```
'(ch2p1)'                % Display label.
```

```
ans =
'(ch2p1)'
```

```
'How are you?'           % Display string.
```

```
ans =
'How are you?'
```

```
-3.96                    % Display scalar number -3.96.
```

```
ans =
-3.9600
```

```
-4 + 7i                  % Display complex number -4 + 7i.
```

```
ans =
-4.0000 + 7.0000i
```

```
-5 - 6j                  % Display complex number -5 - 6j.
```

```
ans =
-5.0000 - 6.0000i
```

```

(-4 + 7i) + (-5 - 6i)    % Add two complex numbers and display sum.
```

```
ans =
-9.0000 + 1.0000i
```

```
(-4 + 7j) * (-5 - 6j)    % Multiply two complex numbers and display product.
```

```
ans =
62.0000 -11.0000i
```

```

M = 5                    % Assign 5 to M and display.
```

```
M =
5
```

```
N = 6                    % Assign 6 to N and display.
```

```
N =
6
```

```
P = M + N                % Assign M + N to P and display.
```

```
P =
11
```

```

Q = 3 + 4j               % Define complex number Q.
```

```
Q =
3.0000 + 4.0000i
```

```
MagQ = abs(Q)            % Find magnitude of Q.
```

```
MagQ =
5
```

```
ThetaQ = (180/pi) * angle(Q) % Find the angle of Q in degrees.
```

```
ThetaQ =
53.1301
```

```
'(ch2p2)'                % Display label.
```

```
ans =
'(ch2p2)'
```

```
P1 = [1 7 -3 23]         % Store polynomial s^3 + 7s^2 - 3s + 23 as P1 and
display.
```

```
P1 = 1×4
     1     7    -3    23
```

```
'(ch2p7)'                % Display label.
```

```
ans =
'(ch2p7)'
```

```


numf = [7 9 12]          % Define numerator of F(s).
```

```
numf = 1×3
     7     9    12
```

```


denf = conv(poly([0 -7]), [1 10 100]); % Define denominator of F(s).

[K, p, k] = residue(numf, denf) % Find residues and assign to K;
```

```
K = 4×1 complex
   0.2554 - 0.3382i
   0.2554 + 0.3382i
  -0.5280 + 0.0000i
   0.0171 + 0.0000i
p = 4×1 complex
  -5.0000 + 8.6603i
  -5.0000 - 8.6603i
  -7.0000 + 0.0000i
   0.0000 + 0.0000i
k =

     []
```

```
                                  % find roots of denominator and assign to p;
                                  % find constant and assign to k.
```

```
'(ch2p8) Example 2.3'   % Display label.
```

```
ans =
'(ch2p8) Example 2.3'
```

```


numy = 32;                 % Define numerator.
deny = poly([0 -4 -8]); % Define denominator.

[r, p, k] = residue(numy, deny) % Calculate residues, poles, and direct
quotient.
```

```
r = 3×1
     1
    -2
     1
p = 3×1
    -8
    -4
     0
k =

     []
```

```
'(ch2p9)'                           % Display label.
```

```
ans =
'(ch2p9)'
```

```
'Vector Method, Polynomial Form'    % Display label.
```

```
ans =
'Vector Method, Polynomial Form'
```

```


numf = 150 * [1 2 7];               % Store 150(s^2 + 2s + 7) in numf and
display.
denf = [1 5 4 0];                   % Store s(s + 1)(s + 4) in denf and
display.

'F(s)'                              % Display label.
```

```
ans =
'F(s)'
```

```
F = tf(numf, denf)                  % Form F(s) and display.
```

```
F =

  150 s^2 + 300 s + 1050
  ----------------------
    s^3 + 5 s^2 + 4 s

Continuous-time transfer function.
Model Properties
```

```
clear                                    % Clear previous variables from
workspace.

'Vector Method, Factored Form'            % Display label.
```

```
ans =
'Vector Method, Factored Form'
```

```
numg = [-2 -4];                          % Store (s + 2)(s + 4) in numg and
display.
deng = [-7 -8 -9];                       % Store (s + 7)(s + 8)(s + 9) in deng
and display.
K = 20;                                   % Define K.

'G(s)'                                   % Display label.
```

```
ans =
'G(s)'
```

```
G = zpk(numg, deng, K)                   % Form G(s) and display.
```

```
G =

   20 (s+2) (s+4)
  -----------------
  (s+7) (s+8) (s+9)

Continuous-time zero/pole/gain model.
Model Properties
```

```
clear                                    % Clear previous variables from
workspace.

'Rational Expression Method, Polynomial Form' % Display label.
```

```
ans =
'Rational Expression Method, Polynomial Form'
```

```
s = tf('s');                             % Define 's' as an LTI object in
polynomial form.
F = 150 * (s^2 + 2*s + 7) / (s * (s^2 + 5*s + 4))
```

```
F =

  150 s^2 + 300 s + 1050
  ----------------------
    s^3 + 5 s^2 + 4 s

Continuous-time transfer function.
Model Properties
```

```
                                         % Form F(s) as an LTI transfer function
in polynomial form.
G = 20 * (s + 2) * (s + 4) / ((s + 7) * (s + 8) * (s + 9))
```

```
G =

     20 s^2 + 120 s + 160
  --------------------------
  s^3 + 24 s^2 + 191 s + 504

Continuous-time transfer function.
Model Properties
```

```
                                   % Form G(s) as an LTI transfer function
in polynomial form.

clear                              % Clear previous variables from
workspace.

'Rational Expression Method, Factored Form'  % Display label.
```

```
ans =
'Rational Expression Method, Factored Form'
```

```
s = zpk('s');                      % Define 's' as an LTI object in
factored form.
F = 150 * (s^2 + 2*s + 7) / (s * (s^2 + 5*s + 4))
```

```
F =

  150 (s^2 + 2s + 7)
  ------------------
    s (s+1) (s+4)

Continuous-time zero/pole/gain model.
Model Properties
```

```
                                   % Form F(s) as an LTI transfer function
in factored form.
G = 20 * (s + 2) * (s + 4) / ((s + 7) * (s + 8) * (s + 9))
```

```
G =

   20 (s+2) (s+4)
  -----------------
  (s+7) (s+8) (s+9)

Continuous-time zero/pole/gain model.
Model Properties
```

```
                                   % Form G(s) as an LTI transfer function
in factored form.
```

```
'(ch2p10)'                    % Display label.
```

```
ans =
'(ch2p10)'
```

```
'Coefficients for F(s)'          % Display label.
```

```
ans =
'Coefficients for F(s)'
```

```
numftf = [10 40 60];             % Form numerator of F(s) = (10s^2 + 40s +
60) / (s^3 + 4s^2 + 5s + 7).
denftf = [1 4 5 7];              % Form denominator of F(s).

'Roots for F(s)'                 % Display label.
```

```
ans =
'Roots for F(s)'
```

```
[numfzp, denfzp] = tf2zp(numftf, denftf)
```

```
numfzp = 2×1 complex
  -2.0000 + 1.4142i
  -2.0000 - 1.4142i
denfzp = 3×1 complex
  -3.1163 + 0.0000i
  -0.4418 + 1.4321i
  -0.4418 - 1.4321i
```

```
                                 % Convert F(s) to factored form.

'Roots for G(s)'                 % Display label.
```

```
ans =
'Roots for G(s)'
```

```
numgzp = [-2 -4];               % Form numerator of G(s) = 10(s + 2)(s + 4).
K = 10;                          % Define K.
dengzp = [0 -3 -5];              % Form denominator of G(s) = 10(s + 2)(s +
4) / [s(s + 3)(s + 5)].

'Coefficients for G(s)'          % Display label.
```

```
ans =
'Coefficients for G(s)'
```

```
[numgtf, dengtf] = zp2tf(numgzp', dengzp', K)
```

```
numgtf = 1×4
     0    10    60    80
dengtf = 1×4
     1     8    15     0
```

```
                                 % Convert G(s) to polynomial form.
```

```
'(ch2p11)'                       % Display label.
```

```
ans =
'(ch2p11)'
```

```
'Fzpk1(s)'                      % Display label.
```

```
ans =
'Fzpk1(s)'
```

```
Fzpk1 = zpk([-2 -4], [0 -3 -5], 10);
                                 % Form Fzpk1(s) = 10(s + 2)(s + 4) / [s(s +
3)(s + 5)].

'Ftf1'                          % Display label.
```

```
ans =
'Ftf1'
```

```
Ftf1 = tf(Fzpk1);               % Convert Fzpk1(s) to coefficient form.

'Ftf2'                          % Display label.
```

```
ans =
'Ftf2'
```

```
Ftf2 = tf([10 40 60], [1 4 5 7]);
                                 % Form Ftf2(s) = (10s^2 + 40s + 60) / (s^3 +
4s^2 + 5s + 7).

'Fzpk2'                         % Display label.
```

```
ans =
'Fzpk2'
```

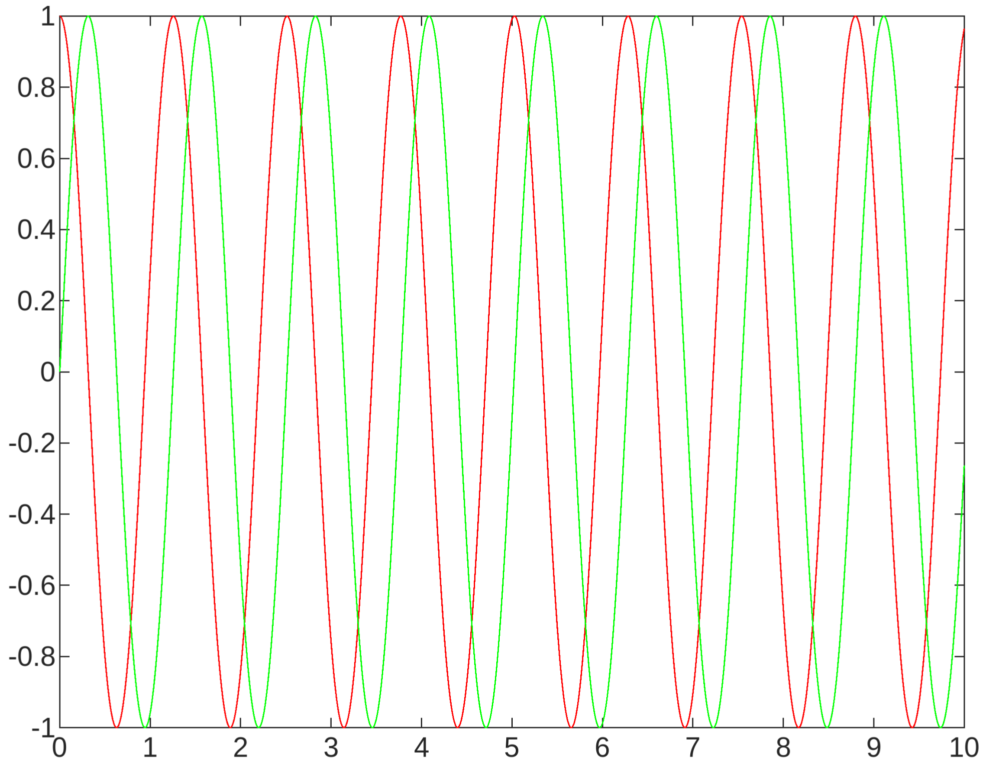
```
Fzpk2 = zpk(Ftf2);              % Convert Ftf2(s) to factored form.
```

```
'(ch2p12)'                  % Display label.
```

```
ans =
'(ch2p12)'
```

```
t = 0:0.01:10;              % Specify time range and increment.
f1 = cos(5 * t);            % Define f1 as cos(5t).
f2 = sin(5 * t);            % Define f2 as sin(5t).

plot(t, f1, 'r', t, f2, 'g');  % Plot f1 in red and f2 in green.
```


1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
1
2
3
4
5
6
7
8
9
10