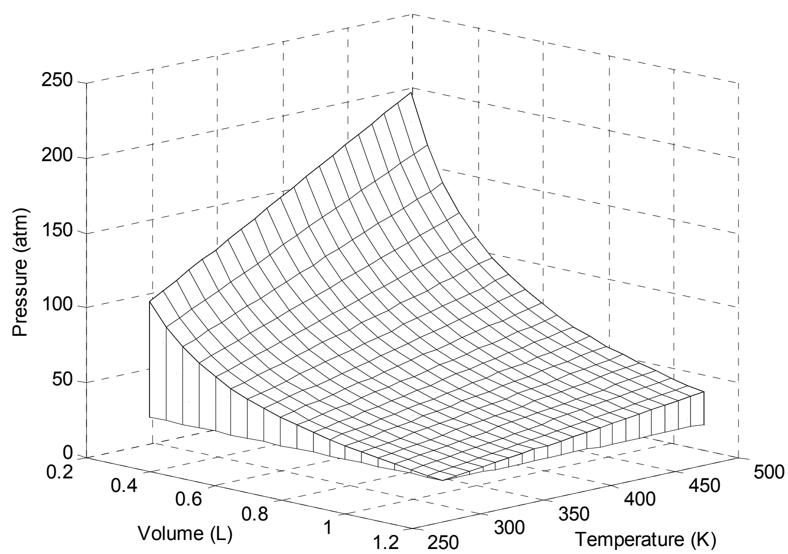


Problem 9

Script file:

```
R=0.08206; n=1.5; a=1.39; b=0.03913;
v=0.3:0.05:1.2;
t=273:10:473;
[V,T]=meshgrid(v,t);
P=n*R*T./(V-n*b)-n^2*a./V.^2;
meshz(V,T,P)
ylabel('Temperature (K)')
xlabel('Volume (L)')
zlabel('Pressure (atm)')
view(45,15)
colormap([0,0,0])
```

Figure:

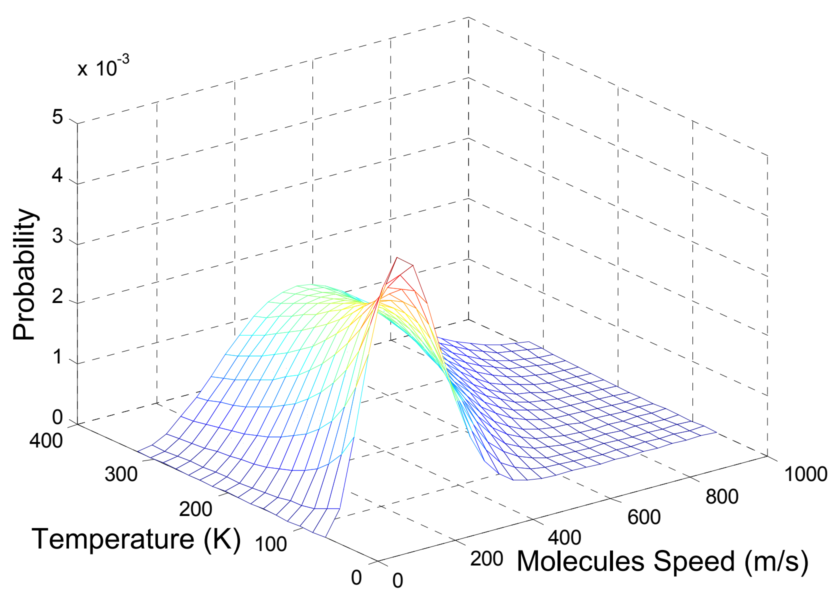


Problem 10

Script File:

```
R=8.31; M=0.032;
x=linspace(0,1000,28);
y=linspace(70,320,16);
[X,Y]=meshgrid(x,y);
Z=4*pi*(M./(2*pi*R*Y)).^(3/2).*X.^2.*exp(-M*X.^2./(2*R*Y));
mesh(X,Y,Z)
xlabel('\fontsize{14}Molecules Speed (m/s)')
ylabel('\fontsize{14}Temperature (K)')
zlabel('\fontsize{14}Probability')
```

Figure:

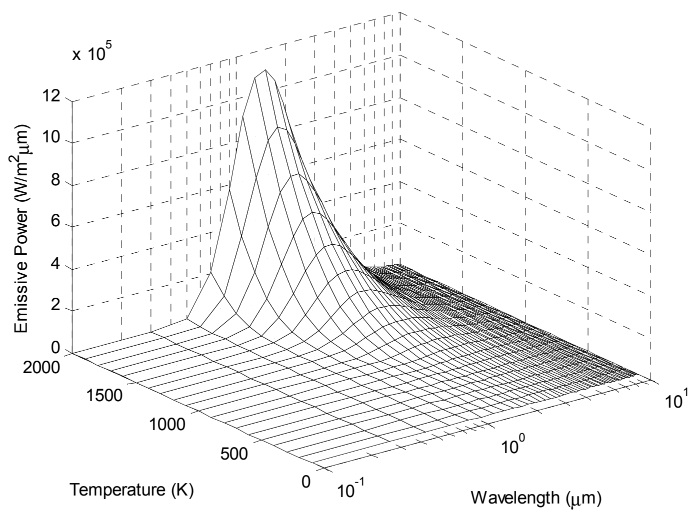


Problem 11

Script file:

```
C1=3.742E8; C2=1.439E4;
L=0.1:0.2:10;
T=100:100:2000;
[W,D]=meshgrid(L,T);
LL=log10(W);
E=C1./(W.^5.*(exp(C2./(W.*D)-1)));
%surf(X,Y,Z)
mesh(W,D,E,'EdgeColor','k')
set(gca,'xscale','log')
xlabel('Wavelength (\mum)'); ylabel('Temperature (K)');
zlabel('Emissive Power (W/m^2\mum)')
```

Figure:

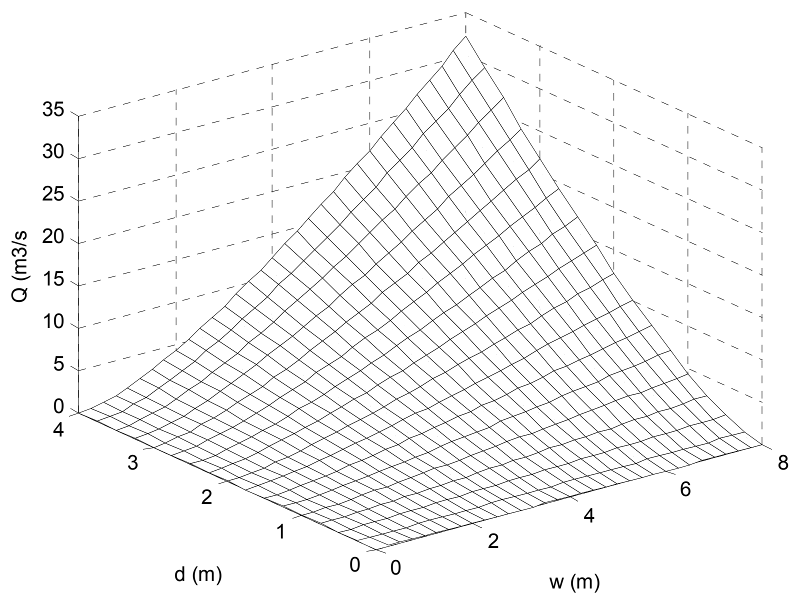


Problem 12

Script file:

```
n=0.05; S=0.001;
Ssr=sqrt(S);
w=0:0.25:8; %x
d=-0:0.25:4; %y
[W,D]=meshgrid(w,d);
Q=(D.*W)/n.*((W.*D)./(W+2*D)).^(2/3)*Ssr;
mesh(W,D,Q,'EdgeColor','k')
xlabel('w (m)'); ylabel('d (m)'); zlabel('Q (m3/s')
```

Figure:



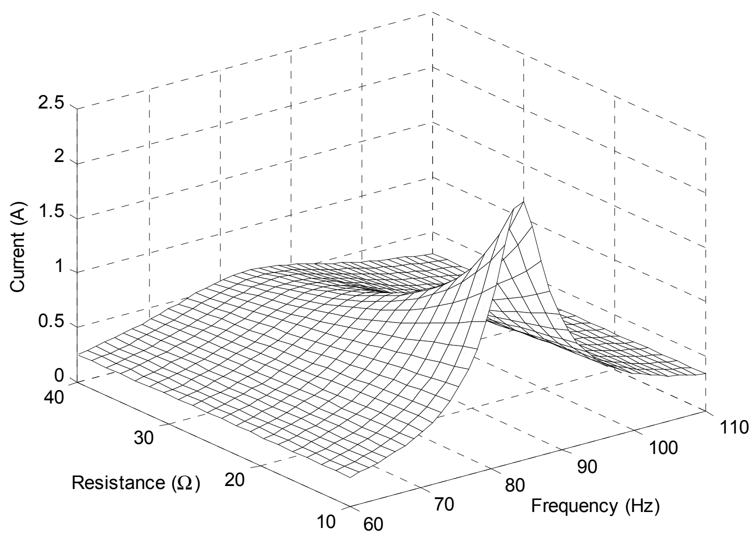
Problem 13

10.*a*

Script file:

```
Em=24; L=240e-3; C=15e-6;
w0=1/sqrt(L*C)
f=linspace(60,110,40);
r=linspace(10,40,20);
[F,R]=meshgrid(f,r);
I=Em./sqrt(R.^2+(2*pi*F*L-1./(2*pi*F*C)).^2);
mesh(F,R,I)
colormap([0 0 0])
xlabel('Frequency (Hz)')
ylabel('Resistance (\Omega)')
zlabel('Current (A)')
```

Figure:

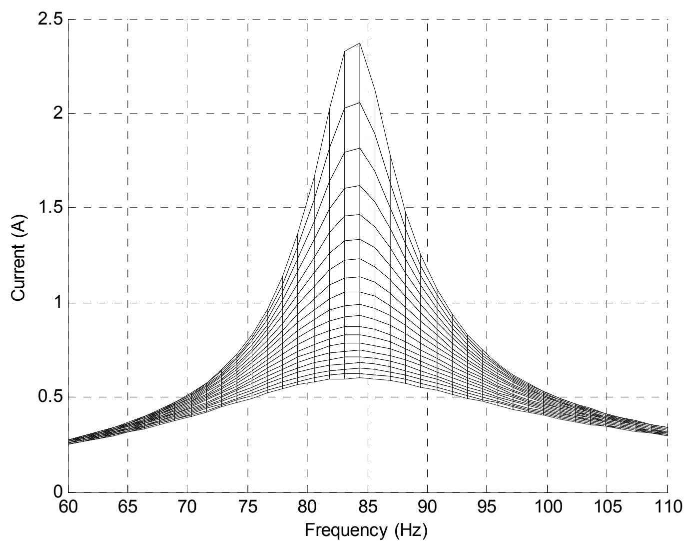


10.*b*

Script file:

```
Em=24; L=240e-3; C=15e-6;
f=linspace(60,110,40);
r=linspace(10,40,20);
[F,R]=meshgrid(f,r);
I=Em./sqrt(R.^2+(2*pi*F*L-1./(2*pi*F*C)).^2);
mesh(F,R,I)
view(0,0)
colormap([0 0 0])
xlabel('Frequency (Hz)')
ylabel('Resistance (\Omega)')
zlabel('Current (A)')
```

Figure:



Calculating the natural frequency:

Command Window:

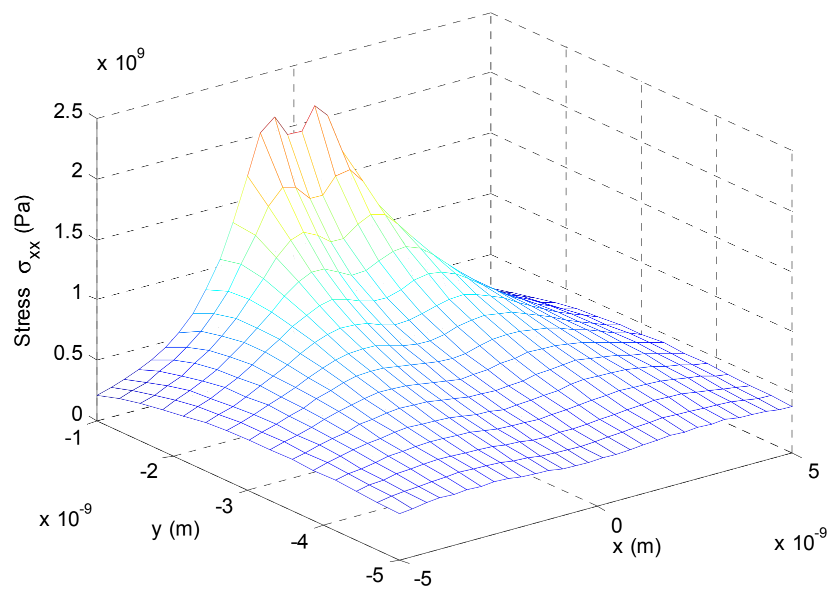
```
>> f0=1/(2*pi*sqrt(240e-3*15e-6))
>> f0 =
   83.8820
```

Problem 14

Script file for σ_{xx}:

```
G=27.7e9; neu=0.334; b=0.286e-9;
K=G*b/(2*pi*(1-neu));
x=linspace(-5.0e-9,5.0e-9,30);
y=linspace(-5e-9,-1e-9,15);
[X,Y]=meshgrid(x,y);
Z=-K*Y.*(3*X.^2+Y.^2)./(X.^2+Y.^2).^2;
mesh(X,Y,Z)
xlabel('x (m)'), ylabel('y (m)')
zlabel('Stress  \sigma_x_x (Pa)')
```

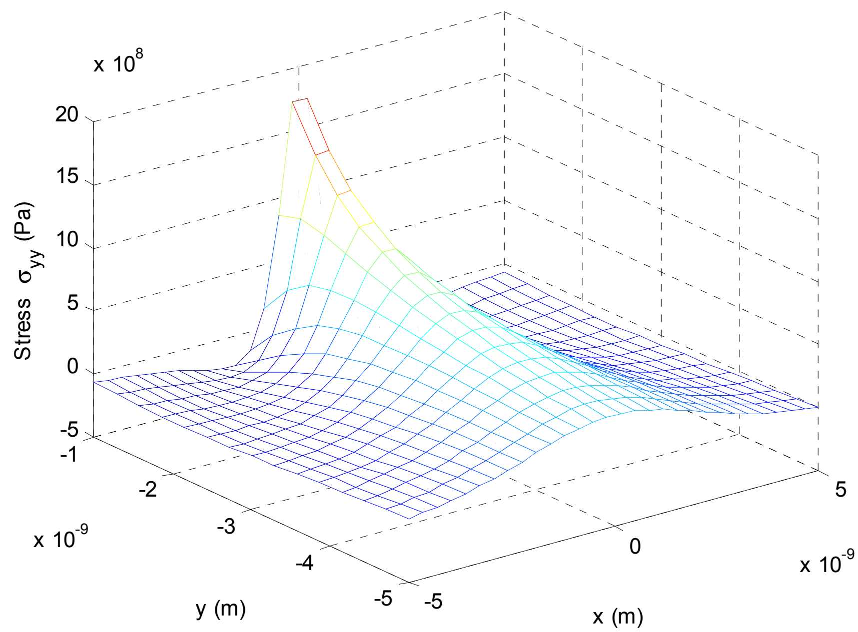
Figure:



Script file for σ_{yy}:

```
% HW9_12 Sigma yy
G=27.7e9; neu=0.334; b=0.286e-9;
K=G*b/(2*pi*(1-neu));
x=linspace(-5.0e-9,5.0e-9,30);
y=linspace(-5e-9,-1e-9,15);
[X,Y]=meshgrid(x,y);
Z=K*Y.*(X.^2-Y.^2)./(X.^2+Y.^2).^2;
mesh(X,Y,Z)
xlabel('x (m)'), ylabel('y (m)')
zlabel('Stress  \sigma_y_y (Pa)')
```

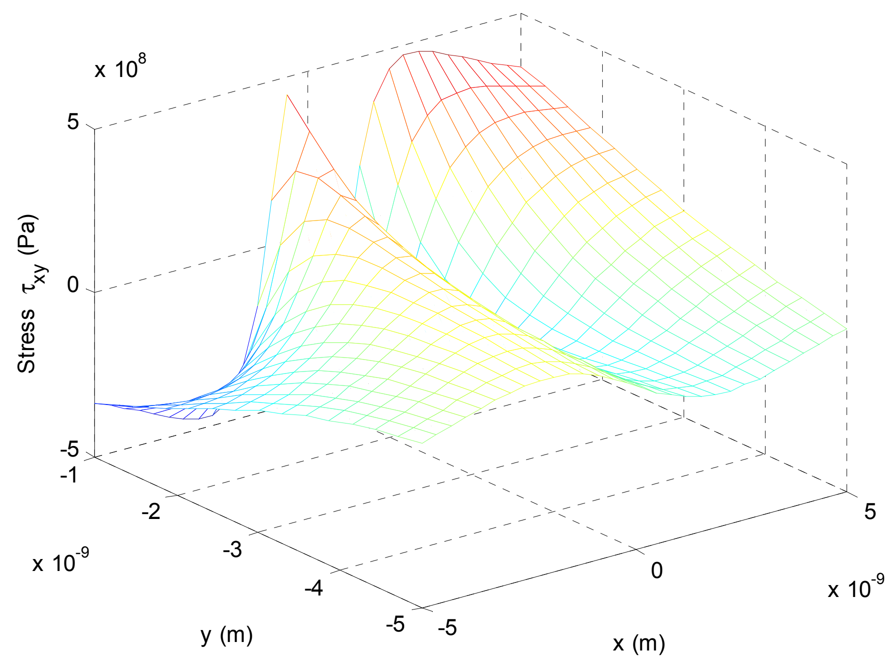
Figure:



Script file for τ_{xy}:

```
% HW9_12 Sigma xy
G=27.7e9; neu=0.334; b=0.286e-9;
K=G*b/(2*pi*(1-neu));
x=linspace(-5.0e-9,5.0e-9,30);
y=linspace(-5e-9,-1e-9,15);
[X,Y]=meshgrid(x,y);
Z=K*X.*(X.^2-Y.^2)./(X.^2+Y.^2).^2;
mesh(X,Y,Z)
xlabel('x (m)'), ylabel('y (m)')
zlabel('Stress  \tau_x_y (Pa)')
```

Figure:

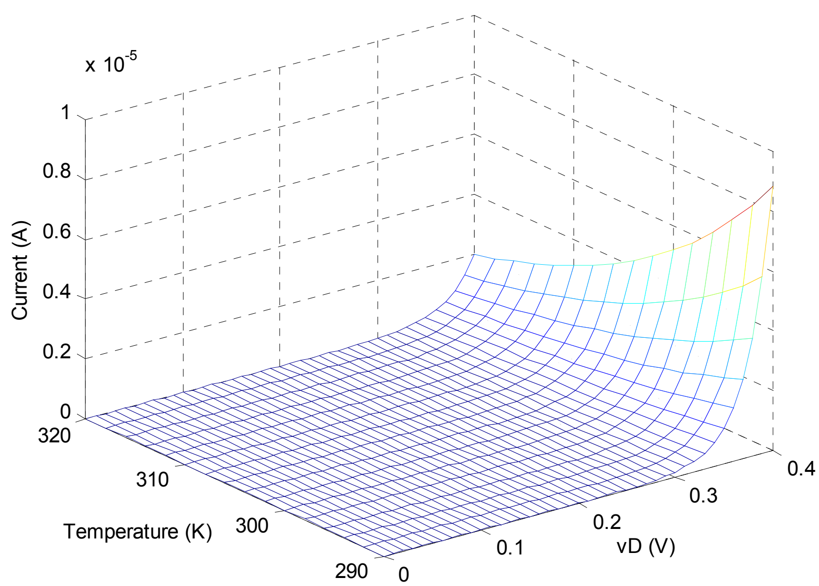


Problem 15

Sceript file:

```
Is=1E-12; q=1.6E-19; k=1.38E-23;
T=290:2:320;
vD=0:0.01:0.4;
[X,Y]=meshgrid(vD,T);
I=Is*(exp((X*q)./(k*Y))-1);
mesh(X,Y,I)
xlabel('vD (V)')
ylabel('Temperature (K)')
zlabel('Current (A)')
```

Figure:

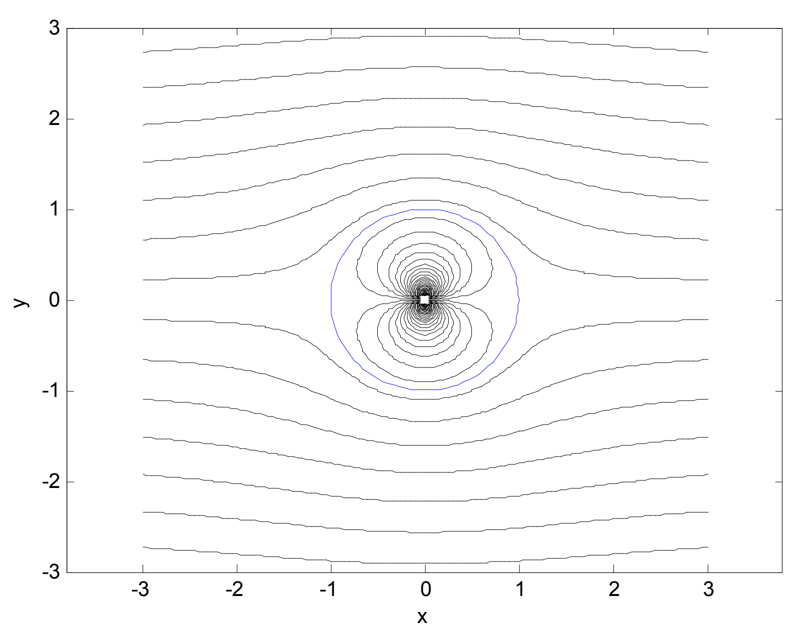


Problem 16

Script file:

```
x = -3:0.05:3;
y = -3:0.05:3;
[X,Y ] = meshgrid(x,y);
Z = Y-Y./(X.^2+Y.^2);
contour(X,Y,Z,100,'k')
xlabel('x'); ylabel('y')
zlabel('z')
hold on
th=linspace(0,2*pi,100);
r(1,1:100)=1;
polar(th,r)
axis equal
hold off
```

Figure:

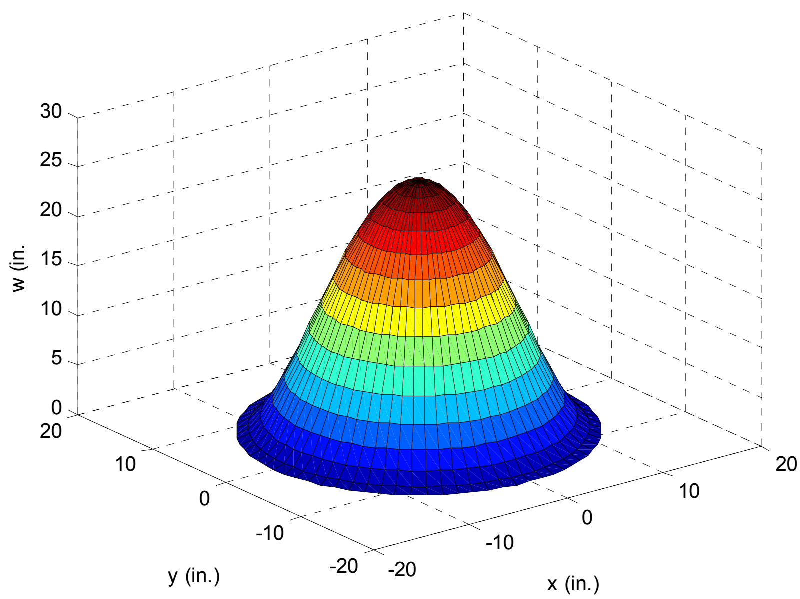


Problem 17

Script file:

```
p=15; rd=15;
E=10E6; t=0.08; nu=0.3;
K=E*t^3/(12*(1-nu^2));
C=p*rd^4/(64*K);
[th,r] = meshgrid((0:5:360)*pi/180,0:1:rd);
[X,Y] = pol2cart(th,r);
%R = sqrt(X.^2 + Y.^2);
w=C*(1-(r/rd).^2).^2;
surf(X,Y,w)
xlabel('x (in.)'); ylabel('y (in.)'); zlabel('w (in.')
```

Figure:

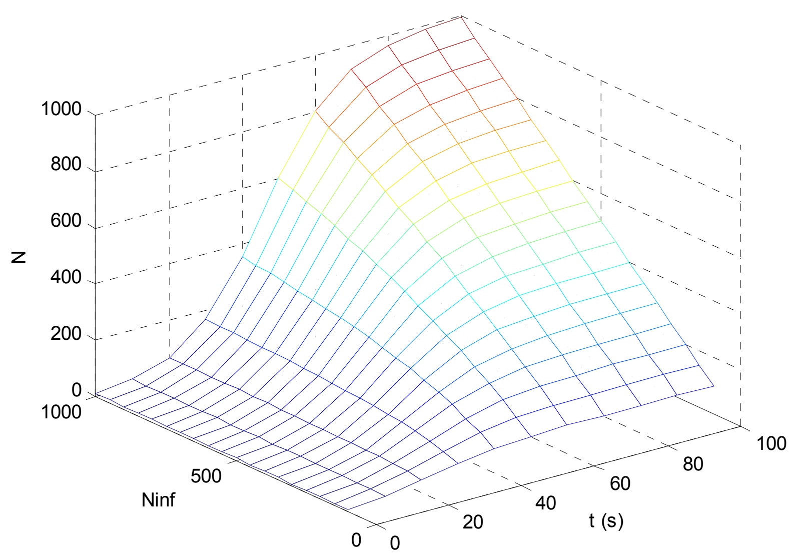


Problem 18

Script file:

```
r=0.1; N0=10;
t=0:10:100;
Ninf=100:50:1000;
[X,Y]=meshgrid(t,Ninf);
N=Y./(1+(Y/N0-1).*exp(-r*X));
mesh(X,Y,N)
xlabel('t (s)')
ylabel('Ninf')
zlabel('N')
```

Figure:

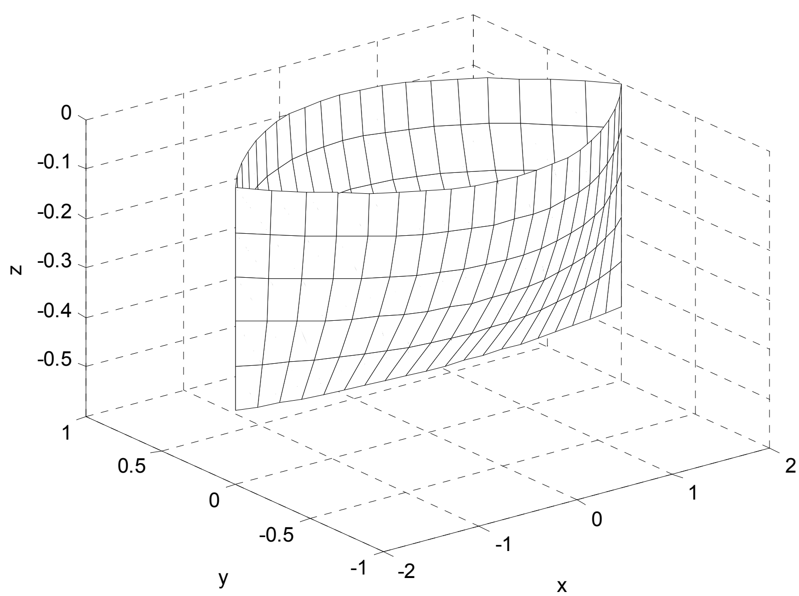


Problem 19

Script file:

```
T=0.5; B=1.2;L=4;
x=-2:0.2:2;
z=0:-0.09:-0.45;
[X,Z]=meshgrid(x,z);
Y=B/2*(1-(2*X/L).^2).*(1-(Z/T).^2);
C=[0 0 0];
mesh(X,Y,Z)
xlabel('x'); ylabel('y'); zlabel('z')
axis([-2 2 -1 1 -0.6 0])
hold on
Y=-B/2*(1-(2*X/L).^2).*(1-(Z/T).^2);
mesh(X,Y,Z)
colormap(C)
```

Figure:

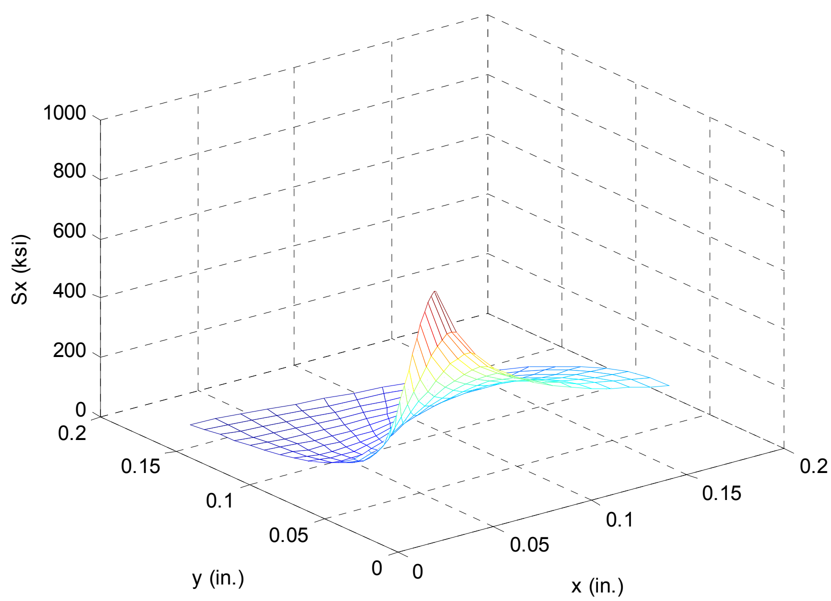


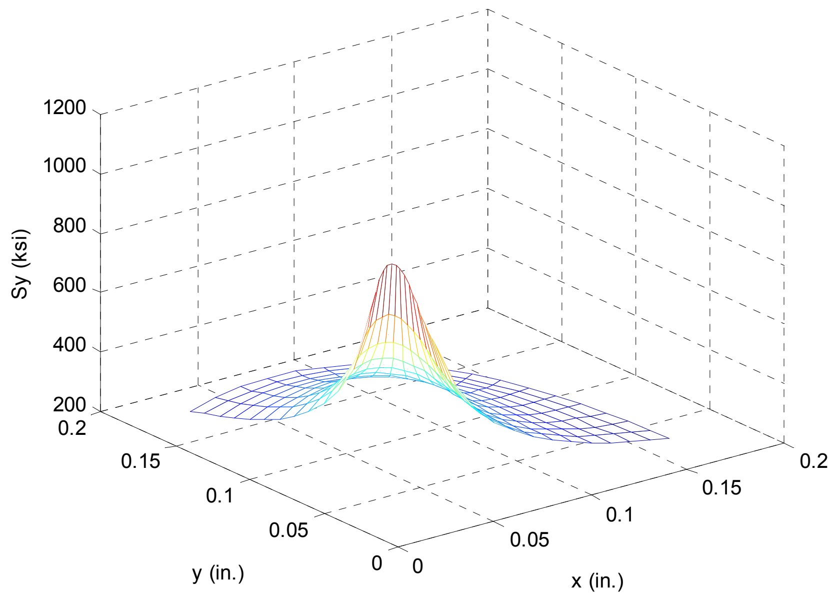
Problem 20

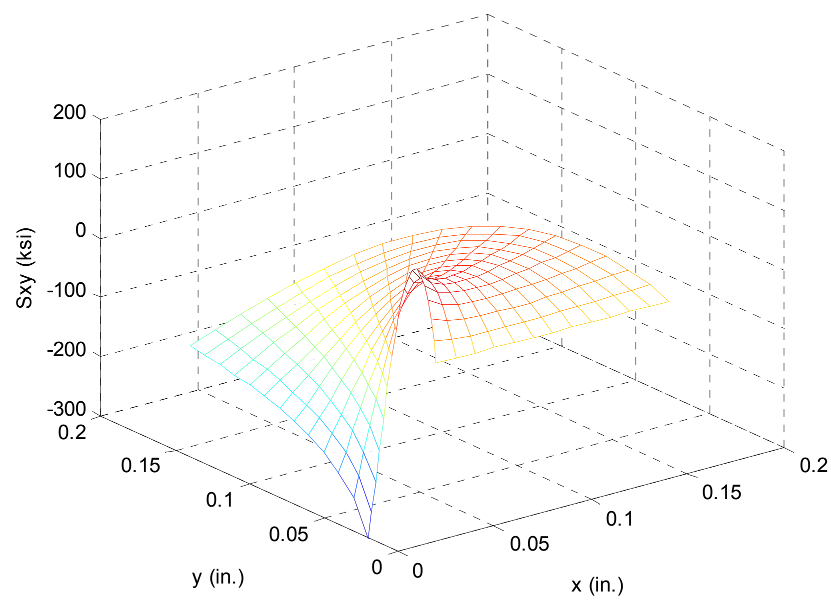
Script file:

```
p=15; rd=3;
E=10E6; t=0.08; nu=0.3;
K=E*t^3/(12*(1-nu^2));
K1=300;
C=p*rd^4/(64*K);
[th,r] = meshgrid((0:5:90)*pi/180,0.02:0.01:0.14);
[X,Y] = pol2cart(th,r);
%R = sqrt(X.^2 + Y.^2);
Sx=K1./sqrt(2*pi*r).*cos(th/2).*(1-sin(th/2).*sin(3*th/2));
Sy=K1./sqrt(2*pi*r).*cos(th/2).*(1+sin(th/2).*sin(3*th/2));
Sxy=K1./sqrt(2*pi*r).*cos(th/2).*sin(th/2).*cos(3*th/2);
mesh(X,Y,Sx)
xlabel('x (in.)'), ylabel('y (in.)'), zlabel('Sx (ksi)')
```

Figures:




Sy (ksi)
1200
1000
800
600
400
200
0.2
0.15
0.1
0.05
0
y (in.)
0
0.05
0.1
0.15
0.2
x (in.)

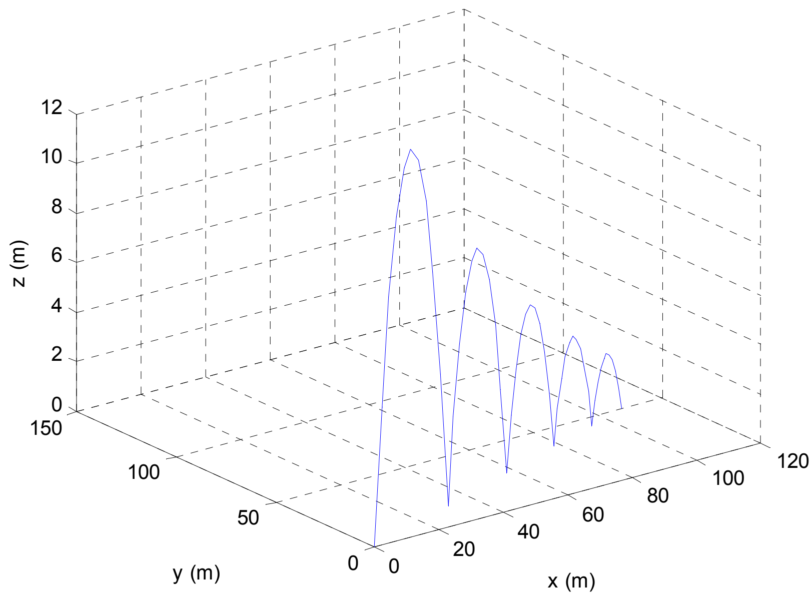

Sxy (ksi)
200
100
0
-100
-200
-300
0.2
0.15
0.1
0.05
0
y (in.)
0
0.05
0.1
0.15
0.2
x (in.)

Problem 21

Script file:

```
g=9.81;
V=20; thz=30; thx=25; thy=65;
Vz=V*cosd(thz);
Vx=V*sind(thz)*cosd(thx); Vy=V*sind(thz)*sind(thx);
n=5
k=11;
X(1)=0; Y(1)=0;
for i=1:5
    tb(i)=2*Vz/g;
    tbn=linspace(0,tb(i),k)
    Zn=Vz*tbn-g*tbn.^2/2;
    length(Zn);
        Xn=Vx*tbn;
        Yn=Vy*tbn;
        in=(i-1)*10+1;
        jn=in+k-1;
        Z(in:jn)=Zn;
        X(in:jn)=Xn+X(in);
        Y(in:jn)=Yn+Y(in);
        Vz=Vz*0.8;
end
plot3(X,Y,Z)
axis([0,120,0,150,0,12])
grid on
xlabel('x (m)'); ylabel('y (m)'); zlabel('z (m)')
```

Figures:



Chapter 11
Solved Problems

Problem 1

Script file:

```
syms x
S1=x^2*(x-6)+4*(3*x-2)
S2=(x+2)^2-8*x
disp('Part (a)')
a=simple(S1*S2)
disp('Part (b)')
b=simple(S1/S2)
disp('Part (c)')
c=simple(S1+S2)
disp('Part (d)')
d=subs(c,5)
```

Command Window:

```
S1 =
12*x + x^2*(x - 6) - 8
S2 =
(x + 2)^2 - 8*x
Part (a)
a =
(x - 2)^5
Part (b)
b =
x - 2
Part (c)
c =
```

```
(x - 1)*(x - 2)^2
Part (d)
d =
   36
```

Problem 2

Script File:

```
syms x
S1=x*(x^2+6*x+12)+8
S2=(x-3)^2+10*x-5
disp('Part (a)')
a=simple(S1*S2)
disp('Part (b)')
b=simple(S1/S2)
disp('Part (c)')
c=simple(S1+S2)
disp('Part (d)')
d=subs(c,3)
```

Command Window:

```
S1 =
x*(x^2 + 6*x + 12) + 8
S2 =
10*x + (x - 3)^2 - 5
Part (a)
a =
(x + 2)^5
Part (b)
b =
x + 2
Part (c)
c =
(x + 2)^2*(x + 3)
Part (d)
d =
   150
```

Problem 3

Script File:

```
syms x y
T=sqrt(x)-y^2;
S=x+sqrt(x)*y^2+y^4;
Q=S*T
QS=simplify(Q)
subs(QS,{x,y},{9,2})
```

Command Window:

```
Q =
(x^(1/2) - y^2)*(x + x^(1/2)*y^2 + y^4)
QS =
x^(3/2) - y^6
ans =
   -37
```

Problem 4

Script File:

```
syms x y
% Part (a)
Sa=(x+2)*(x+0.5)*(x-2)*(x-4.5);
disp('Part (a)')
P=expand(Sa)
% Part (b)
Sp=x^6 - 6.5*x^5 - 58*x^4 + 167.5*x^3 + 728*x^2 - 890*x -
1400;
disp('Part (b)')
SpFF=factor(Sp)
```

Command Window:

```
Part (a)
P =
x^4 - 4*x^3 - (25*x^2)/4 + 16*x + 9
Part (b)
SpFF =
((x - 2)*(2*x + 7)*(x - 4)*(x + 5)*(x - 10)*(x + 1))/2
```

The roots are: 2, -3.5, 4, -5, 10, and -1

Problem 5

Command Window:

```
>> syms x
>> % Part (a)
>> aRHS=4*sin(x)*cos(x)-8*sin(x)^3*cos(x)
aRHS =
4*cos(x)*sin(x) - 8*cos(x)*sin(x)^3
>> a=simple(aRHS)
a =
sin(4*x)
>> % Part (b)
>> syms x y
>> bRHS=(cos(x-y)+cos(x+y))/2
bRHS =
cos(x - y)/2 + cos(x + y)/2
>> b=simple(bRHS)
b =
cos(x)*cos(y)
```

Problem 6

```
>> syms x
>> aRHS=(3*tan(x)-tan(x)^3)/(1-3*tan(x)^2)
aRHS =
-(3*tan(x) - tan(x)^3)/(3*tan(x)^2 - 1)
>> a=simple(aRHS)
a =
tan(3*x)
>> syms x y z
>>
bRHS=sin(x)*cos(y)*cos(z)+cos(x)*sin(y)*cos(z)+cos(x)*
cos(y)*sin(z)-sin(x)*sin(y)*sin(z)
bRHS =
cos(x)*cos(y)*sin(z)     +     cos(x)*cos(z)*sin(y)     +
cos(y)*cos(z)*sin(x) - sin(x)*sin(y)*sin(z)
>> b=simple(bRHS)
b =
sin(x + y + z)
```

Problem 7

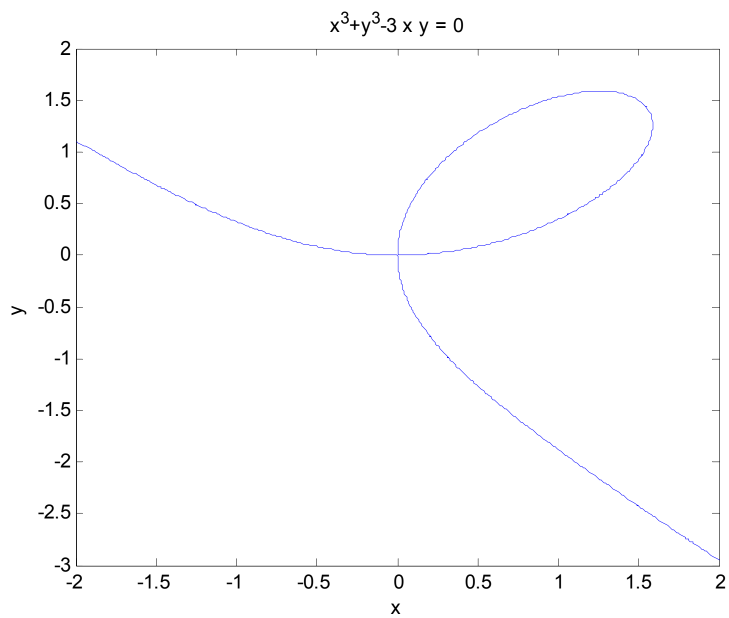
Script File:

```
syms xs ys t
xs=3*t/(1+t^3)
ys=3*t^2/(1+t^3)
fL=xs^3+ys^3
fLS=simple(fL)
fR=3*xs*ys
ezplot('x^3+y^3-3*x*y',[-2,2,-3,2])
```

Command Window:

```
xs =
3*t/(1+t^3)
ys =
3*t^2/(1+t^3)
fL =
27*t^3/(1+t^3)^3+27*t^6/(1+t^3)^3
fLS =
27*t^3/(1+t^3)^2
fR =
27*t^3/(1+t^3)^2
```

Figure Window:



Problem 8

Script file:

```
syms V r h
Vt=pi*(r^2*h+2*r^3/3)
Vth=subs(Vt,h,10)
rs=double(solve(Vth-1050,r))
```

Command Window:

```
Vt =
pi*((2*r^3)/3 + h*r^2)
Vth =
pi*((2*r^3)/3 + 10*r^2)
rs =
   5.0059
 -10.0030 + 0.2986i
 -10.0030 - 0.2986i
```

The radius is 5.0059 m.

Problem 9

Script file:

```
clear
eqn1='(T+a)*(v+b)=(T0+a)*b'
eqn2=subs(eqn1,'T',0)
disp('Answer to part a:')
vmax=solve(eqn2,'v')
eqn3=subs(eqn1,'b','vmax*a/T0')
disp('Answer to part b:')
v=solve(eqn3,'v')
```

Command Window:

```
eqn1 =
(T+a)*(v+b)=(T0+a)*b
eqn2 =
a*(v+b) = (T0+a)*b
Answer to part a:
vmax =
b*T0/a
eqn3 =
(T+a)*(v+(vmax*a/T0))=(T0+a)*(vmax*a/T0)
Answer to part b:
v =
-vmax*a*(T-T0)/T0/(T+a)
```

Problem 10

Script File:

```
syms x y
ezplot('(x-1)^2/6^2+y^2/3^2=1',[-8,8,-4,10])
hold on
ezplot('(x+2)^2/2^2+(y-5)^2/4^2=1',[-8,8,-4,10])
axis equal
xlabel('x')
ylabel('y')
hold off
[xs,ys]=solve('(x-1)^2/6^2+y^2/3^2=1','(x+2)^2/2^2+(y-5)^2/
4^2=1')
```

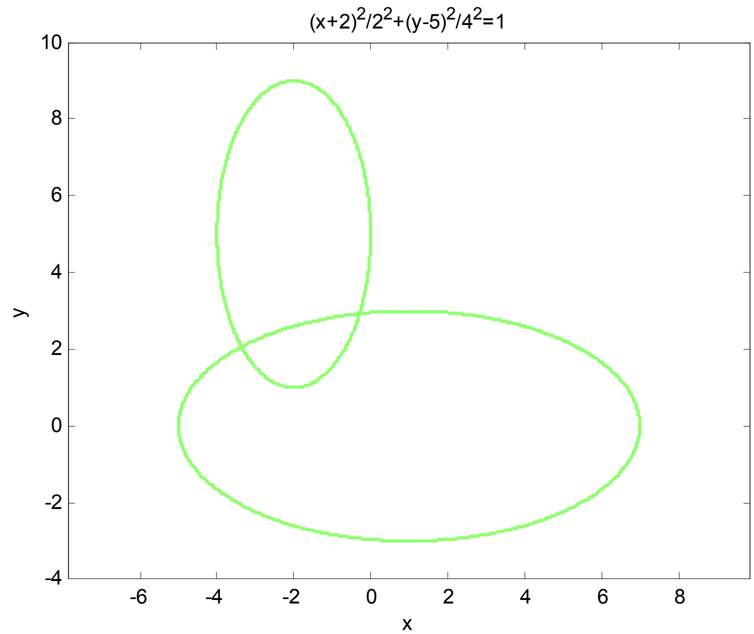
Command Window:

```
xs =
                                                            -
0.28863594242289174161458727944367
                                                            -
3.3574030955497314062304035725114
        -        3.5688008215556039389212634955543*i        -
2.5769804810136884260775045740225
                  3.5688008215556039389212634955543*i       -
2.5769804810136884260775045740225
ys =

2.9299922102241102050567052735977

2.0623432220955377577306552655663
                   1.0090261877640585055284255078 98*i      -
3.1628343828264906480603469362487
         -        1.0090261877640585055284255078 98*i       -
3.1628343828264906480603469362487
```

Intersection points:

(-0.2886359424, 2.9299922102) and (-3.3574030955, 2.0623432220)

Figure:



(x+2)^2/2^2+(y-5)^2/4^2=1
10
8
6
4
2
0
-2
-4
y
-6
-4
-2
0
2
4
6
8
x

Problem 11

Script file:

```
syms T W FAx FAy d h L Lc
eq1 = 'FAx-T*d/Lc=0';
eq2 = 'FAy+T*sqrt(Lc^2-d^2)/Lc-W=0';
eq3 = 'T*sqrt(Lc^2-d^2)*d/Lc-W*L=0';
disp('Part a')
[FAx FAy T]=solve(eq1,eq2,eq3,FAx,FAy,T)
disp('Part b')
FAxN = subs(FAx,{W,L, Lc},{200, 120,66})
FAyN = subs(FAy,{W,L, Lc},{200, 120,66})
TN = subs(T,{W,L, Lc},{200, 120,66})
FAN=sqrt(FAxN^2+FAyN^2)
ezplot(TN,[20,70])
TNd=diff(TN)
dFmin=double(solve(TNd))
Tmin=subs(TN,dFmin)
hold on
ezplot(FAN,[20,70])
legend('T','FA',2)
xlabel('d (in.)')
ylabel('Force (lb)')
hold off
```

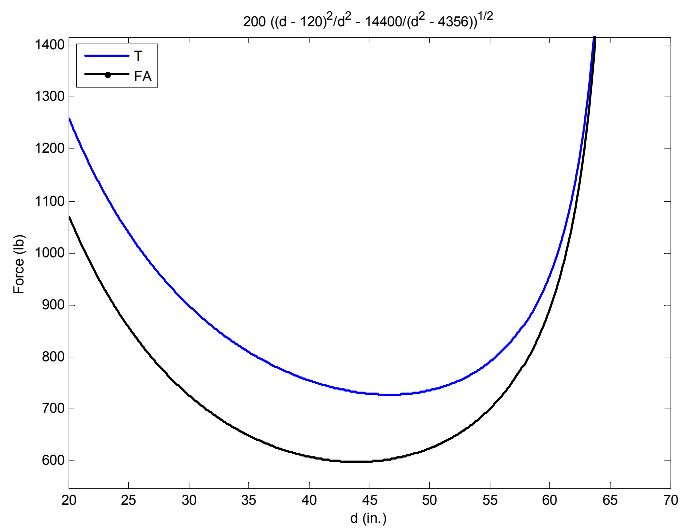
Command Window:

```
Part a
FAx =
(L*W)/(Lc^2 - d^2)^(1/2)
FAy =
-(W*(L - d))/d
T =
(L*Lc*W)/(d*(Lc^2 - d^2)^(1/2))
Part b
FAxN =
24000/(4356 - d^2)^(1/2)
FAyN =
(200*(d - 120))/d
TN =
```

```
1584000/(d*(4356 - d^2)^(1/2))
FAN =
200*((d - 120)^2/d^2 - 14400/(d^2 - 4356))^(1/2)
TNd =
1584000/(4356 - d^2)^(3/2) - 1584000/(d^2*(4356 - d^2)^(1/
2))
dFmin =
   46.6690
  -46.6690
Tmin =
  727.2727
 -727.2727
```

The smalles tension in the cable is 727.2727 lb at $d = 46.669$ in.

Figure Window:



The line style was formated in the Figure Window.

Problem 12

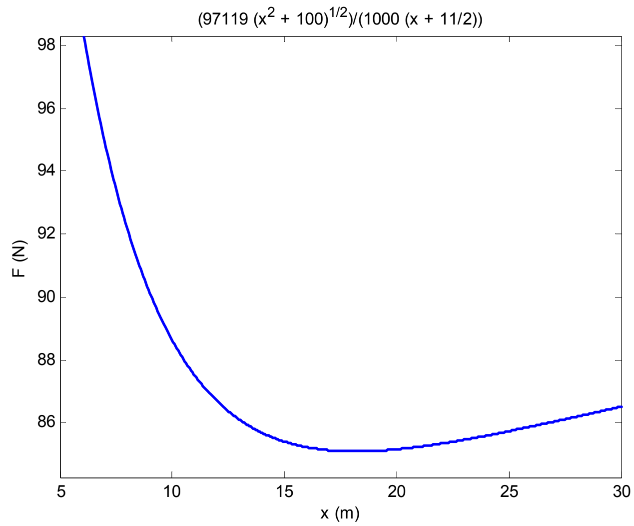
Script file:

```
syms F N x m g h mew
eq1 = '-F*x/sqrt(x^2+h^2)+mew*N=0';
eq2 = '-m*g+N+F*h/sqrt(x^2+h^2)=0';
disp('Part a')
[F N]=solve(eq1,eq2,F,N)
Fs=simple(F)
Ns=simple(N)
disp('Part b')
Fx = subs(F,{m,g,h,mew},{18,9.81,10,0.55})
Fd = diff(Fx)
xFmin=double(solve(Fd))
Fmin=double(subs(Fx,x,xFmin))
ezplot(Fx,[5,30])
xlabel('x (m)')
ylabel('F (N)')c
```

Command Window:

```
Part a
F =
(g*m*mew*(h^2 + x^2)^(1/2))/(x + h*mew)
N =
(g*m*x)/(x + h*mew)
Fs =
(g*m*mew*(h^2 + x^2)^(1/2))/(x + h*mew)
Ns =
(g*m*x)/(x + h*mew)
Part b
Fx =
(97119*(x^2 + 100)^(1/2))/(1000*(x + 11/2))
Fd =
(97119*x)/(1000*(x^2 + 100)^(1/2)*(x + 11/2)) - (97119*(x^2
+ 100)^(1/2))/(1000*(x + 11/2)^2)
xFmin =
   18.1818
Fmin =
   85.0972
```

Figure Window:

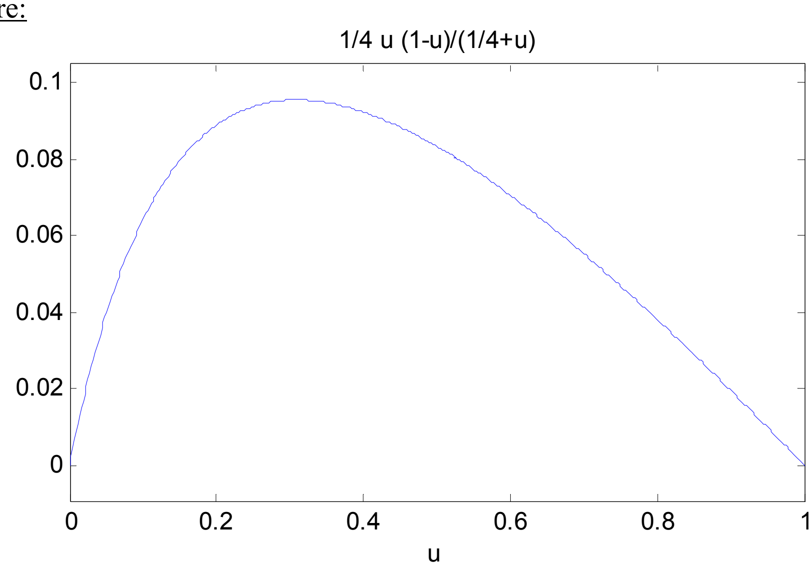


Problem 13

Command Window:

```
>> k=0.25;
>> syms u
>> p=k*u*(1-u)/(k+u)
p =
1/4*u*(1-u)/(1/4+u)
>> % Part a
>> ezplot(p,[0,1])
>> % Part b
>> dp=diff(p,u)
dp =
1/4*(1-u)/(1/4+u)-1/4*u/(1/4+u)-1/4*u*(1-u)/(1/4+u)^2
>> uMaxMin=solve(dp,u)
uMaxMin =
 -1/4*5^(1/2)-1/4
  1/4*5^(1/2)-1/4
>> double(uMaxMin)
ans =
   -0.8090
    0.3090
>> pMax=subs(p,u,uMaxMin(2))
pMax =
1/5*(1/4*5^(1/2)-1/4)*(5/4-1/4*5^(1/2))*5^(1/2)
>> pMaxNumber=double(pMax)
pMaxNumber =
    0.0955
```

Figure:



Problem 14

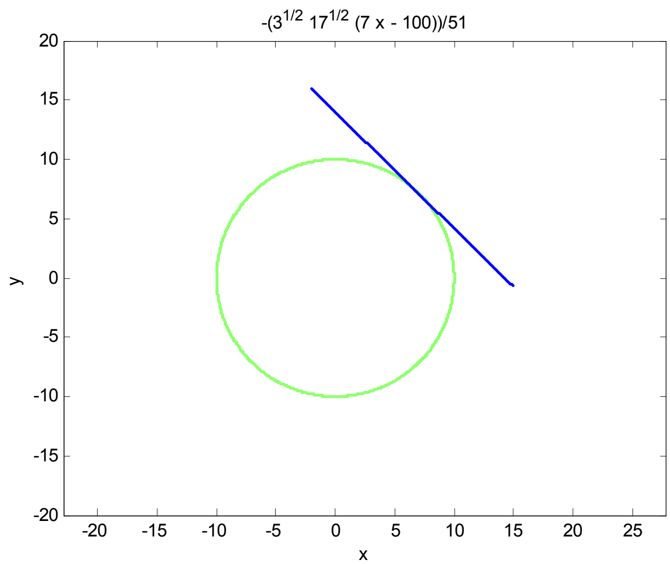
Script File:

```
syms R
syms x y x0 y0
C=x^2+y^2-R^2;
% The equation of circle in the form y=f(x)
yC=solve(C,y);
yCp=yC(1);    % Taking the solution for y>0
slope=diff(yCp,x);
Spx0=subs(slope,x,x0);  % The tangent to the ellipse at x=x0
y0=subs(yCp,x,x0);  % The value of y0 at x0
bL=y0-Spx0*x0;  % The value of b in the equation of the line
(y=mx+b)
y=Spx0*x+bL;  % The equation of the line
ys=simplify(y)  % The equation of the line
Eab=subs(C,R,10);
yx0=subs(ys,{R,x0},{10,7});
ezplot(Eab,[-15 15])
hold on
ezplot(yx0,[-2 15])
axis([-20 20 -20 20])
axis equal
hold off
```

Command Window:

```
ys =
-(x*x0 - R^2)/((R + x0)^(1/2)*(R - x0)^(1/2))
```

Figure:



Problem 15

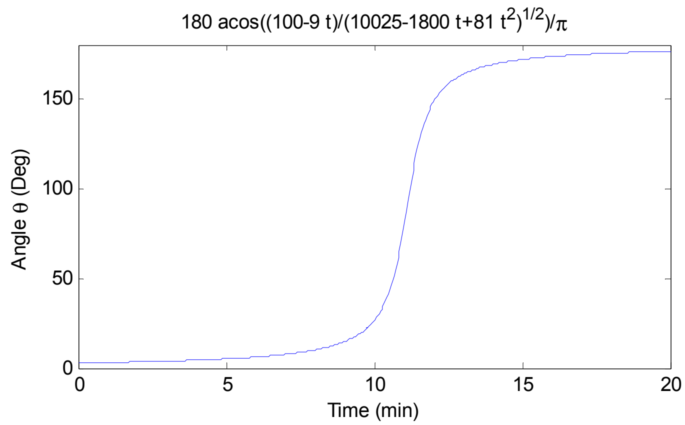
Script file:

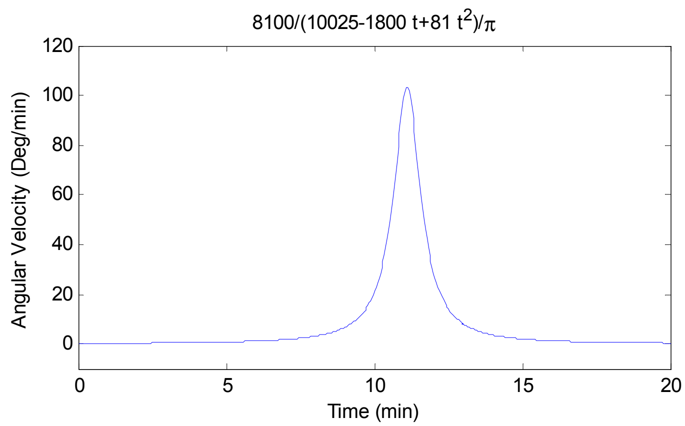
```
syms x t
v=540*1000/60; h=5000;
x=100000-v*t
s=sqrt(x^2+h^2)
q=simple(acos(x/s))
qt=simple(diff(q,t))
subplot(2,1,1)
qdeg=q*180/pi;
ezplot(qdeg,[0,20])
axis([0,20,0,180])
xlabel('Time (min)')
ylabel('Angle \theta (Deg)')
subplot(2,1,2)
qtdeg=qt*180/pi;
ezplot(qtdeg,[0,20])
axis([0,20,-10,120])
xlabel('Time (min)')
ylabel('Angular Velocity (Deg/min)')
```

Command Window:

```
x =
100000-9000*t
s =
1000*(10025-1800*t+81*t^2)^(1/2)
q =
acos((100-9*t)/(10025-1800*t+81*t^2)^(1/2))
qt =
45/(10025-1800*t+81*t^2)
```

Figure:


180 acos((100-9 t)/(10025-1800 t+81 t^2)^1/2)/π
Angle θ (Deg)
Time (min)
0
50
100
150
0
5
10
15
20


8100/(10025-1800 t+81 t^2)/π
Angular Velocity (Deg/min)
Time (min)
0
20
40
60
80
100
120
0
5
10
15
20

Problem 16

Script file:

```
syms x
Sa=x^3/sqrt(1-x^2)
ISa=int(Sa)
Sb=x^2*cos(x)
ISb=int(Sb)
```

Command Window:

```
Sa =
x^3/(1 - x^2)^(1/2)
ISa =
-((1 - x^2)^(1/2)*(x^2 + 2))/3
Sb =
x^2*cos(x)
ISb =
x^2*sin(x) - 2*sin(x) + 2*x*cos(x)
```

Problem 17

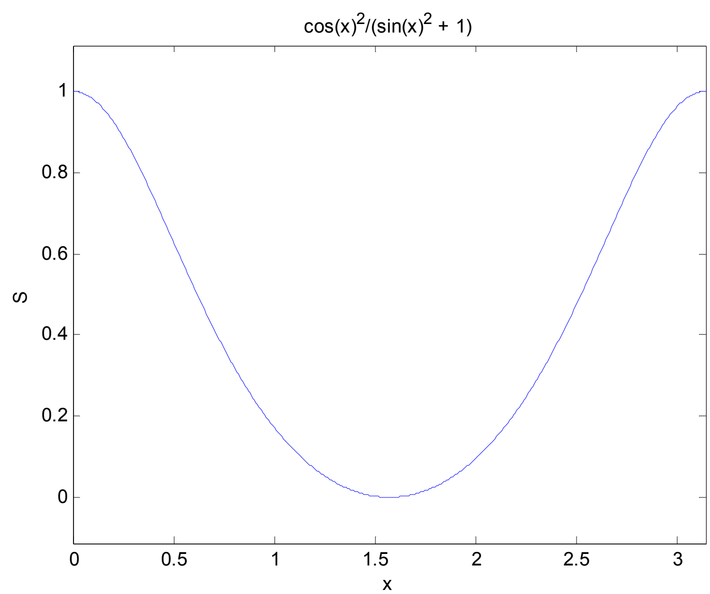
Script file:

```
syms x
Sa=cos(x)^2/(1+sin(x)^2)
ezplot(Sa,[0,pi])
ylabel('S')
ISaa=int(Sa)
ISa=int(Sa,0,pi)
```

Command Window:

```
Sa =
cos(x)^2/(sin(x)^2 + 1)
ISaa =
2^(1/2)*atan(2^(1/2)*tan(x)) - x
ISa =
pi*(2^(1/2) - 1)
```

Figure:



Problem 18

The area at a given z is $\pi a \ \sin v b \ \sin v$
also: $z = c \ \cos v \qquad dz = c \ (-\sin v) dv$

Than: $dV = -\pi abc \sin^3 v dv$

Script file:

```
syms x
Sa=sin(x)^3
ISaa=int(Sa)
ISa=-int(Sa,-pi,0)
```

Command Window:

```
Sa =
sin(x)^3
ISaa =
cos(3*x)/12 - (3*cos(x))/4
ISa =
4/3
```

So, the volume is: $\frac{4}{3}\pi abc$

Problem 19

(*a*)

Script File:

```
syms x w a t c A B C m
S=A*exp(-x^2/(4*m*t))/sqrt(t)+B
Sdt=diff(S,t)
Sddx=diff(S,x,2)
E=Sdt-m*Sddx
simplify(E)
```

Command Window:

```
S =
B + A/(t^(1/2)*exp(x^2/(4*m*t)))
Sdt =
(A*x^2)/(4*m*t^(5/2)*exp(x^2/(4*m*t))) - A/(2*t^(3/
2)*exp(x^2/(4*m*t)))
Sddx =
(A*x^2)/(4*m^2*t^(5/2)*exp(x^2/(4*m*t))) - A/
(2*m*t^(3/2)*exp(x^2/(4*m*t)))
E =
m*(A/(2*m*t^(3/2)*exp(x^2/(4*m*t))) - (A*x^2)/
(4*m^2*t^(5/2)*exp(x^2/(4*m*t)))) - A/(2*t^(3/
2)*exp(x^2/(4*m*t))) + (A*x^2)/(4*m*t^(5/2)*exp(x^2/
(4*m*t)))
ans =
0
```

(*b*)

Script File:

```
syms x w a t c A B C m
S=A*exp(-a*x)*cos(a*x-2*m*a^2*t+B)+C
Sdt=diff(S,t)
Sddx=diff(S,x,2)
E=Sdt-m*Sddx
simplify(E)
```

Command Window:

```
S =
C + (A*cos(- 2*m*t*a^2 + x*a + B))/exp(a*x)
Sdt =
(2*A*a^2*m*sin(- 2*m*t*a^2 + x*a + B))/exp(a*x)
```

```
Sddx =
(2*A*a^2*sin(- 2*m*t*a^2 + x*a + B))/exp(a*x)
E =
0
ans =
0
```

Problem 20

Script File:

```
syms k x y
y=-k*x^2+12*k*x;
Ared=int(y,x,0,12);
Awhite=180-Ared;
equation=Ared-Awhite;
ks=solve(equation)
```

Command Window:

```
ks =
5/16
```

Problem 21

Script File:

```
syms R x y
x=sqrt(R^2-y^2);
A=2*int(x,y,0,R);
xy=y*x;
Ax=2*int(xy,y,0,R);
ybar=Ax/A
```

Command Window:

```
ybar =
(4*R)/(3*pi)
```

Problem 22

Script File:

```
syms R x y
x=sqrt(R^2-y^2);
xy2=2*x*y^2;
I=int(xy2,y,0,R)
```

Command Window:

```
I =
(pi*R^4)/8
```

Problem 23

Part *a*):

Script file:

```
syms w t T V
vt=V*cos(w*t)
vt2=vt^2
vrms=sqrt(int(vt2,t,0,T)/T)
vrmsANS=subs(vrms,T,2*pi/w)
```

Command Window:

```
vt =
V*cos(w*t)
vt2 =
V^2*cos(w*t)^2
vrms =
1/2*2^(1/2)*(V^2*(cos(w*T)*sin(w*T)+w*T)/w/T)^(1/2)
vrmsANS =
1/2*2^(1/2)*(V^2)^(1/2)
```

Part *b*):

Script file:

```
syms w t T V
vt=2.5*cos(w*t)+3
vt2=vt^2
vrms=sqrt(int(vt2,t,0,T)/T)
vrmsANS=subs(vrms,T,2*pi/w)
vrmsNUMBER=double(vrmsANS)
```

Command Window:

```
vt =
5/2*cos(w*t)+3
vt2 =
(5/2*cos(w*t)+3)^2
vrms =
1/4*2^(1/2)*((25*cos(w*T)*sin(w*T)+97*w*T+120*sin(w*T))/w/
T)^(1/2)
vrmsANS =
1/4*194^(1/2)
vrmsNUMBER =
    3.4821
```

Problem 24

Script File:

```
clear
syms x N R t
x=dsolve('Dx=-R*x*(N+1-x)','x(0)=N')
t_max=solve(diff(x,2),t)
```

Command Window:

```
x =
exp(-R*(N+1)*t)*N*(N+1)/(1+exp(-R*(N+1)*t)*N)
t_max =
log(N)/R/(N+1)
```

Problem 25

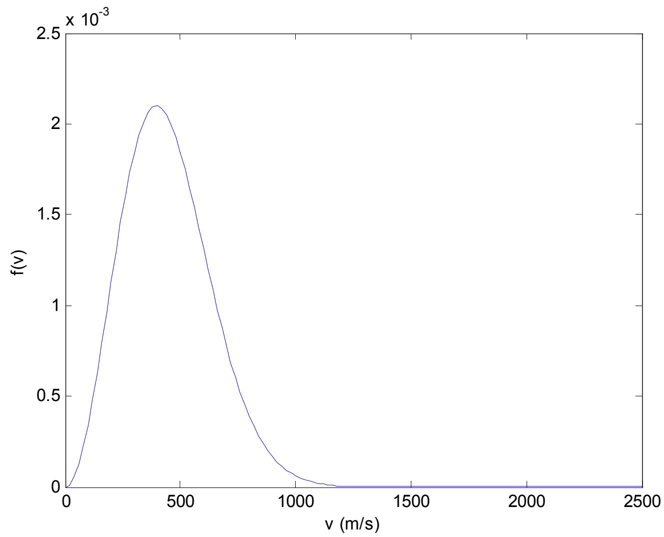
Script File:

```
m=5.3E-26;
kB=1.38E-23;
T1=300;
v=0:20:2500;
k=m/(kB*T1);
K3=sqrt(k^3*2/pi);
vsq=v.^2;
Fv=K3*vsq.*exp(-k/2*vsq);
plot(v,Fv)
xlabel('v (m/s)')
ylabel('f(v)')
syms M K T V
S=sqrt(2*(M/(K*T))^3/pi)*V^2*exp(-M*V^2/(2*K*T))
Sd=diff(S,V)
VP=solve(Sd,V)
VPn=double(subs(VP(2),{K M T},{1.38E-23,5.3E-26,300}))
```

Command Window:

```
S =
(2^(1/2)*V^2*(M^3/(K^3*T^3))^(1/2))/(pi^(1/
2)*exp((M*V^2)/(2*K*T)))
Sd =
(2*2^(1/2)*V*(M^3/(K^3*T^3))^(1/2))/(pi^(1/
2)*exp((M*V^2)/(2*K*T))) - (2^(1/2)*M*V^3*(M^3/
(K^3*T^3))^(1/2))/(K*pi^(1/2)*T*exp((M*V^2)/(2*K*T)))
VP =
                            0
  (2^(1/2)*(K*M*T)^(1/2))/M
 -(2^(1/2)*(K*M*T)^(1/2))/M
VPn =
  395.2549
```

Figure:



Problem 26

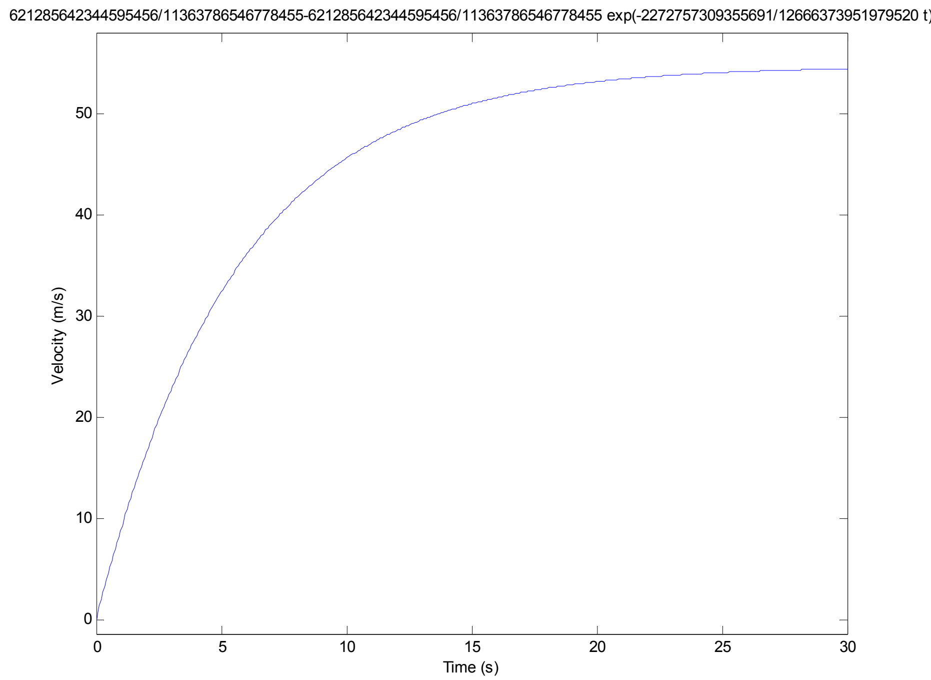
Script file:

```
syms m g c v t
disp('Answer to Part a:')
vs=dsolve('m*g-c*v=m*Dv','v(0)=0')
vsn=subs(vs,{m,g,t},{90,9.81,4});
vsneq=vsn-28;
disp('Answer to Part b:')
cs=double(solve(vsneq))
disp('Velocity as a function of time:')
vst=subs(vs,{m,g,c},{90,9.81,cs(1)})
ezplot(vst,[0,30])
xlabel('Time (s)')
ylabel('Velocity (m/s)'
```

Command Window:

```
Answer to Part a:
vs =
g/c*m-exp(-c/m*t)*g/c*m
Answer to Part b:
cs =
   16.1489
         0
Velocity as a function of time:
vst =
621285642344595456/11363786546778455-621285642344595456/
11363786546778455*exp(-2272757309355691/12666373951979520*t)
```

Figure:


621285642344595456/11363786546778455-621285642344595456/11363786546778455 exp(-2272757309355691/12666373951979520 t)
Velocity (m/s)
Time (s)
0
10
20
30
40
50
0
5
10
15
20
25
30

Problem 27

Script file for Parts *a* and *b*, and one plot in part *d*:

```
syms v R L I t
disp('Answer to Part a:')
Ia=dsolve('R*I+L*DI=v','I(0)=0')
Iat=subs(Ia,{v, R, L},{6, 0.4, 0.08});
Va_in_Rt=Iat*0.4;
Equation=Va_in_Rt-5;
timeVis5=solve(Equation);
disp('Answer to Part b:')
tBA=double(timeVis5)
disp('Current at tBA:')
I_at_tBA=subs(Iat,t,tBA)
subplot(1,2,1)
ezplot(Va_in_Rt,[0,tBA])
xlabel('Time (s)')
ylabel('Voltage Across R (V)')
```

Command Window:

```
Answer to Part a:
Ia =
1/R*v-exp(-R/L*t)/R*v
Answer to Part b:
tBA =
    0.3584
Current at tBA:
I_at_tBA =
   12.5000
```

Use the values of tBA and I_at_tBA for the initial condition in the solution of Part *c*.

Script file for Part *c*, and the second plot in part *d*:

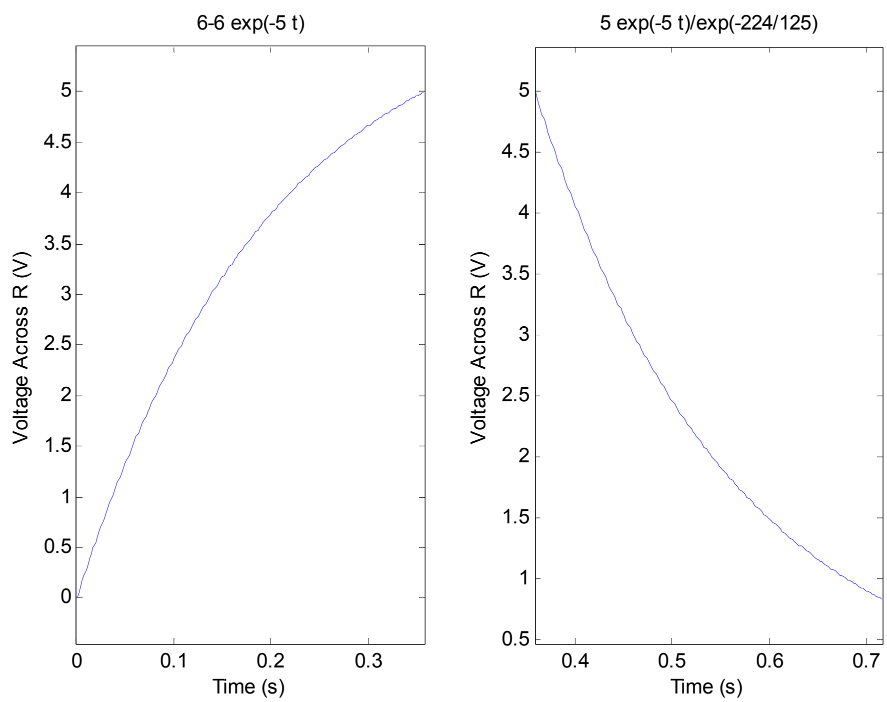
```
syms v R L I t
disp('Answer to Part c:')
Ic=dsolve('R*I+L*DI=0','I(0.3584)=12.5')
Ict=subs(Ic,{R, L},{0.4, 0.08});
Vc_in_Rt=Ict*0.4;
subplot(1,2,2)
ezplot(Vc_in_Rt,[tBA,2*tBA])
```

```
xlabel('Time (s)')
ylabel('Voltage Across R (V)')
```

Command Window:

```
Answer to Part c:
Ic =
25/2*exp(-R/L*t)/exp(-224/625*R/L)
```

Figure:



Problem 28

Script file:

```
syms x y
ys=dsolve('Dy=(x^4-2*y)/(2*x)','x')
yd=diff(ys)
Equation=simplify(yd-(x^4-2*ys)/(2*x))
```

Command Window:

```
ys =
C5/x + x^4/10
yd =
(2*x^3)/5 - C5/x^2
Equation =
0
```

Problem 29

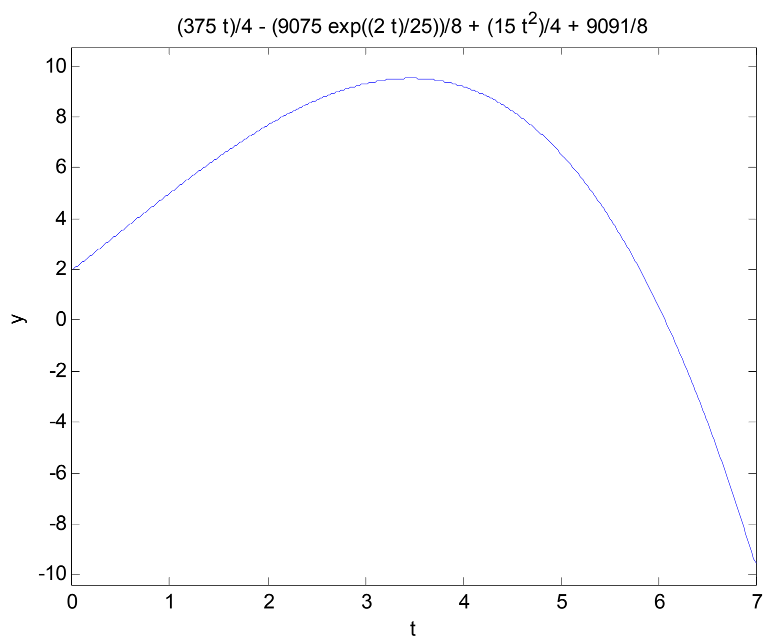
Script file:

```
syms x y t
ys=dsolve('D2y-0.08*Dy+0.6*t=0','y(0)=2','Dy(0)=3')
ezplot(ys,[0,7])
xlabel('t')
ylabel('y')
```

Command Window:

```
ys =
(375*t)/4 - (9075*exp((2*t)/25))/8 + (15*t^2)/4 + 9091/
8
```

Figure:



Problem 30

Script file:

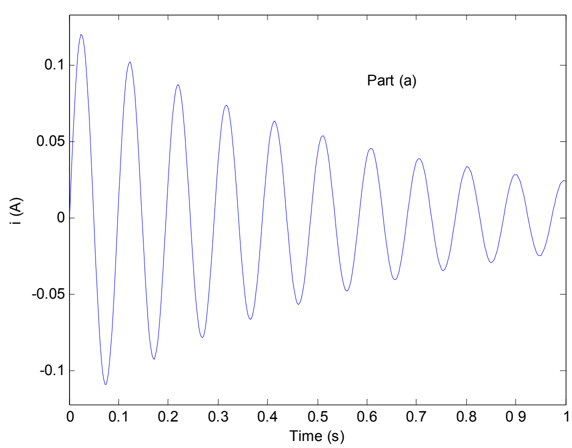
```
syms i t R C L
% Part a
i=dsolve('L*D2i+R*Di+1/C*i=10','i(0)=0','Di(0)=8')
isim=simple(i)
% Part b
iNb=subs(i,{L,R,C},{3,10,80E-6})
ezplot(iNb,[0,1])
xlabel('Time (s)')
ylabel('i (A)')
text(0.6,0.09,'Part (a)')
% Part c
iNc=subs(i,{L,R,C},{3,200,1200E-6})
figure
ezplot(iNc,[0,1])
xlabel('Time (s)')
ylabel('i (A)')
text(0.6,0.09,'Part (b)')
% Part d
iNd=subs(i,{L,R,C},{3,201,300E-6})
figure
ezplot(iNd,[0,3])
xlabel('Time (s)')
ylabel('i (A)')
text(0.6,0.09,'Part (c)')
axis([0 1 0 0.1])
```

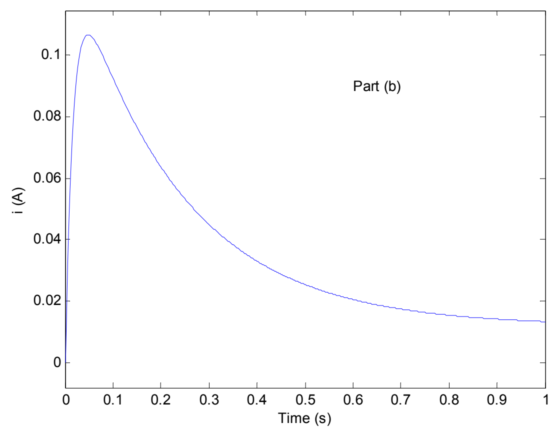
Command Window:

```
i =
10*C - (C*(8*L + 5*(C^2*R^2 - 4*C*L)^(1/2) - 5*C*R))/
(exp((t*((C^2*R^2 - 4*C*L)^(1/2) + C*R))/
(2*C*L))*(C^2*R^2 - 4*C*L)^(1/2)) - (C*exp((t*((C^2*R^2
- 4*C*L)^(1/2) - C*R))/(2*C*L))*(5*(C^2*R^2 -
4*C*L)^(1/2) - 8*L + 5*C*R))/(C^2*R^2 - 4*C*L)^(1/2)
isim =
```

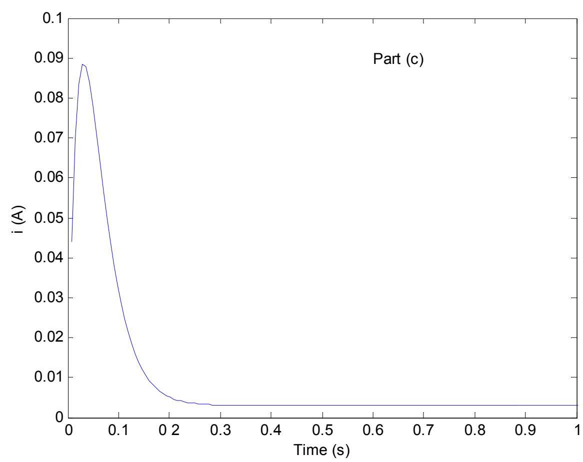
```
10*C - (C*(8*L + 5*(C^2*R^2 - 4*C*L)^(1/2) - 5*C*R))/
(exp((t*((C^2*R^2 - 4*C*L)^(1/2) + C*R))/
(2*C*L))*(C^2*R^2 - 4*C*L)^(1/2)) - (C*exp((t*((C^2*R^2
- 4*C*L)^(1/2) - C*R))/(2*C*L))*(5*(C^2*R^2 -
4*C*L)^(1/2) - 8*L + 5*C*R))/(C^2*R^2 - 4*C*L)^(1/2)
iNb =
(1499^(1/2)*(5999/250 + (1499^(1/2)*sqrt(-1))/
250)*sqrt(-1))/(14990*exp((6250*t*(1/1250 + (1499^(1/
2)*sqrt(-1))/1250))/3)) + 1/1250 + (1499^(1/
2)*exp((6250*t*(- 1/1250 + (1499^(1/2)*sqrt(-1))/
1250))/3)*(- 5999/250 + (1499^(1/2)*sqrt(-1))/
250)*sqrt(-1))/14990
iNc =
3/250 - (27^(1/2)*(27^(1/2)/5 + 114/5))/
(900*exp((1250*t*(27^(1/2)/25 + 6/25))/9)) - (27^(1/
2)*exp((1250*t*(27^(1/2)/25 - 6/25))/9)*(27^(1/2)/5 -
114/5))/900
iNd =
3/1000 - (3609^(1/2)*(3609^(1/2)/2000 + 47397/2000))/
(1203*exp((5000*t*(3609^(1/2)/10000 + 603/10000))/9))
- (3609^(1/2)*exp((5000*t*(3609^(1/2)/10000 - 603/
10000))/9)*(3609^(1/2)/2000 - 47397/2000))/1203
>>
```

Figures:





Part (b)
i (A)
0
0.02
0.04
0.06
0.08
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Time (s)



Part (c)
i (A)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0
0.1
0 2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Time (s)

Problem 31

Part a:

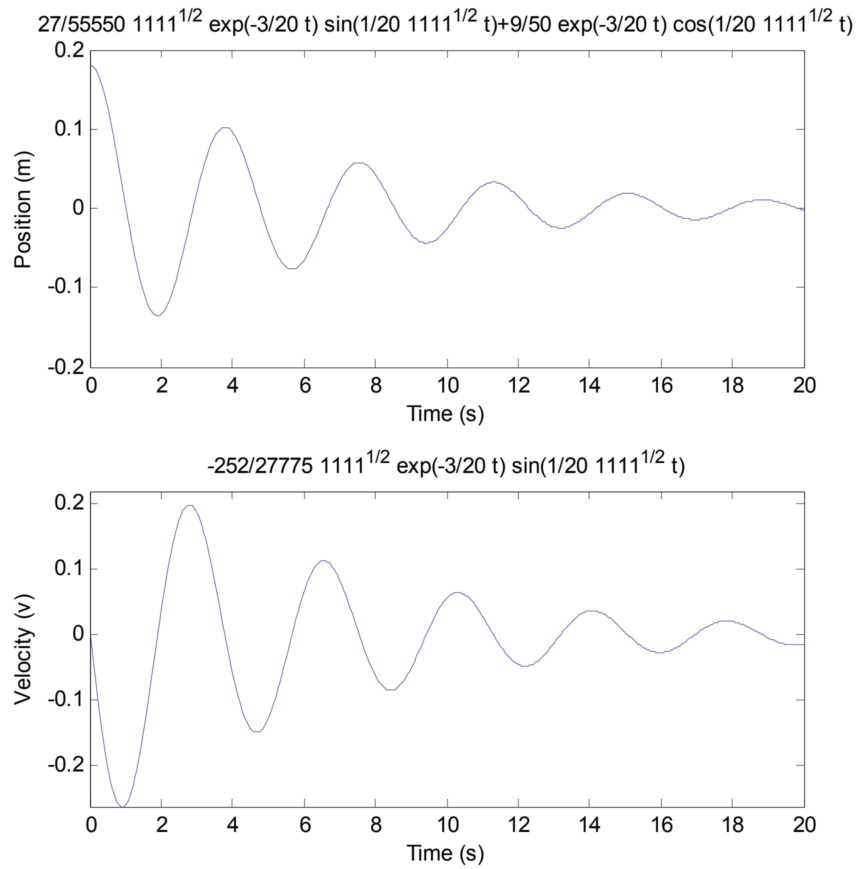
Script file:

```
clear all
syms x t
% Part a
disp('Part a:')
disp('Displacement x as a function of time:')
xs=dsolve('10*D2x+3*Dx+28*x=0','x(0)=0.18','Dx(0)=0')
%xs2=subs(xs,t,2)
subplot(2,1,1)
ezplot(xs,[0,20])
axis([0,20,-0.2,0.2])
xlabel('Time (s)')
ylabel('Position (m)')
disp('Velocity v as a function of time:')
v=diff(xs)
subplot(2,1,2)
ezplot(v,[0,20])
xlabel('Time (s)')
ylabel('Velocity (v)')
```

Command Window:

```
Part a:
Displacement x as a function of time:
xs =
27/55550*1111^(1/2)*exp(-3/20*t)*sin(1/20*1111^(1/2)*t)+9/
50*exp(-3/20*t)*cos(1/20*1111^(1/2)*t)
Velocity v as a function of time:
v =
-252/27775*1111^(1/2)*exp(-3/20*t)*sin(1/20*1111^(1/2)*t)
```

Figure:



Part b:

Script file:

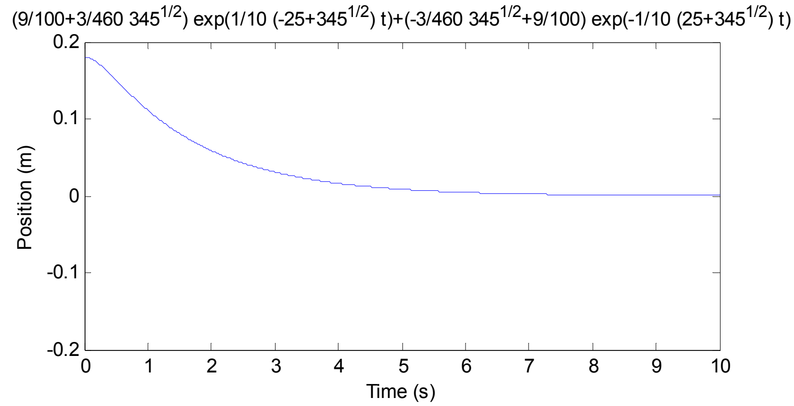
```
clear all
syms x t
disp('Part b:')
disp('Displacement x as a function of time:')
xs=sim-
ple(dsolve('10*D2x+50*Dx+28*x=0','x(0)=0.18','Dx(0)=0'))
%xs2=subs(xs,t,2)
subplot(2,1,1)
ezplot(xs,[0,10])
axis([0,10,-0.2,0.2])
xlabel('Time (s)')
```

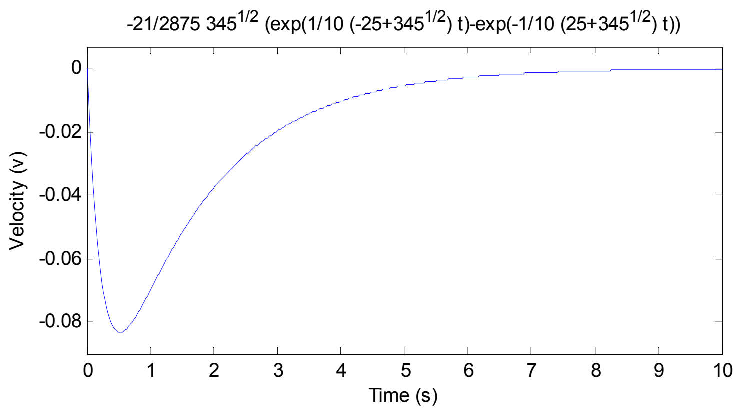
```
ylabel('Position (m)')
disp('Velocity v as a function of time:')
v=simple(diff(xs))
subplot(2,1,2)
ezplot(v,[0,10])
xlabel('Time (s)')
ylabel('Velocity (v)')
```

Command Window:

```
Part b:
Displacement x as a function of time:
xs =
(9/100+3/460*345^(1/2))*exp(1/10*(-25+345^(1/2))*t)+(-3/
460*345^(1/2)+9/100)*exp(-1/10*(25+345^(1/2))*t)
Velocity v as a function of time:
v =
-21/2875*345^(1/2)*(exp(1/10*(-25+345^(1/2))*t)-exp(-1/
10*(25+345^(1/2))*t))
```

Figure:


(9/100+3/460 345^1/2) exp(1/10 (-25+345^1/2) t)+(-3/460 345^1/2+9/100) exp(-1/10 (25+345^1/2) t)
Position (m)
Time (s)


-21/2875 345^1/2 (exp(1/10 (-25+345^1/2) t)-exp(-1/10 (25+345^1/2) t))
Velocity (v)
Time (s)