```
%Name: Martins Davis Bernhards
%Student number: 552135
%Assignments week 2
```

```
%Assignment 1
```

```
x = [1:0.2:5]
```

```
x = 1×21
    1.0000    1.2000    1.4000    1.6000    1.8000    2.0000    2.2000    2.4000 ⋯
```

```
x(19) % 19th element: 4.6
```

```
ans =
4.6000
```

```
length(x) % length of x: 21
```

```
ans =
21
```

```
%Assignment 2
```

```
x = linspace(35,47,100)
```

```
x = 1×100
   35.0000   35.1212   35.2424   35.3636   35.4848   35.6061   35.7273   35.8485 ⋯
```

```
x(19) % 19th element: 37.1818
```

```
ans =
37.1818
```

```
x(22) % 22nd element: 37.5455
```

```
ans =
37.5455
```

```
%Assignment 3
```

```
z1 = 3 + 4j
```

```
z1 =
3.0000 + 4.0000i
```

```
z2 = -1 + j
```

```
z2 =
-1.0000 + 1.0000i
```

```
% modulus
abs(z1) % 5
```

```
ans =
5
```

```
abs(z2) % 1.4142
```

```
ans =
1.4142
```

```
% argument
angle(z1) % 0.9273
```

```
ans =
0.9273
```

```
angle(z2) % 2.3562
```

```
ans =
2.3562
```

```
z1 * z2 % -7 - j
```

```
ans =
-7.0000 - 1.0000i
```

```
z1 / z2 % 0.5 - 3.5j
```

```
ans =
0.5000 - 3.5000i
```

```
ztemp = 1 / z1 + 1/ z2
```

```
ztemp =
-0.3800 - 0.6600i
```

```
z3 = 1 / ztemp % -0.6552 + 1.1379j
```

```
z3 =
-0.6552 + 1.1379i
```

```
abs(z3) % mod: 1.3131
```

```
ans =
1.3131
```

```
angle(z3) % arg: 2.0932
```

```
ans =
```

```
2.0932
```

```

```

```
%Assignment 4
```

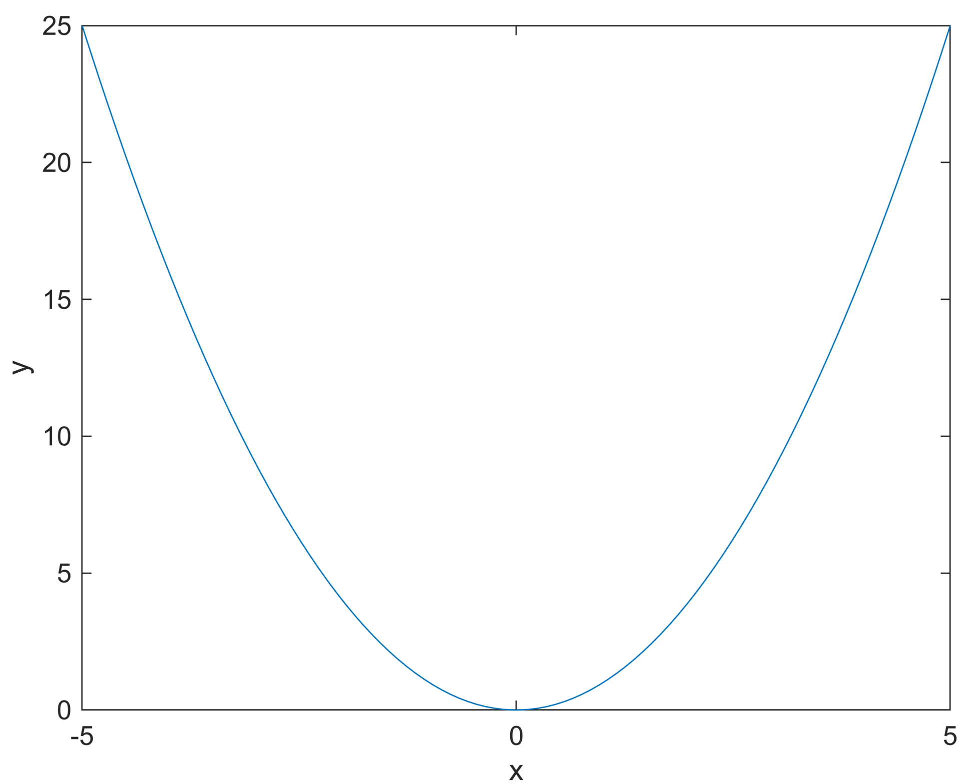
```
x = linspace(-5,5,100)
```

```
x = 1×100
   -5.0000   -4.8990   -4.7980   -4.6970   -4.5960   -4.4949   -4.3939   -4.2929 ···
```

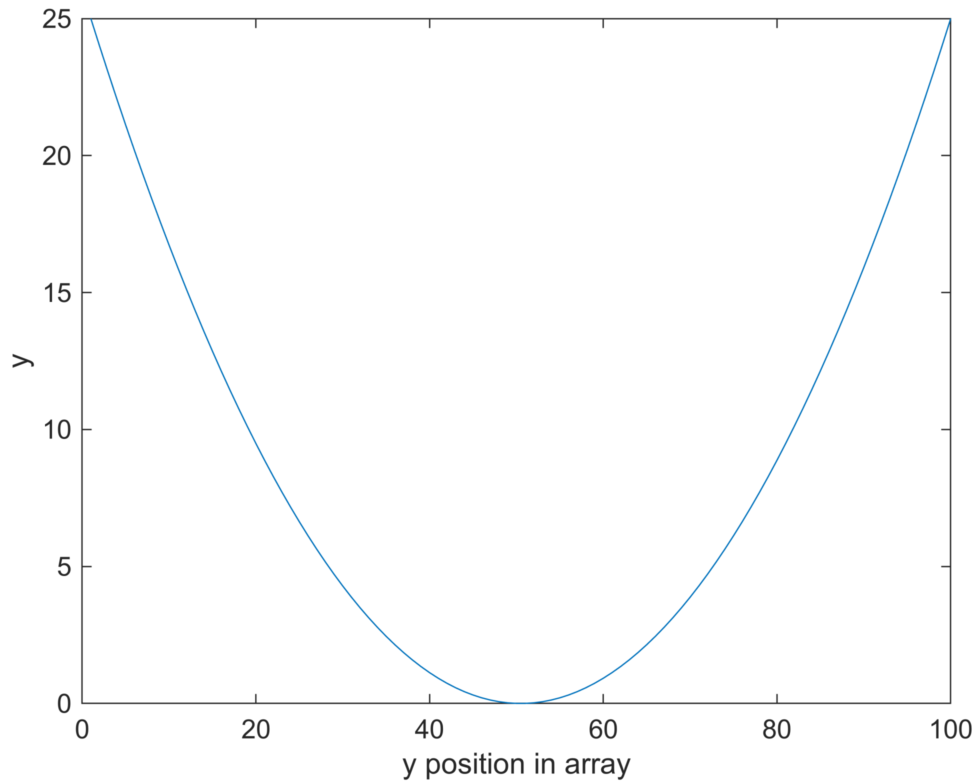
```
y = x.^2
```

```
y = 1×100
   25.0000   24.0001   23.0206   22.0615   21.1228   20.2046   19.3067   18.4292 ···
```

```
plot(x,y)
xlabel('x')
ylabel('y')
```




```
plot(y)
ylabel('y')
xlabel('y position in array')
```




```
% The difference is that first plot uses variable x for x axis
% The second one uses y array position for x axis
```

```
%Assignment 5
```

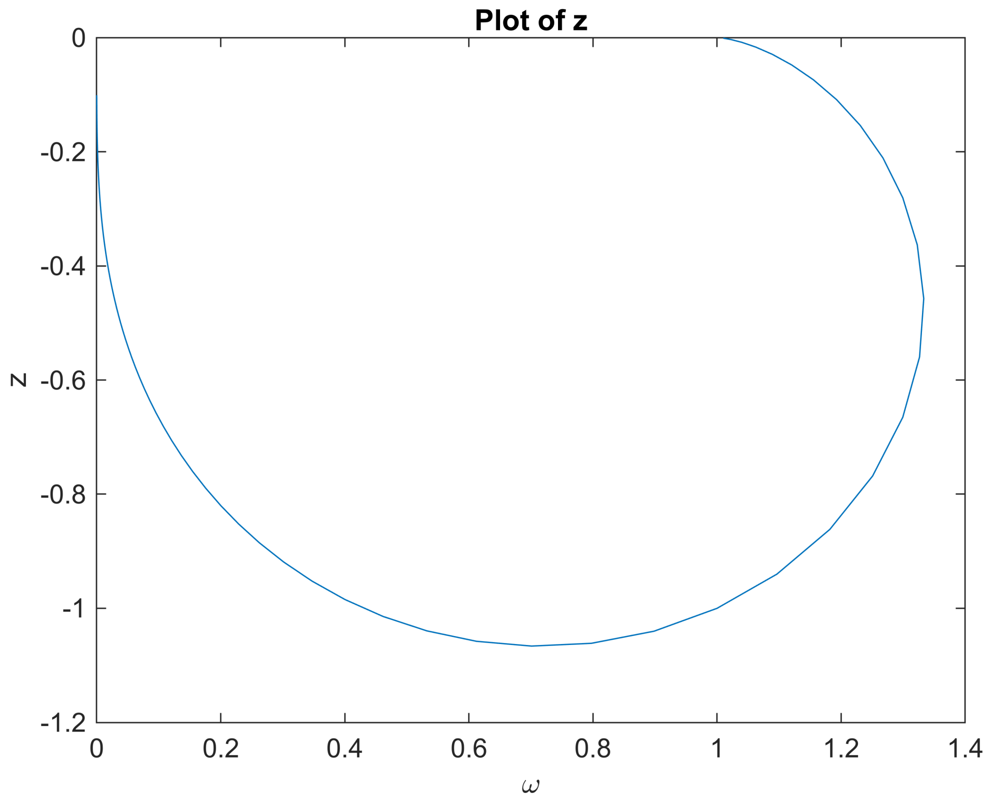
```
omega = 0.1:0.05:10
```

```
omega = 1×199
    0.1000    0.1500    0.2000    0.2500    0.3000    0.3500    0.4000    0.4500 ⋯
```

```
z = (1 + 1j*omega) ./ (1 + 1j*omega - omega.^2)
```

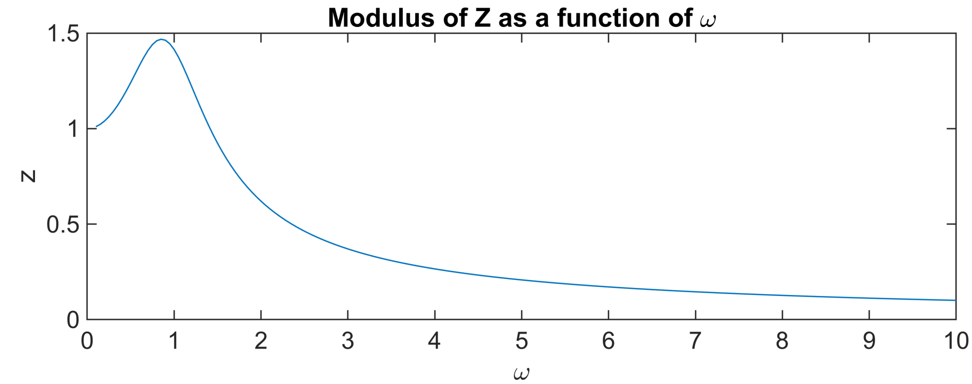
```
z = 1×199 complex
   1.0100 - 0.0010i   1.0225 - 0.0035i   1.0399 - 0.0083i   1.0622 - 0.0166i ⋯
```

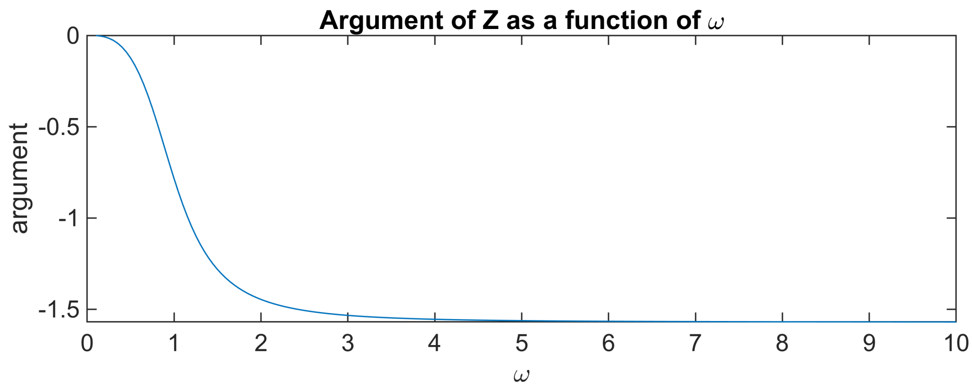
```
plot(z)
title('Plot of z')
xlabel('\omega')
ylabel('z')
```




```
figure
subplot(2,1,1)
plot(omega, abs(z))
title('Modulus of Z as a function of \omega')
xlabel('\omega')
ylabel('z')

subplot(2,1,2)
plot(omega, angle(z))
title('Argument of Z as a function of \omega')
xlabel('\omega')
ylabel('argument')
```






```
%Assignment 6
```

```
f = logspace(1, 5, 1000)
```

```
f = 1×1000
10^5 ×
    0.0001    0.0001    0.0001    0.0001    0.0001    0.0001    0.0001    0.0001 ···
```

```
R = 10
```

```
R =
10
```

```
L = R ./ (2000*pi)
```

```
L =
0.0016
```

```
C = 1 ./ (2000*pi*R)
```

```
C =
1.5915e-05
```

```
omega = 2*pi*f
```

```
omega = 1×1000
```

```
10^5 ×
    0.0006    0.0006    0.0006    0.0006    0.0007    0.0007    0.0007    0.0007 ···
```

```
z1 = 1 ./ (j*omega*C)
```

```
z1 = 1×1000 complex
10^3 ×
   0.0000 - 1.0000i   0.0000 - 0.9908i   0.0000 - 0.9817i   0.0000 - 0.9727i ···
```

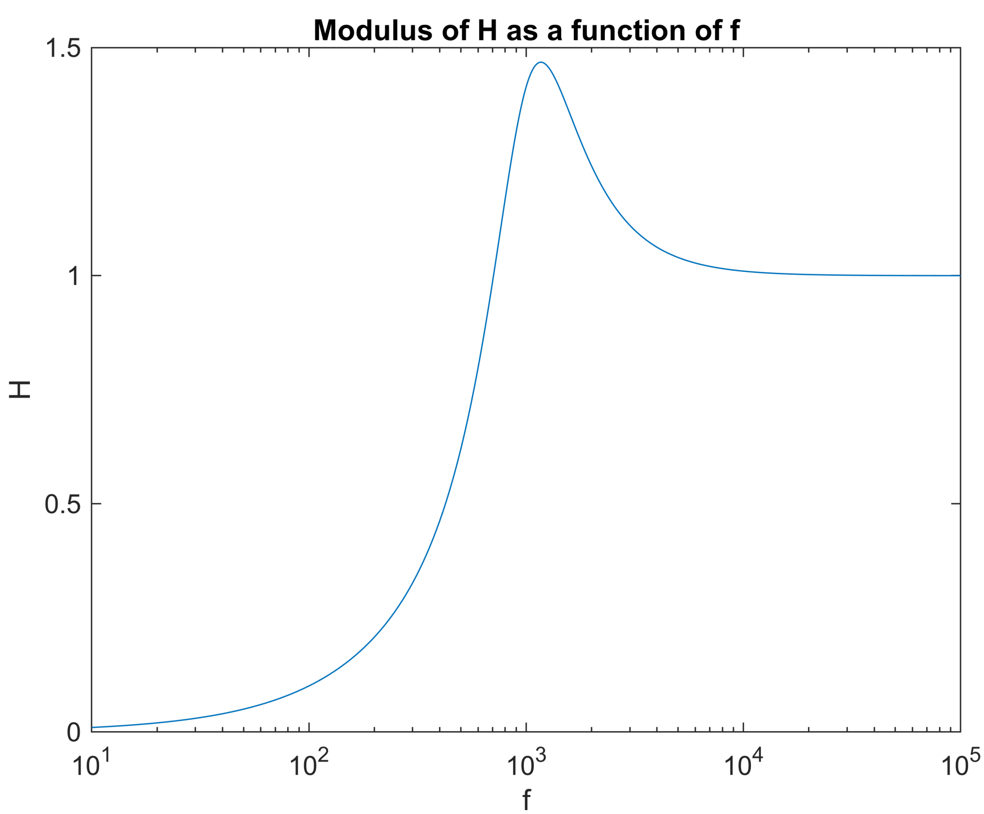
```
z2 = R + (j*omega*L)
```

```
z2 = 1×1000 complex
10^3 ×
   0.0100 + 0.0001i   0.0100 + 0.0001i   0.0100 + 0.0001i   0.0100 + 0.0001i ···
```

```
H = z2 ./ (z1 + z2)
```

```
H = 1×1000 complex
   0.0000 + 0.0100i   0.0000 + 0.0101i   0.0000 + 0.0102i   0.0000 + 0.0103i ···
```

```
figure
semilogx(f, abs(H))
title('Modulus of H as a function of f')
xlabel('f')
ylabel('H')
```



```
%Assignment 7
```

```
omega = 5
```

```
omega =
5
```

```
t = linspace(0, 2*pi, 1000);

f = 3 * cos(omega * t + pi/4)
```

```
f = 1×1000
    2.1213    2.0536    1.9838    1.9121    1.8384    1.7630    1.6858    1.6069 ···
```

```
g = 2 * cos(omega * t - pi/6 * 5)
```

```
g = 1×1000
   -1.7321   -1.6998   -1.6658   -1.6301   -1.5929   -1.5541   -1.5137   -1.4719 ···
```

```
k = f - g
```

```
k = 1×1000
    3.8534    3.7533    3.6496    3.5422    3.4313    3.3171    3.1995    3.0788 ···
```

```
fExp = 3*exp(pi/4*j)
```

```
fExp =
2.1213 + 2.1213i
```

```
gExp = 2*exp(-pi/6*5j)
```

```
gExp =
-1.7321 - 1.0000i
```

```
c =  fExp - gExp
```

```
c =
3.8534 + 3.1213i
```

```
r = abs(c)
```

```
r =
4.9589
```

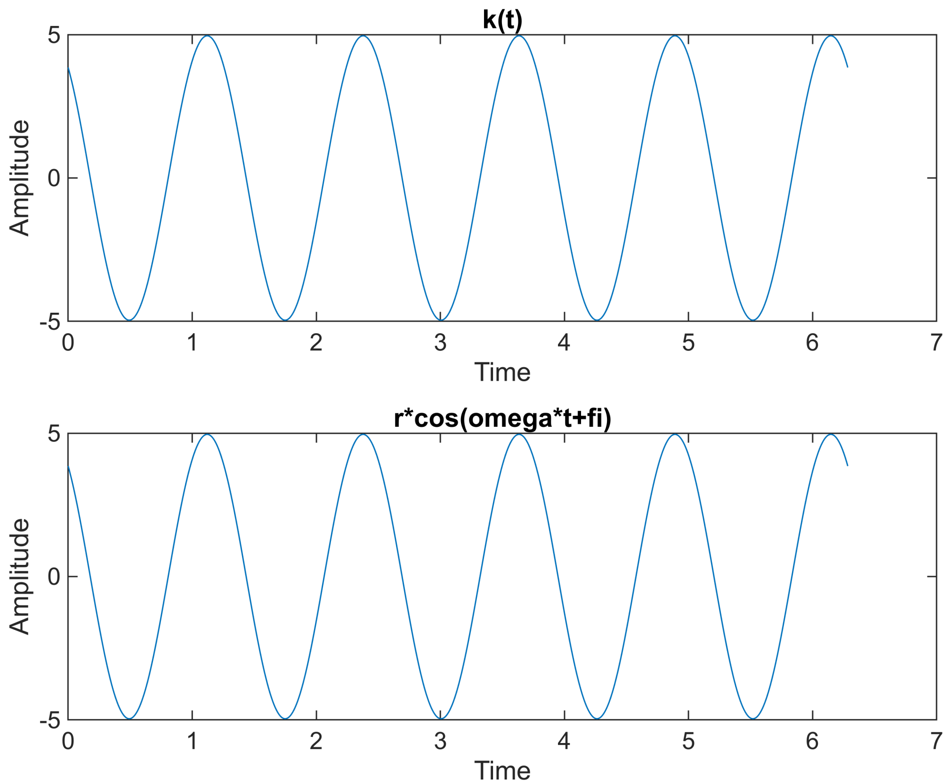
```
fi = angle (c)
```

```
fi =
0.6808
```

```
figure
subplot(2, 1, 1)
plot(t, k)
title('k(t)')
```

```
xlabel('Time')
ylabel('Amplitude')

subplot(2, 1, 2)
plot(t, r*cos(omega*t+fi))
title('r*cos(omega*t+fi)')
xlabel('Time')
ylabel('Amplitude')
```




```
%Assignment 8
```

```
A = [2, 1, 4]
```

```
A = 1×3
     2     1     4
```

```
B = [1, -2, 3]
```

```
B = 1×3
     1    -2     3
```

```
C = [4, 5, 2]
```

```
C = 1×3
     4     5     2
```

```
a = A
```

```
a = 1×3
     2     1     4
```

```
b = B
```

```
b = 1×3
     1    -2     3
```

```
c = C
```

```
c = 1×3
     4     5     2
```

```

d = a + b -3*c
```

```
d = 1×3
    -9   -16     1
```

```

AB = B-A
```

```
AB = 1×3
    -1    -3    -1
```

```
AC = C-A
```

```
AC = 1×3
     2     4    -2
```

```
BC = C-B
```

```
BC = 1×3
     3     7    -1
```

```

M = (A + B) / 2;
CM = M - C;

innerProduct = dot(AB, AC)
```

```
innerProduct =
-12
```

```
%Assignment 9
```

```
A = [2, 1, 4]
```

```
A = 1×3
     2     1     4
```

```
B = [1, -2, 3]
```

```
B = 1×3
```

```
     1    -2     3
```

```
C = [4, 5, 2]
```

```
C = 1×3
     4     5     2
```

```
AB = B - A;
AC = C - A;

cross_product = cross(AB, AC);

normalized = norm(cross_product);

area = 0.5 * normalized;
```

```
%Assignment 10
```

```
A = [1 -6 5; -2 0 2]
```

```
A = 2×3
     1    -6     5
    -2     0     2
```

```
B = [3 -1; 4 1]
```

```
B = 2×2
     3    -1
     4     1
```

```
%AB = A*B
% this is not possible because a matrix has 3 columns but b matrix only 2
% rows

BA = B*A
```

```
BA = 2×3
     5   -18    13
     2   -24    22
```

```
AtB = A'*B
```

```
AtB = 3×2
    -5    -3
   -18     6
    23    -3
```

```
size(A)
```

```
ans = 1×2
     2     3
```

```
size(B)
```

```
ans = 1×2
     2     2
```

```
size(BA)
```

```
ans = 1×2
     2     3
```

```
size(AtB)
```

```
ans = 1×2
     3     2
```

```
%Assignment 11
```

```
A = [5 4; 3 6]
```

```
A = 2×2
     5     4
     3     6
```

```
b = [4 16]
```

```
b = 1×2
     4    16
```

```
x = A/b
```

```
x = 2×1
    0.3088
    0.3971
```

```
%Assignment 12
```

```
A = [5 4 -2 6; -1 3 -1 6; 6 -2 12 16; 0 42 2 -4]
```

```
A = 4×4
     5     4    -2     6
    -1     3    -1     6
     6    -2    12    16
     0    42     2    -4
```

```
b = [4 13 20 6]
```

```
b = 1×4
     4    13    20     6
```

```
x = A/b
```

```
x = 4×1
```

```
0.1095
0.0821
0.5378
0.9050
```

```
%Assignment 13a
```

```
%V3+R4*I3-R5*I4-V2+R1*I3-R1*I1 = 0
%-V1+R1*I1-R1*I3+R2*I1-R2*I2 = 0
%V2+R3*I2-R3*I4+R2*I2-R2*I1 = 0
%R5*I4-R5*I3+R6*I4+R3*I4-R3*I2 = 0

%-R1*I1 + 0 + I3(R4+R1) - R5*I4 = V2 - V3
%I1(R1+R2) - R2*I2 - R1*I3 + 0 = V1
%- R2*I1 + I2(R2+R3) + 0 - R3*I4 = -V2
%- R3*I2 - R5*I3 + I4(R5+R6+R3) = 0

A = [-R1*I1 0 I3(R4+R1) -R5*I4
     I1(R1+R2) -R2*I2 -R1*I3 0
     -R2*I1 I2(R2+R3) 0 -R3*I4
     0 -R3*I2 -R5*I3 I4(R5+R6+R3)]

b = [V2-V3; V1; -V2; 0]

x = A/b
```

```
%Assignment 13b
```

```
V1=20, V2=12, V3=40, R1=18, R2=10, R3=16, R4=6, R5=15, R6=8
```

```
V1 =
20
V2 =
12
V3 =
40
R1 =
18
R2 =
10
R3 =
16
R4 =
6
R5 =
15
R6 =
8
```

```
A = [-R1 0 (R4+R1) -R5
     (R1+R2) -R2 -R1 0
```

```
    -R2 (R2+R3) 0 -R3
    0 -R3 -R5 (R5+R6+R3)]
```

```
A = 4×4
   -18     0    24   -15
    28   -10   -18     0
   -10    26     0   -16
     0   -16   -15    39
```

```
b = [V2-V3 V1 -V2 0]
```

```
b = 1×4
   -28    20   -12     0
```

```
x = A/b
```

```
x = 4×1
    0.1627
   -0.5783
    0.6024
   -0.1054
```

```
% 4 found values:
%  0.1627
% -0.5783
%  0.6024
% -0.1054
```

```
%Assignment 14
```

```
x = linspace(0, 6, 100)
```

```
x = 1×100
         0    0.0606    0.1212    0.1818    0.2424    0.3030    0.3636    0.4242 ···
```

```
y = sin(x)
```

```
y = 1×100
         0    0.0606    0.1209    0.1808    0.2401    0.2984    0.3557    0.4116 ···
```

```
dx = diff(x)
```

```
dx = 1×99
    0.0606    0.0606    0.0606    0.0606    0.0606    0.0606    0.0606    0.0606 ···
```

```
dy = diff(y)
```

```
dy = 1×99
    0.0606    0.0603    0.0599    0.0592    0.0584    0.0573    0.0560    0.0544 ···
```

```
y_derivative = dy ./ dx
```

```
y_derivative = 1×99
    0.9994    0.9957    0.9884    0.9774    0.9629    0.9448    0.9233    0.8983 ⋯
```

```
n = length(x) - 1
```

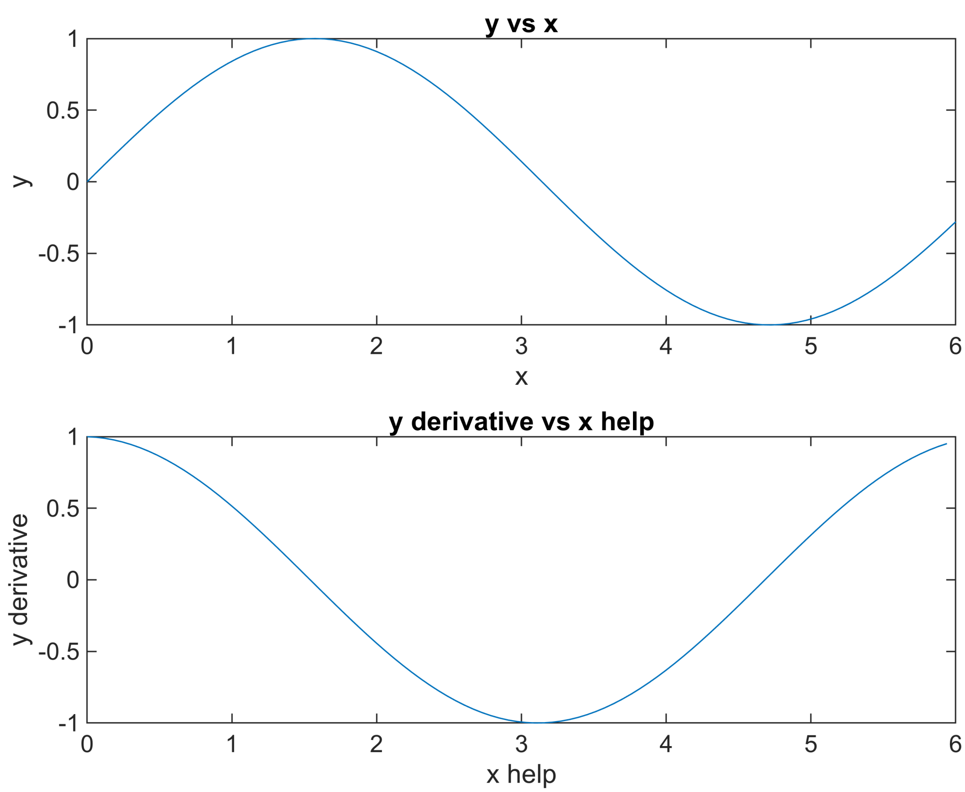
```
n =
99
```

```
x_help = x(1:n)
```

```
x_help = 1×99
         0    0.0606    0.1212    0.1818    0.2424    0.3030    0.3636    0.4242 ⋯
```

```
figure
subplot(2, 1, 1)
plot(x, y)
title('y vs x')
xlabel('x')
ylabel('y')

subplot(2, 1, 2)
plot(x_help, y_derivative)
title('y derivative vs x help')
xlabel('x help')
ylabel('y derivative')
```



```
%Assignment 15
```

```
t = linspace(0,8,801)
```

```
t = 1×801
         0    0.0100    0.0200    0.0300    0.0400    0.0500    0.0600    0.0700 ···
```

```
s1 = (t >= 0).*(t < 1).*t
```

```
s1 = 1×801
         0    0.0100    0.0200    0.0300    0.0400    0.0500    0.0600    0.0700 ···
```

```
s2 = (t >= 1).*(t < 2).*(t.^2 -t + 1)
```

```
s2 = 1×801
     0     0     0     0     0     0     0     0     0     0     0     0     0 ···
```

```
s3 = (t >= 2).*(t < 3).*(3*t-3)
```

```
s3 = 1×801
     0     0     0     0     0     0     0     0     0     0     0     0     0 ···
```

```
s4 = (t >= 3).*(t <= 8).*(-t.^2+9*t-12)
```

```
s4 = 1×801
     0     0     0     0     0     0     0     0     0     0     0     0     0 ···
```

```
s = s1 + s2 + s3 + s4
```

```
s = 1×801
         0    0.0100    0.0200    0.0300    0.0400    0.0500    0.0600    0.0700 ···
```

```
dt = diff(t)
```

```
dt = 1×800
    0.0100    0.0100    0.0100    0.0100    0.0100    0.0100    0.0100    0.0100 ···
```

```
ds = diff(s)
```

```
ds = 1×800
    0.0100    0.0100    0.0100    0.0100    0.0100    0.0100    0.0100    0.0100 ···
```

```
v = ds ./ dt
```

```
v = 1×800
     1     1     1     1     1     1     1     1     1     1     1     1     1 ···
```

```
n = length(t) - 1
```

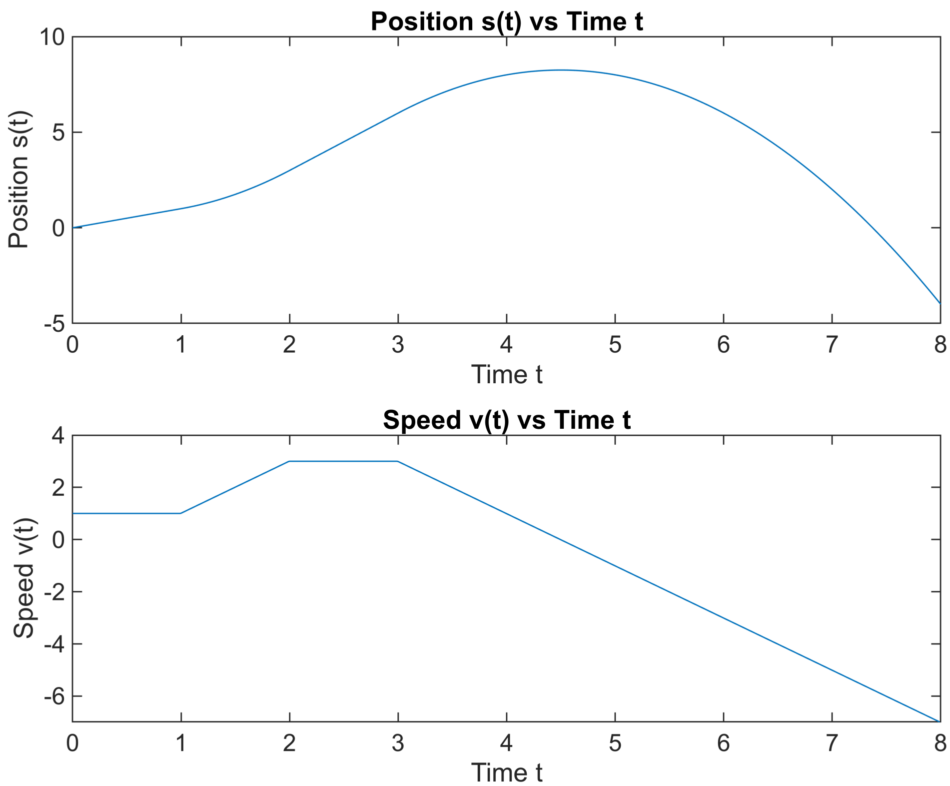
```
n =
800
```

```
t_help = t(1:n)
```

```
t_help = 1×800
         0    0.0100    0.0200    0.0300    0.0400    0.0500    0.0600    0.0700 ⋯
```

```
figure
subplot(2, 1, 1)
plot(t, s)
title('Position s(t) vs Time t');
xlabel('Time t');
ylabel('Position s(t)');

subplot(2, 1, 2)
plot(t_help, v)
title('Speed v(t) vs Time t');
xlabel('Time t');
ylabel('Speed v(t)');
```




```
%Assignment 16
```

```
R = 4
```

```
R =
4
```

```
L = 1.3
```

```
L =
1.3000
```

```
V = 12
```

```
V =
12
```

```
t = 0:0.01:2
```

```
t = 1×201
         0    0.0100    0.0200    0.0300    0.0400    0.0500    0.0600    0.0700 ⋯
```

```
i1 = (t >= 0).*(t <= 0.5).*(V/R * (1-exp(-R/L * t)))
```

```
i1 = 1×201
         0    0.0909    0.1790    0.2645    0.3474    0.4278    0.5057    0.5813 ⋯
```

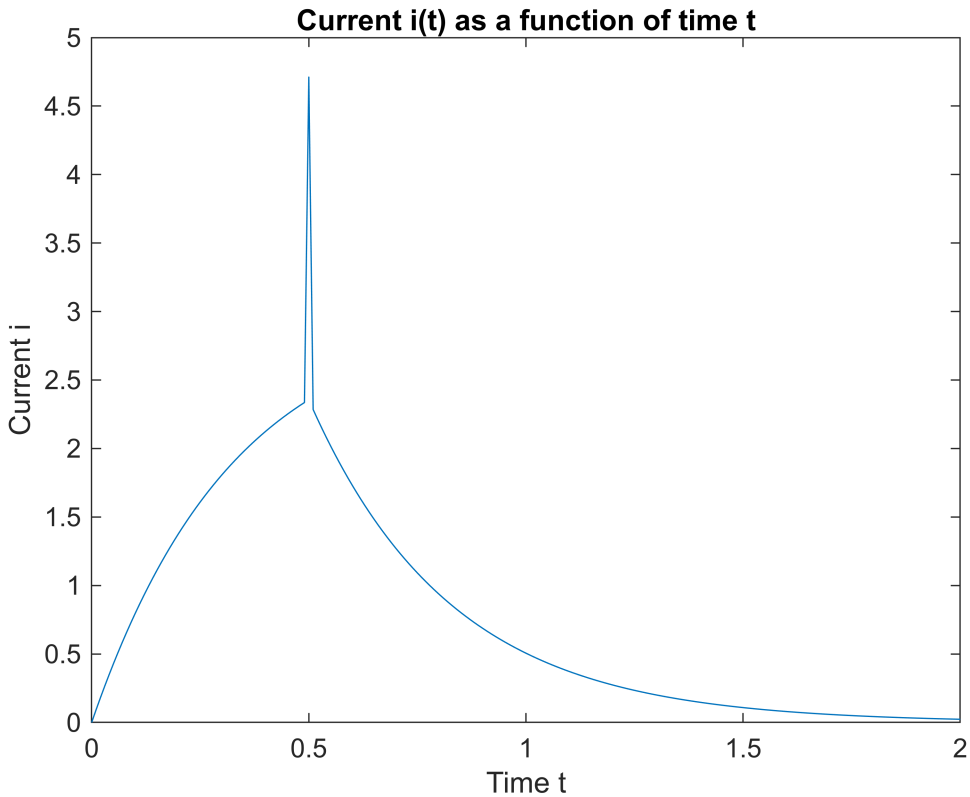
```
i2 = (t >= 0.5).*(t <= 2).*(exp(-R/L * t)*V/R*(exp(R/(2*L)) - 1))
```

```
i2 = 1×201
     0     0     0     0     0     0     0     0     0     0     0     0     0 ⋯
```

```
i = i1 + i2
```

```
i = 1×201
         0    0.0909    0.1790    0.2645    0.3474    0.4278    0.5057    0.5813 ⋯
```

```
figure
subplot(1, 1, 1)
plot(t, i)
title('Current i(t) as a function of time t');
xlabel('Time t');
ylabel('Current i');
```


Current i(t) as a function of time t
Current i
Time t
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0
0.5
1
1.5
2