1 Show that if z is

$$\frac{x_1 + jy_1}{x_2 + jy_2}\left(\frac{x_2 - jy_2}{x_2 - jy_2}\right)$$

$$\frac{x_1 x_2 - jx_1 y_2 + x_2 jy_1 + y_1 y_2}{x_2^2 + y_2^2}$$

$$\frac{x_1 x_2 + y_1 y_2}{x_2^2 + y_2^2} + j\left(\frac{x_2 y_1 - x_1 y_2}{x_2^2 + y_2^2}\right)$$

let $x_1 = 1$ $x_2 = 2$ $y_1 = 3$ $y_2 = 4$

$$\frac{1(2) + 3(4)}{(2)^2 + (4)^2} + j\left(\frac{2(3) - 1(4)}{(2)^2 + (4)^2}\right)$$

$$\frac{14}{20} + j\,\frac{2}{20} = \boxed{\frac{7}{10} + j\,\frac{1}{10}}$$

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$$z^* = \frac{x_1 - jy_1}{x_2 - jy_2}\left(\frac{x_2 + jy_2}{x_2 + jy_2}\right)$$

$$\frac{x_1 x_2 + jx_1 y_2 - jx_2 y_1 + y_1 y_2}{x_2^2 + y_2^2}$$

$$\frac{x_1 x_2 + y_1 y_2}{x_2^2 + y_2^2} + j\left(\frac{x_1 y_2 - x_2 y_1}{x_2^2 + y_2^2}\right)$$

Let $x_1 = 1$ $x_2 = 2$ $y_1 = 3$ $y_2 = 4$

$$\frac{1(2) + 3(4)}{2^2 + 4^2} + j\left(\frac{1(4) - 2(3)}{2^2 + 4^2}\right)$$

$$\frac{14}{20} + j\left(\frac{-2}{20}\right)$$

$$\boxed{\frac{7}{10} - j\frac{1}{10}}$$

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3 Prove that $\cos(x) = \frac{1}{2}\left(e^{jx} + e^{-jx}\right)$

Through Euler's formula we know

$$e^{jx} = \cos(x) + i\sin(x)$$

and

$$e^{-jx} = e^{j(-x)} = \cos(-x) + i\sin(-x) = \cos(x) - i\sin(x)$$

Now we can substitute

$$\cos(x) = \frac{1}{2}\left(\cos(x) + \cancel{i\sin(x)} + \cos(x) - \cancel{i\sin(x)}\right)$$

$$\cos(x) = \frac{1}{2}\left(2\cos(x)\right)$$

$$\cos(x) = \cos(x) \checkmark$$

```
numbers = [0.0: 1.0:100.0]

function sign = sin(numbers)
Value = cosine(numbers)
endfunction

plot(numbers, Value)
```

```
R = 50.0;
C = 470.0 * 10^-12;
L = 54 * 10^-6;
omega = [0.0:1.0e3:2.0e6]
omega = (omega * 10^6)
omega_LC = 1/sqrt(L*C)
T = R*C

function notch = rlc(omega, omega_LC, T)
k_squared = 1-(omega./omega_LC).^2
k_fourth = k_squared.*k_squared
Denominator = k_fourth + (omega.*T).^2
r_real = k_fourth./denominator
r_imag = -omega*T*k_squared./Denominator
R = r_real + sqrt(-1)*r_imag
endfunction

plot(omega, abs(rlc(omega,omega_LC, T))
```

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