

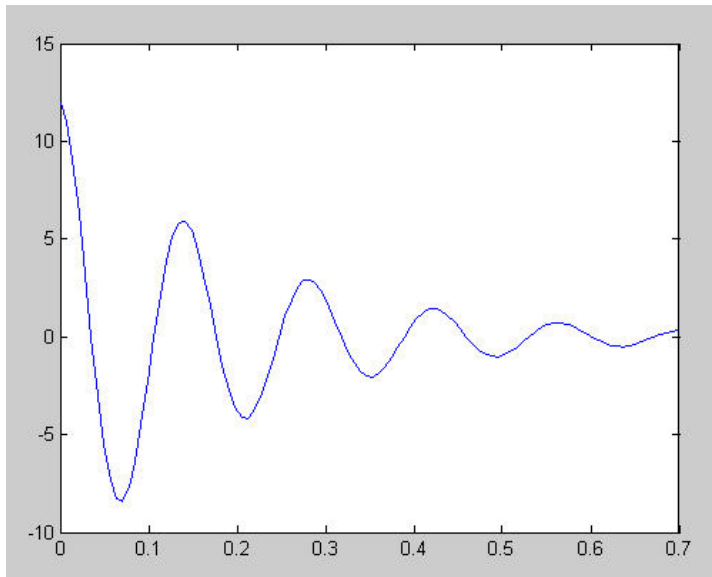
***Applied Numerical Methods with MATLAB for
Engineers and Scientists 2nd edition Steven Chapra
Solutions Manual***

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CHAPTER 2

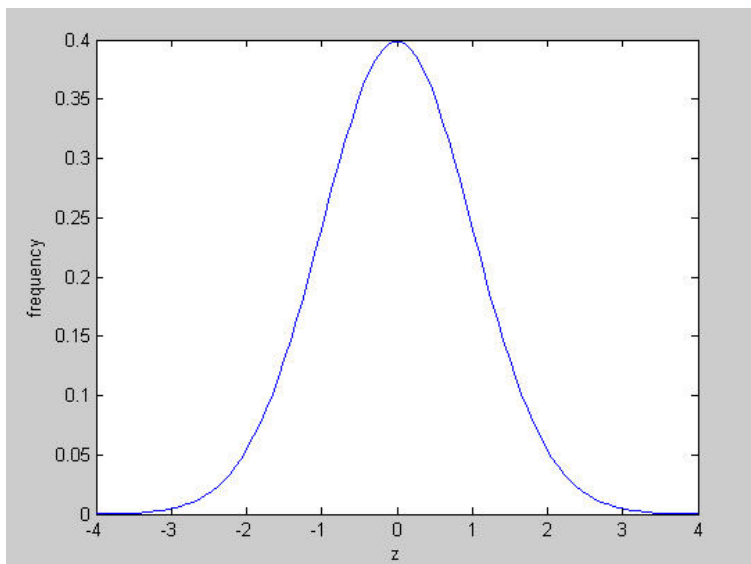
2.1

```
>> 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')
```



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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
```

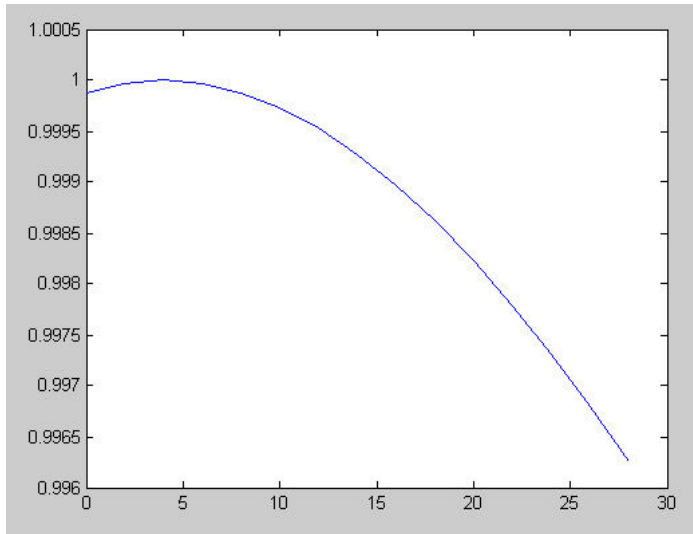
```
U =
     0.0715     0.1200     0.0675     0.0450     0.0720
```

```
>> 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]
```

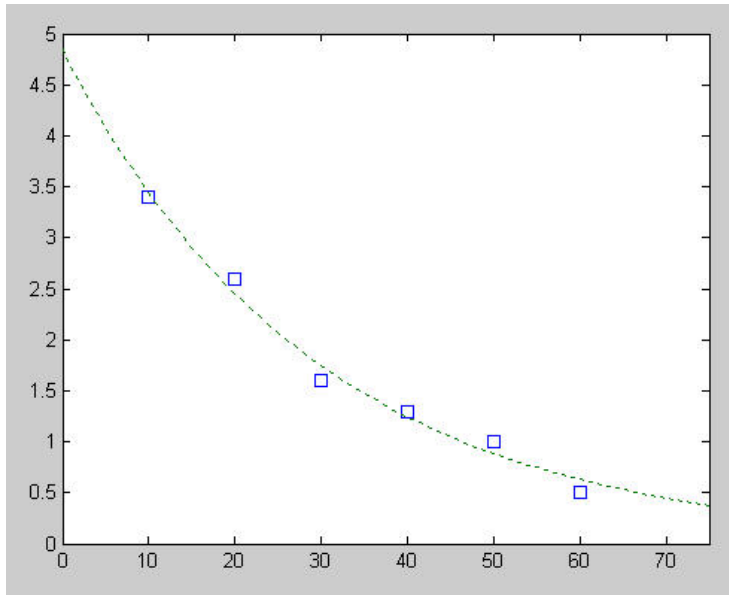
```
A =
    0.0350    0.0001   10.0000    2.0000
    0.0200    0.0002    8.0000    1.0000
    0.0150    0.0010   19.0000    1.5000
    0.0300    0.0008   24.0000    3.0000
    0.0220    0.0003   15.0000    2.5000
```

```
>> 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
```

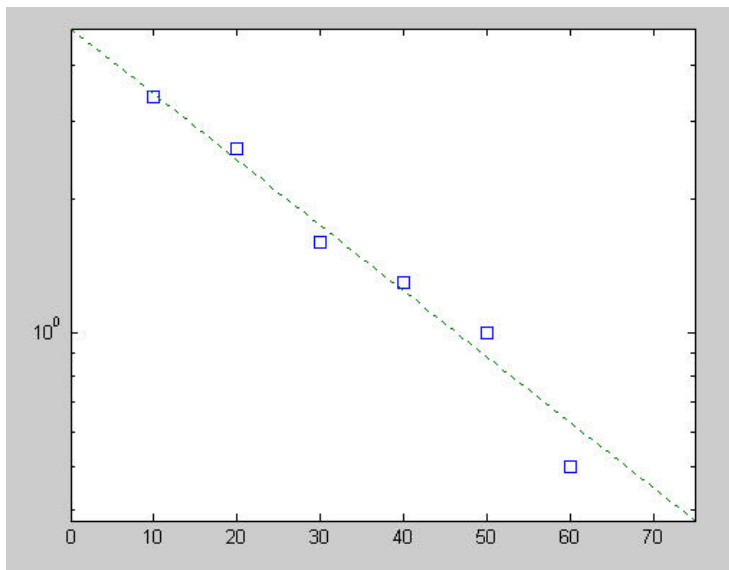
2.8

```
>> 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,

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

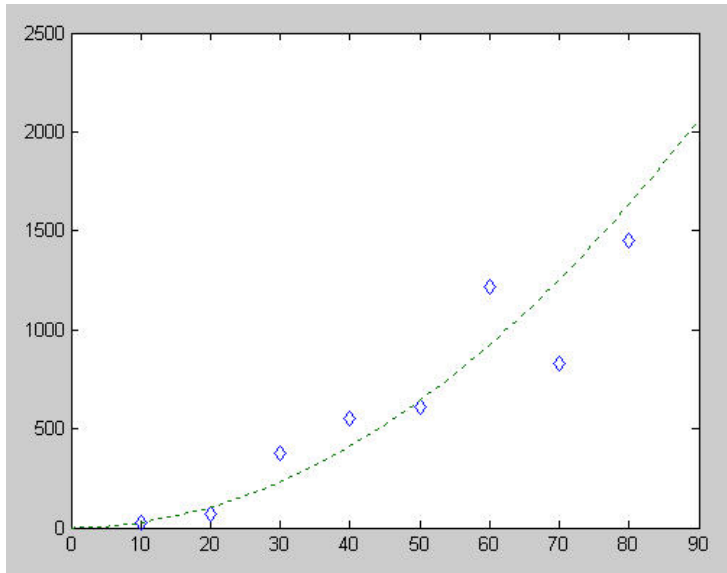
Because $\log_{10} e = 0.4343$, this simplifies to the equation for a straight line,

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$$\log_{10} c = 0.6848 - 0.0148t$$

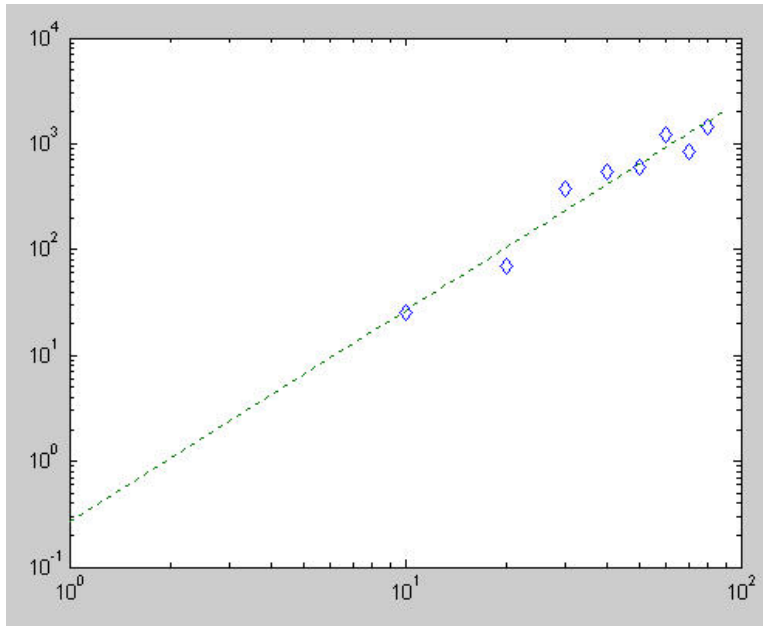
2.10

```
>> 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,':')
```



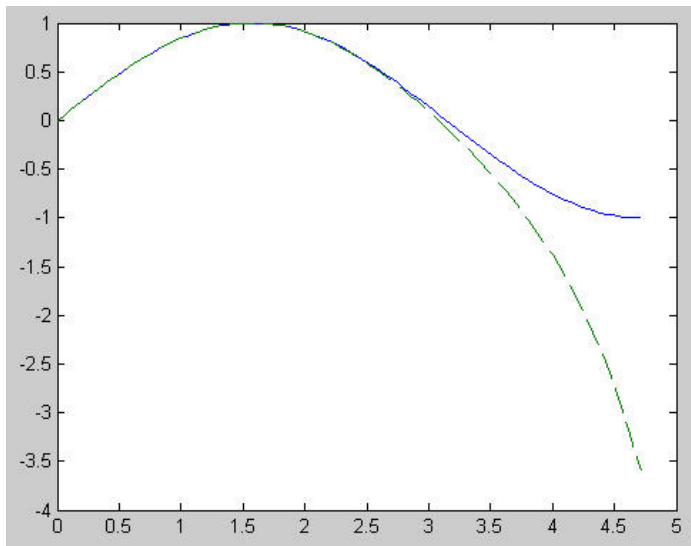
2.11

```
>> 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
```

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```
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)
```

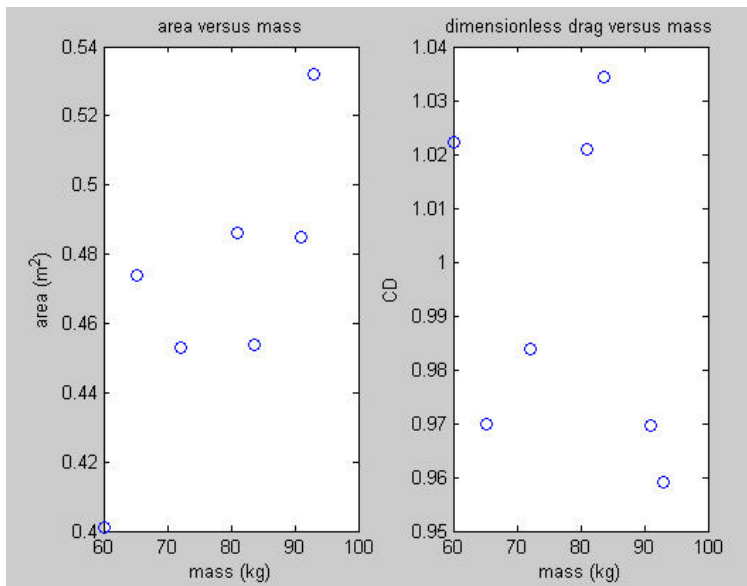
```
CDavg =
    0.9943
```

```
CDmin =
    0.9591
```

```
CDmax =
    1.0343
```

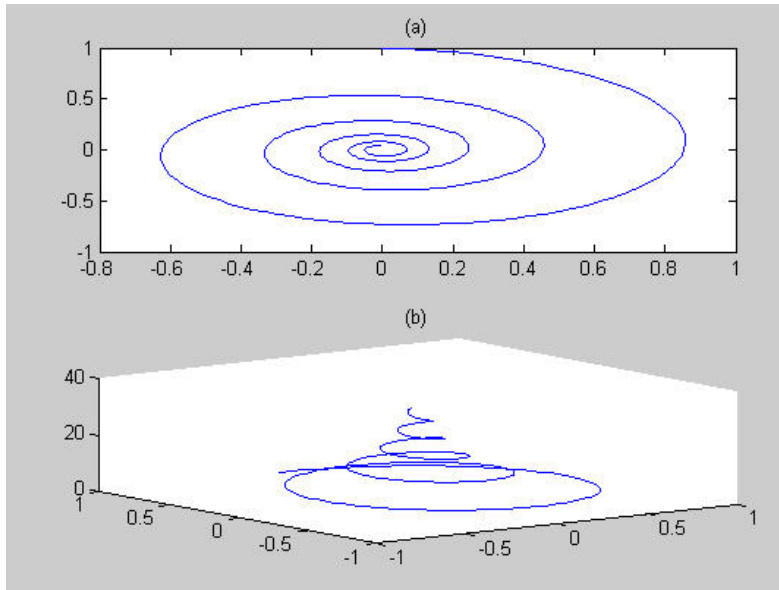
(b)

```
>> 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
```

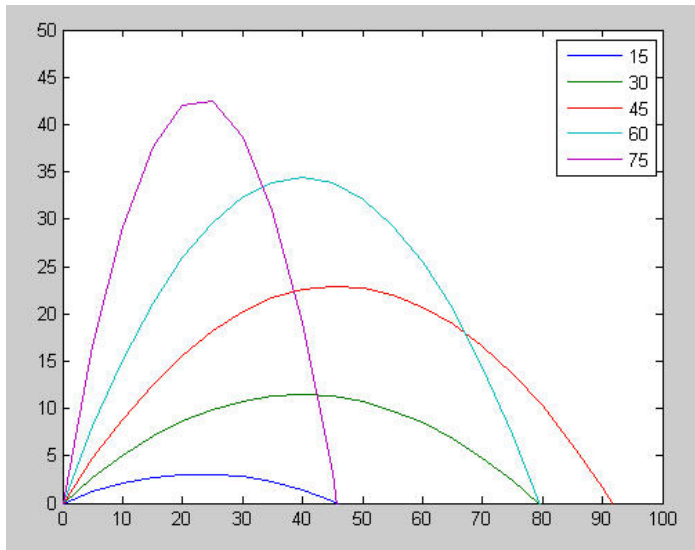
(b)

```
>> 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')
```

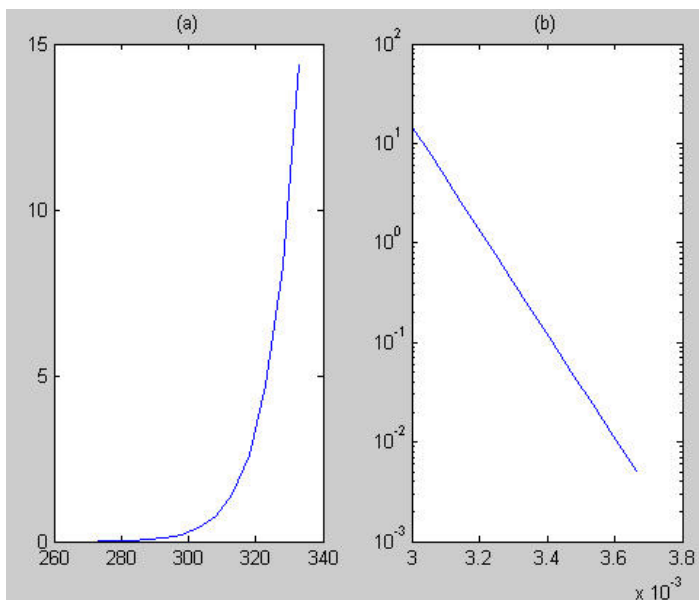


2.17

```
>> 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)
```



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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 $-(E/R)\log_{10} e = -5.2237 \times 10^3$ and an intercept of $\log_{10} A = 16.8451$.