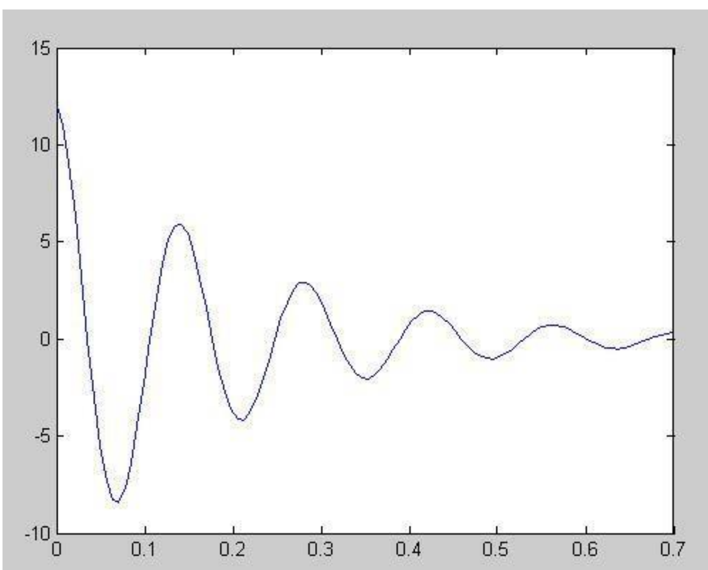
Solution Manual for Applied Numerical Methods with MATLAB for Engineers and Scientists 2nd Edition Steven Chapra 007313290X 9780073132907

CHAPTER 2

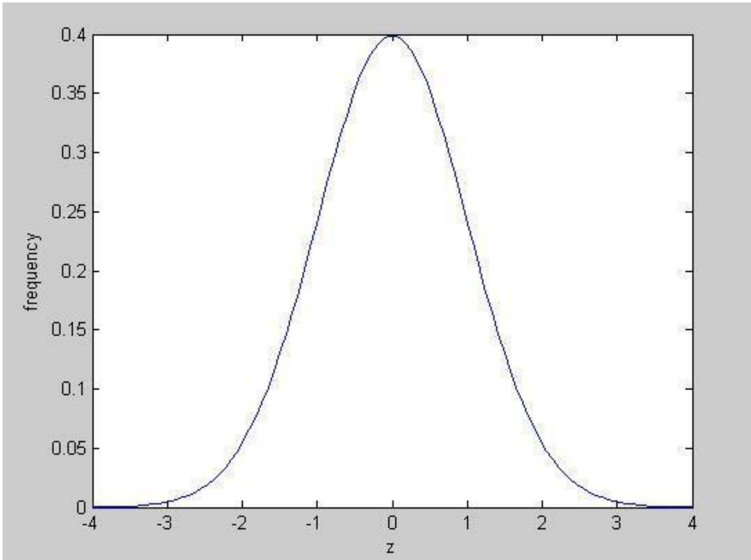
2.1

```
>> q0 = 12;R = 50;L = 5;C = 1e-4;
>> t = linspace(0,.7);
>> q = q0*exp(-R*t/(2*L)).*cos(sqrt(1/(L*C)-(R/(2*L))^2)*t);
>> plot(t,q)
```



2.2

```
>> z = linspace(-4,4);
>> f = 1/sqrt(2*pi)*exp(-z.^2/2);
>> plot(z,f)
>> xlabel('z')
>> ylabel('frequency')
```


0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
frequency
-4
-3
-2
-1
0
1
2
3
4
z

2.3 (a)

```
>> t =  linspace(5,29,5)
t =
     5    11    17    23    29
```

(*b*)

```
>> x = linspace(-3,4,8)
x =
    -3    -2    -1     0     1     2     3     4
```

2.4 (a)

```
>> v = -3:0.5:1

v =
   -3.0000 -2.5000 -2.0000 -1.5000 -1.0000 -0.5000      0   0.5000 1.0000
```

(b)

```
>> r = 8:-0.5:0

r =
  Columns 1 through 6
    8.0000    7.5000    7.0000    6.5000    6.0000    5.5000
  Columns 7 through 12
    5.0000    4.5000    4.0000    3.5000    3.0000    2.5000
  Columns 13 through 17
    2.0000    1.5000    1.0000    0.5000         0
```

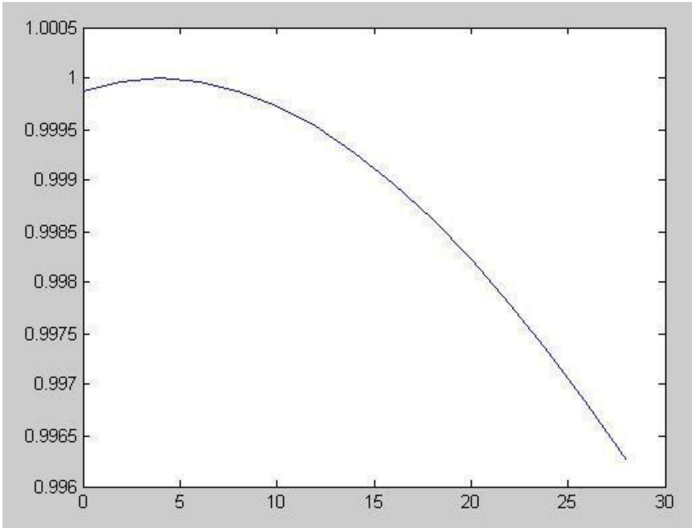
2.5

```
>> F = [11 12 15 9 12];
>> x = [0.013 0.020 0.009 0.010   0.012];
>> k = F./x
k =
  1.0e+003 *
    0.8462    0.6000    1.6667    0.9000    1.0000
>> U =
.5*k.*x.^2 U =
    0.0715    0.1200    0.0675    0.0450    0.0720
>>
max(U)
```

```
ans =
    0.1200
```

2.6

```
>> TF = 32:3.6:82.4;
>> TC = 5/9*(TF-32);
>> rho = 5.5289e-8*TC.^3-8.5016e-6*TC.^2+6.5622e-5*TC+0.99987;
>> plot(TC,rho)
```



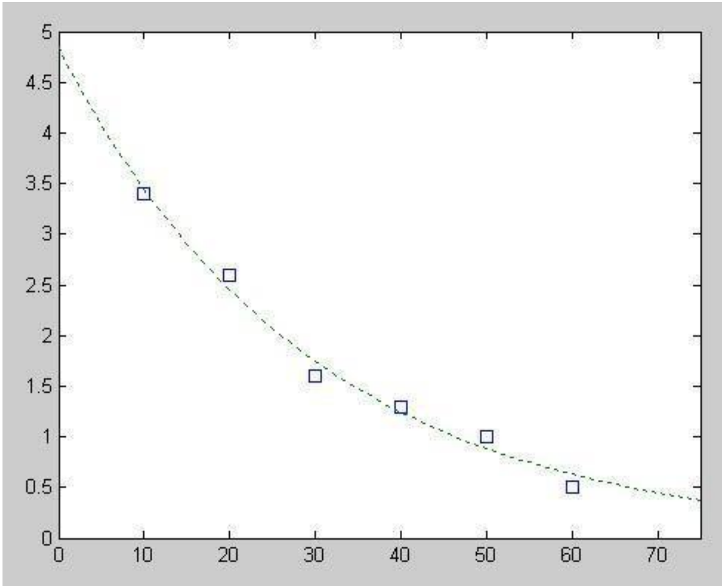
2.7

```
>> A = [.035 .0001 10 2;
0.02 0.0002 8 1;
0.015 0.001 19 1.5;
0.03 0.0008 24 3;
0.022 0.0003 15 2.5]
    0.0350    0.0001   10.0000    2.0000
    0.0200    0.0002    8.0000    1.0000
    0.0150    0.0010   19.0000    1.5000
    0.0300    0.0008   24.0000    3.0000
    0.0220    0.0003   15.0000    2.5000

>> U =sqrt(A(:,2))./A(:,1).*(A(:,3).*A(:,4)./(A(:,3)+2*A(:,4))).^(2/3) U =
    0.3624
    0.6094
    2.5053
    1.6900
    1.1971
```

2.8

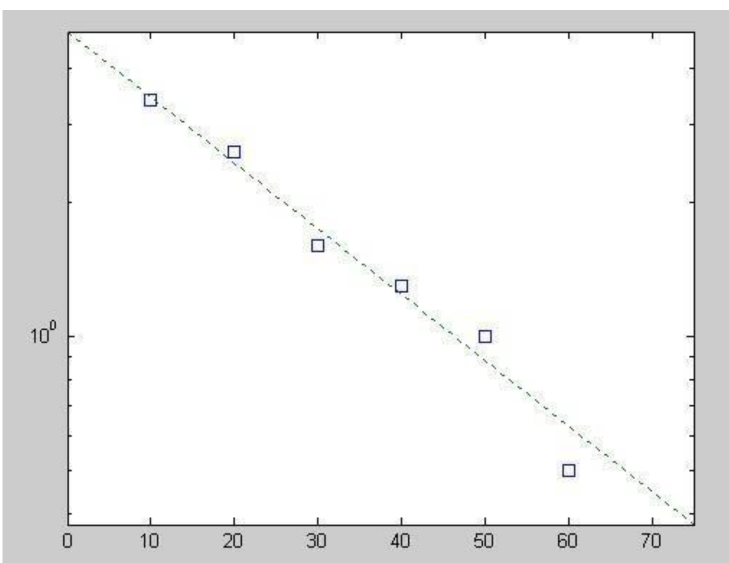
```
>> t = 10:10:60;
>> c = [3.4 2.6 1.6 1.3 1.0 0.5];
>> tf = 0:75;
>> cf = 4.84*exp(-0.034*tf);
>> plot(t,c,'s',tf,cf,':')
```

```
>> xlim([0 75])
```



2.9

```
>> t = 10:10:60;
>> c = [3.4 2.6 1.6 1.3 1.0 0.5];
>> tf = 0:70;
>> cf = 4.84*exp(-0.034*tf);
>> semilogy(t,c,'s',tf,cf,'--')
```



The result is a straight line. The reason for this outcome can be understood by taking the common logarithm of the function to give,

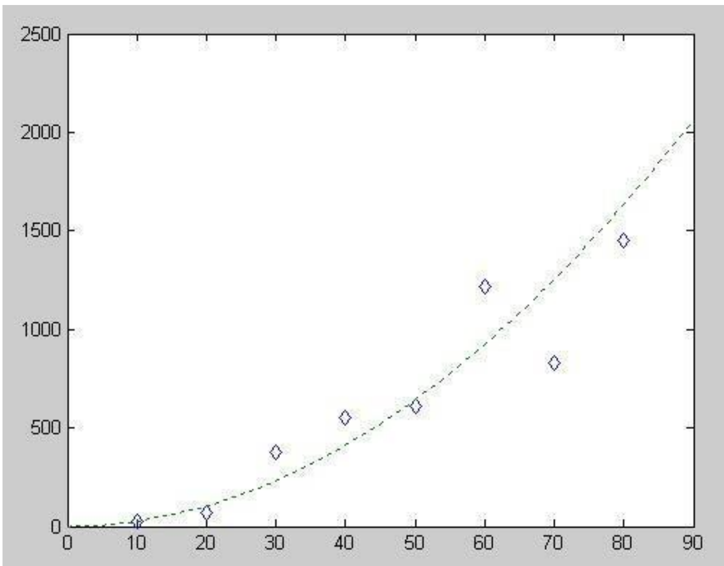
$$\log_{10} c = \log_{10} 4.84 - 0.034t \log_{10} e$$

Because $\log_{10}e = 0.4343$, this simplifies to the equation for a straight line,

$\log_{10} c$ □ 0.6848 □ 0.0148t

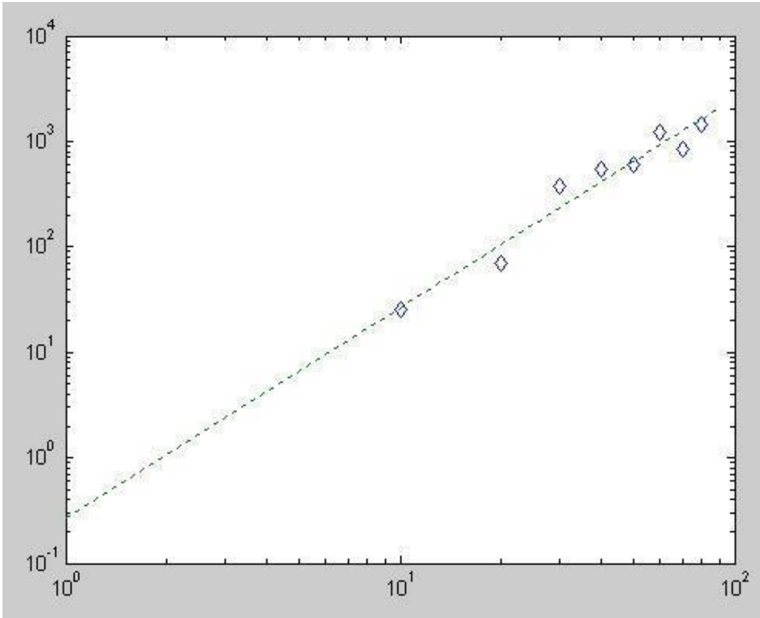
2.10

```
>> v = 10:10:80;
>> F = [25 70 380 550 610 1220 830 1450];
>> vf = 0:90;
>> Ff = 0.2741*vf.^1.9842;
>> plot(v,F,'d',vf,Ff,':')
```



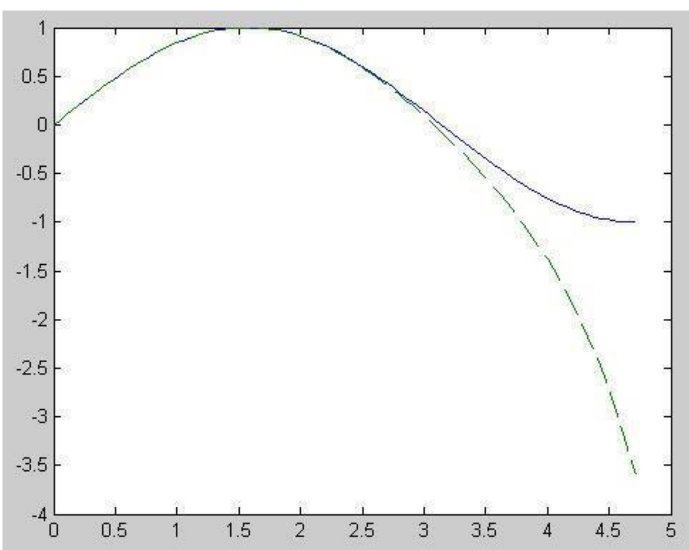
2.11

```
>> v = 10:10:80;
>> F = [25 70 380 550 610 1220 830 1450];
>> vf = 0:90;
>> Ff = 0.2741*vf.^1.9842;
>> loglog(v,F,'d',vf,Ff,':')
```



2.12

```
>> x = linspace(0,3*pi/2);
>> s = sin(x);
>> sf = x-x.^3/factorial(3)+x.^5/factorial(5)-x.^7/factorial(7);
>> plot(x,s,x,sf,'--')
```



2.13 (a)

```
>> m=[83.6 60.2 72.1 91.1 92.9 65.3 80.9];
```

```
>> vt=[53.4 48.5 50.9 55.7 54 47.7 51.1];
>> g=9.81; rho=1.225;
>> A=[0.454 0.401 0.453 0.485 0.532 0.474 0.486];
>> cd=g*m./vt.^2;
>> CD=2*cd/rho./A
```

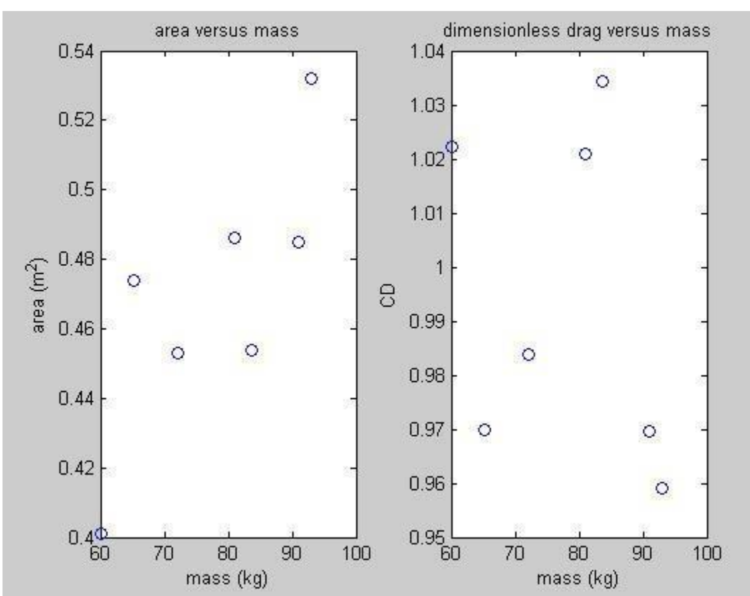
```
CD =
    1.0343    1.0222    0.9839    0.9697    0.9591    0.9698    1.0210
```

(b)

```
>> CDavg=mean(CD),CDmin=min(CD),CDmax=max(CD)

CDavg =
    0.9943

CDmin =
    0.9591

CDmax =
    1.0343
```

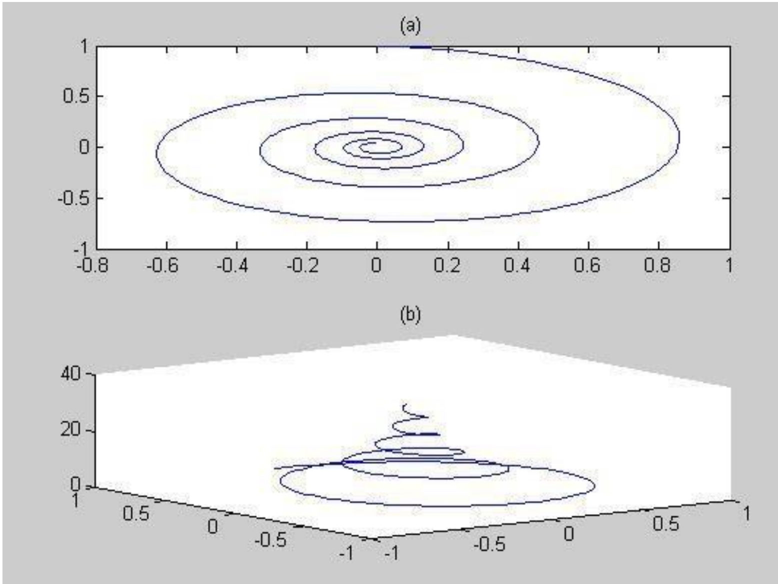
(b)

```
>> subplot(1,2,1);plot(m,A,'o')
>> xlabel('mass (kg)');ylabel('area (m^2)')
>> title('area versus mass')
>> subplot(1,2,2);plot(m,CD,'o')
>> xlabel('mass (kg)');ylabel('CD')
>> title('dimensionless drag versus mass')
```



2.14 (a)

```
t = 0:pi/50:10*pi;
subplot(2,1,1);plot(exp(-0.1*t).*sin(t),exp(-0.1*t).*cos(t)) title('(a)')
subplot(2,1,2);plot3(exp(-0.1*t).*sin(t),exp(-0.1*t).*cos(t),t); title('(b)')
```



2.15 (a)

```
>> x = 2;
>> x ^ 3;
>> y = 8 - x

y =
       6
```

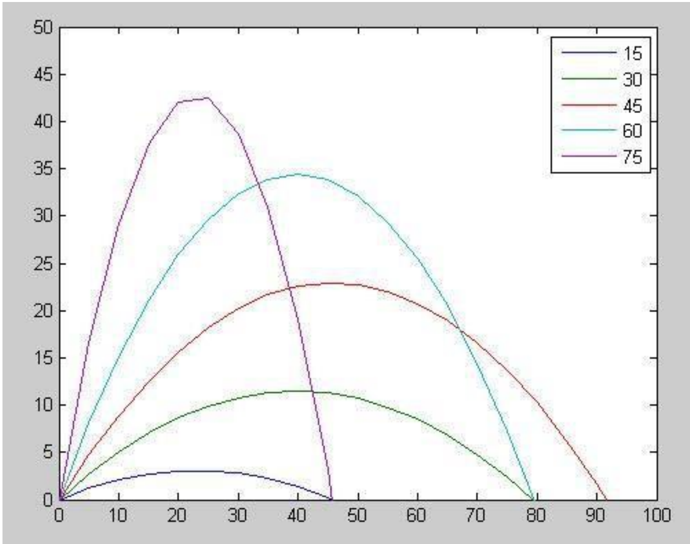
(b)

```
>> q = 4:2:10;
>> r = [7 8 4; 3 6 -2];
>> sum(q) * r(2, 3)

ans =
   -56
```

2.16

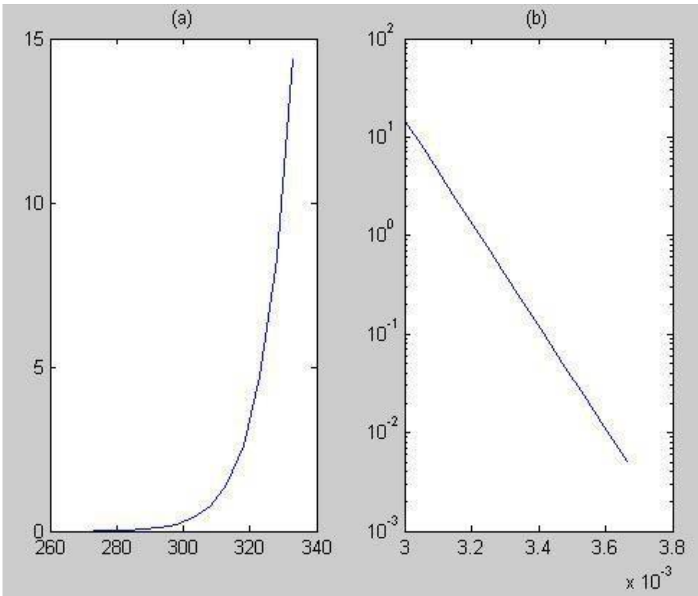
```
>> y0=0;v0=30;g=9.81;
>> x=0:5:100;
>> theta0=15*pi/180;
>> y1=tan(theta0)*x-g/(2*v0^2*cos(theta0)^2)*x.^2+y0;
>> theta0=30*pi/180;
>> y2=tan(theta0)*x-g/(2*v0^2*cos(theta0)^2)*x.^2+y0;
>> theta0=45*pi/180;
>> y3=tan(theta0)*x-g/(2*v0^2*cos(theta0)^2)*x.^2+y0;
```

```
>> theta0=60*pi/180;
>> y4=tan(theta0)*x-g/(2*v0^2*cos(theta0)^2)*x.^2+y0;
>> theta0=75*pi/180;
>> y5=tan(theta0)*x-g/(2*v0^2*cos(theta0)^2)*x.^2+y0;
>> y=[y1' y2' y3' y4' y5']
>> plot(x,y)
>> axis([0 100 0 50])
>> legend('15','30','45','60','75')
```



2.17

```
>> R=8.314;E=1e5;A=7E16;
>> Ta=273:5:333;
>> k=A*exp(-E./(R*Ta))

k =
  Columns 1 through 10
    0.0051    0.0113    0.0244    0.0510    0.1040    0.2070    0.4030
0.7677    1.4326    2.6213
  Columns 11 through 13
    4.7076    8.3048   14.4030

>> subplot(1,2,1);plot(Ta,k)
>> subplot(1,2,2);semilogy(1./Ta,k)
```


(a)
(b)
15
10
5
0
260
280
300
320
340
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
3
3.2
3.4
3.6
3.8
x 10^{-3}

The result in (b) is a straight line. The reason for this outcome can be understood by taking the common logarithm of the function to give,

$$\log_{10} k = \log_{10} A - \left(\frac{E}{R}\log_{10} e\right)\frac{1}{T_a}$$

Thus, a plot of $\log_{10}k$ versus $1/T_a$ is linear with a slope of $-(E/R)\log_{10}e = -5.2237\times10^3$ and an intercept of $\log_{10}A = 16.8451$.