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Question 1 - finds the poles of the closed loop system when unity negative feedback is applied.

```
function poles = MatlabHW3(num, den)
   % get the transfer function ready for inputs
   G = tf(num, den);

   % use feedback instead of the actual equation
   T = feedback(G, 1);

   % finding the poles of the closed-loop system
   poles = pole(T);
   disp('The poles of the closed-loop system:'); % display result
   disp(poles);
end
```

Input -

num = [1 2];
den = [1 2 3];
poles = MatlabHW3(num, den);

Output -

The poles of the closed-loop system:
-1.5000 + 1.6583i
-1.5000 - 1.6583i

Question 2 - Matlab Verification of Problem 1 from Homework 5

Using Matlab to check my work, I can see if the system is stable if all poles have negative real parts. If any pole has a positive real part, or is on the right half of the s-plane, the system will be unstable.

Input >> num_a = [4 8];
den_a = conv([1 0], [1 2 3 4]);
poles_a = MatlabHW3(num_a, den_a);

num_b = [2 8];
den_b = conv([1 0 0], [1 1]);
poles_b = MatlabHW3(num_b, den_b);

num_c = [4 8 4 4];
den_c = conv([1 0 0], [1 2 -1 -1]);
poles_c = MatlabHW3(num_c, den_c);

Output >> The poles of the closed-loop system:

```
   0.4711 + 1.7994i
   0.4711 - 1.7994i
  -1.4711 + 0.3851i
  -1.4711 - 0.3851i
```

The poles of the closed-loop system:

```
  -2.0000 + 0.0000i
   0.5000 + 1.9365i
   0.5000 - 1.9365i
```

The poles of the closed-loop system:

```
  -2.0000 + 0.0000i
   0.2856 + 1.5674i
   0.2856 - 1.5674i
  -0.2856 + 0.8404i
  -0.2856 - 0.8404i
```

Explanation:

There are positive real parts on some poles for all of the transfer functions. This aligns with the results from the Homework using Routh's criterion. All three of the systems are **unstable**.