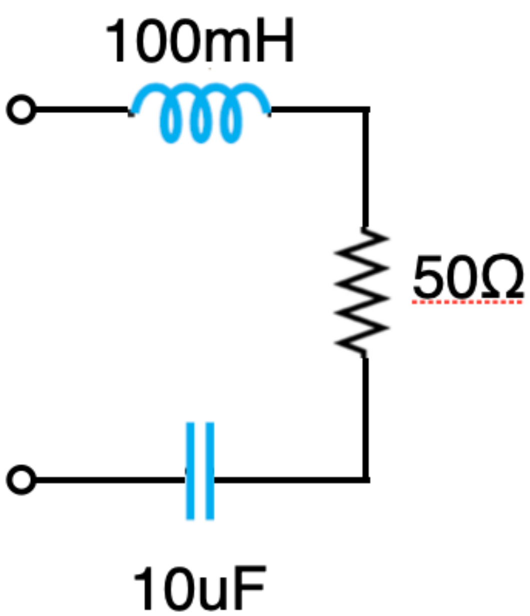
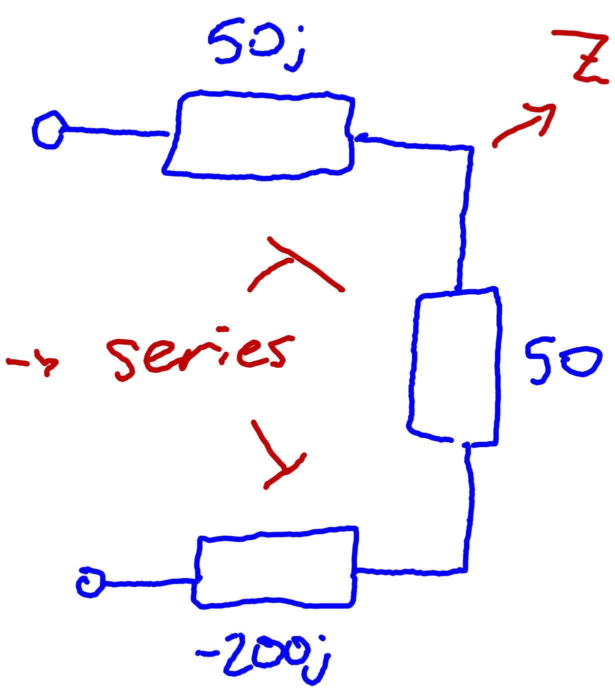
Last Class…

Find the impedance in polar form for each of the components below. Assume $\omega = 500$



$Z \rightarrow$ series



$Z = 50 - 150j$

$Z_R = 50\Omega$

$Z_L = j\omega L = j(500)(100\times10^{-3}) = 50j\,\Omega$

$Z_C = \dfrac{1}{j\omega C} = \dfrac{1}{j(500)(10\times10^{-6})} = \dfrac{200}{j} = -200j\,\Omega$

$V_s(t) =$

1) Ideally ans in polar form & degrees

↳ mode → complex number → $a+bi$ $re^{\theta i}$

↳ angle → degrees

$18e^{45j} = 18e^{45i} + 5i = 22e$

$18e^{45i\pi/180}$

ans = $12.7 + 12.7j$

THE OHIO STATE UNIVERSITY

COLLEGE OF ENGINEERING

Impedances

This Lecture…

- Learning Objectives:
    - Determine combinations of impedances connected in series or in parallel.

Calculator

$(3+2i)(2-i)$

$6-3i+4i+2$

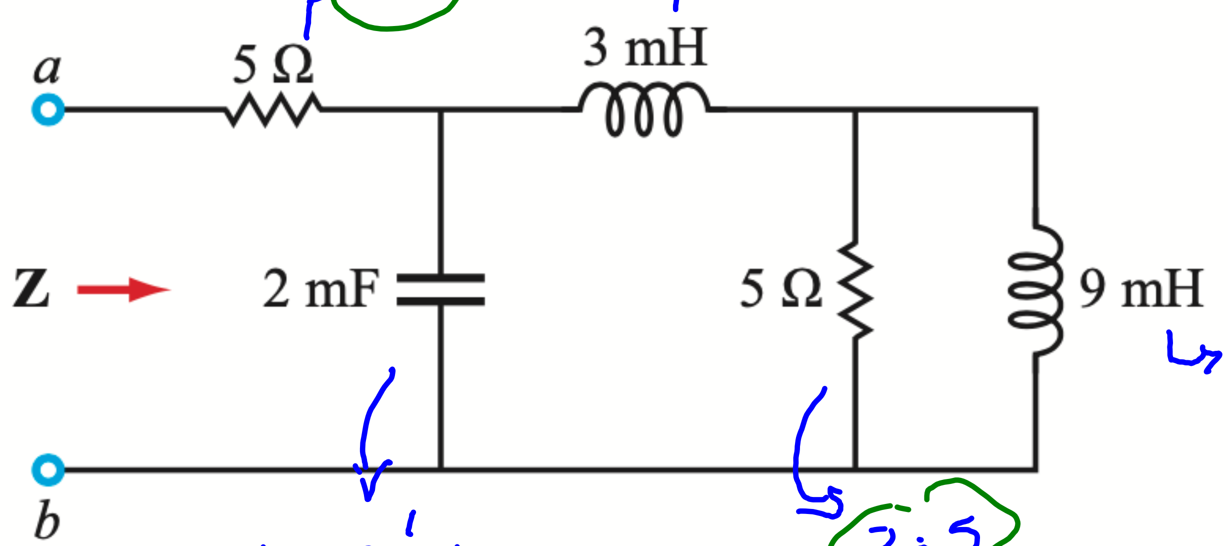
$8+i$

Example 1

Find the input impedance $\boldsymbol{Z}$ of the circuit below. Assume that $\omega = 400\, rad/s$.

$Z = 5$

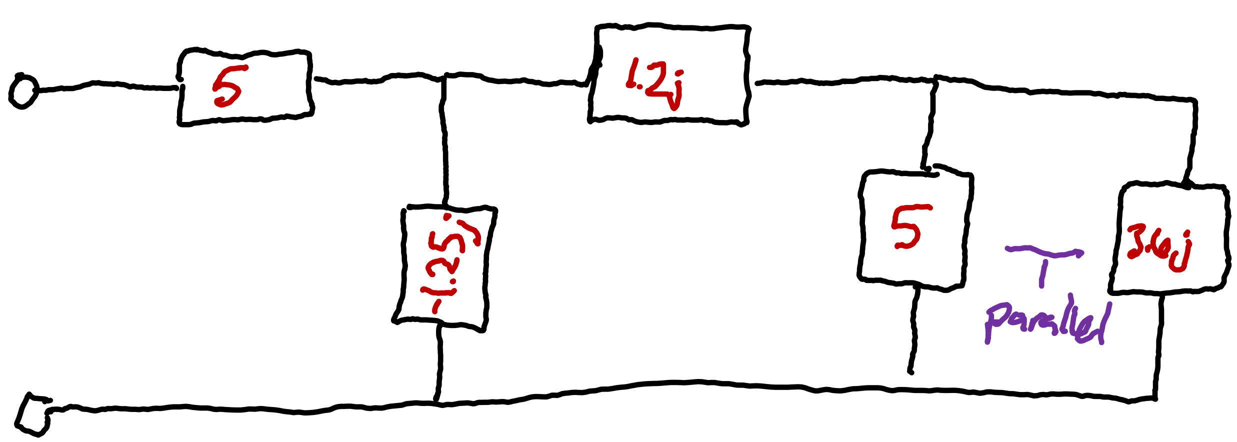
$Z = j\omega L = j(400)(3\times10^{-3}) = 1.2j$



$Z = j\omega L = j(400)(9\times10^{-3}) = 3.6j$

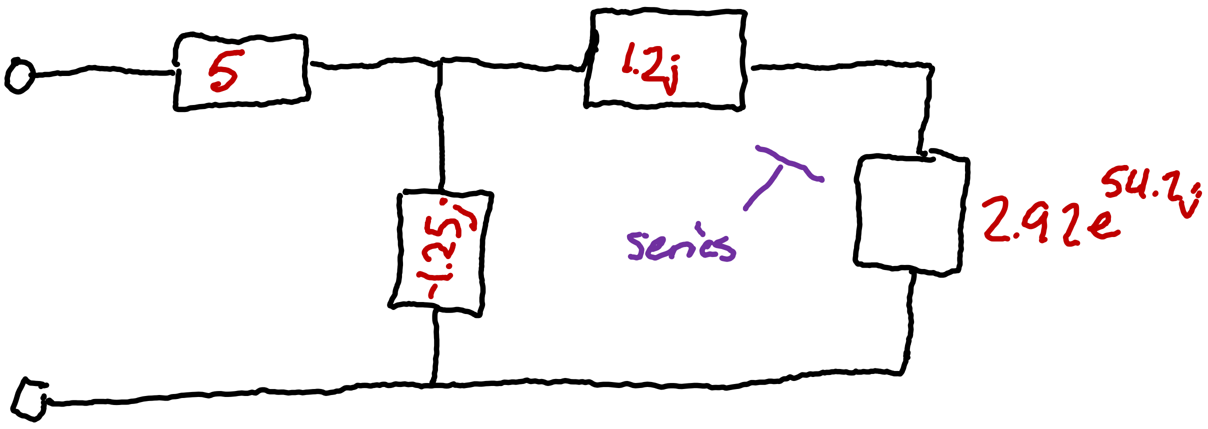
$Z = 5$

$$Z = \frac{1}{j\omega C} = \frac{1}{j(400)(2\times10^{-3})} = -1.25j$$



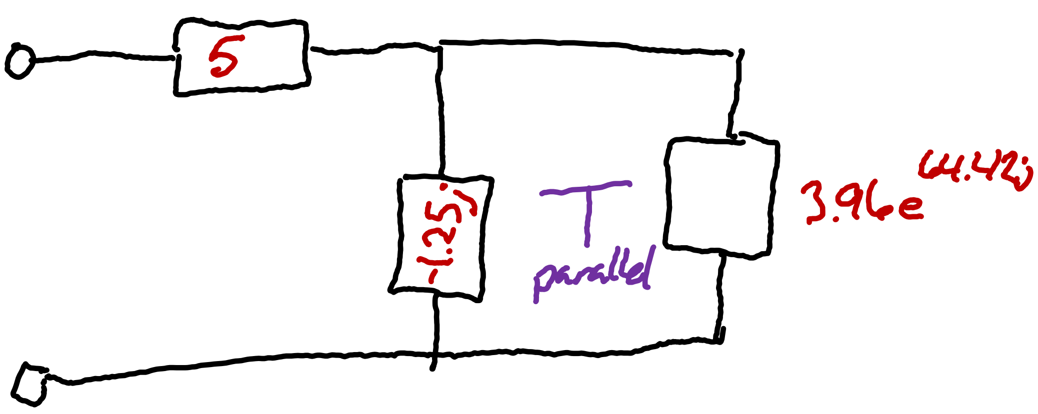
$$Z_{\parallel} = \frac{5(3.6j)}{5+3.6j} = 2.92e^{54.2j}$$

$1.71 + 2.37j$



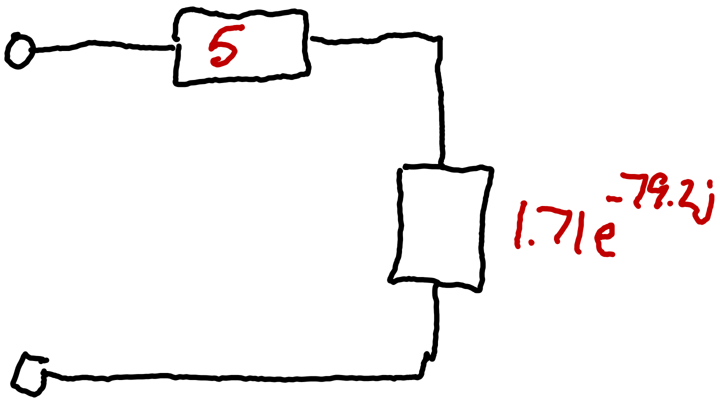
$$Z = 1.2j + 2.92e^{54.2j} = 3.96e^{64.42j}$$

$$1.71 + 3.57j$$



$$Z = \frac{1}{\frac{1}{1.25j} + \frac{1}{3.96e^{64.42j}}} = 0.32 - 1.67j$$

$$1.71e^{-79.2j}$$

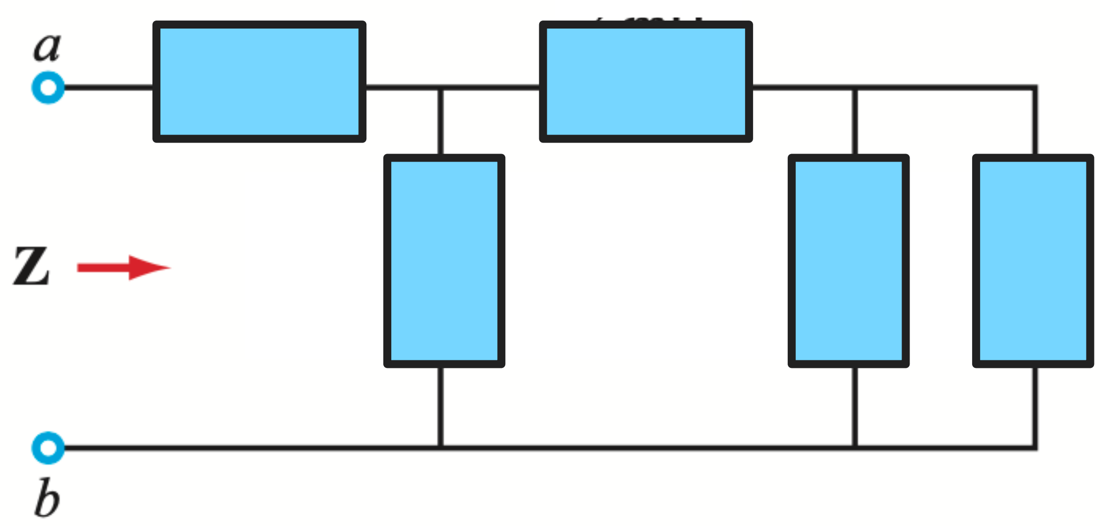


$$Z = 5 + 1.71e^{-79.2j} = 5.02 - 1.67j$$

$$5.58e^{-17.58j}$$

Example 1

Find the input impedance $\boldsymbol{Z}$ of the circuit below. Assume that $\omega = 400\, rad/s$.

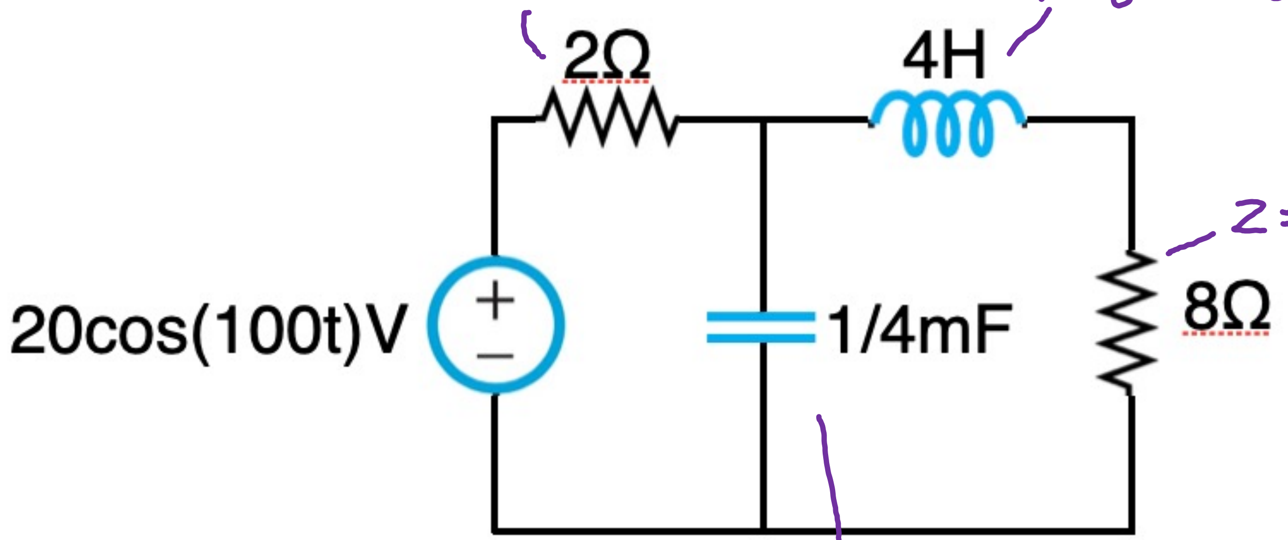


Example 2

Find the equivalent impedance.

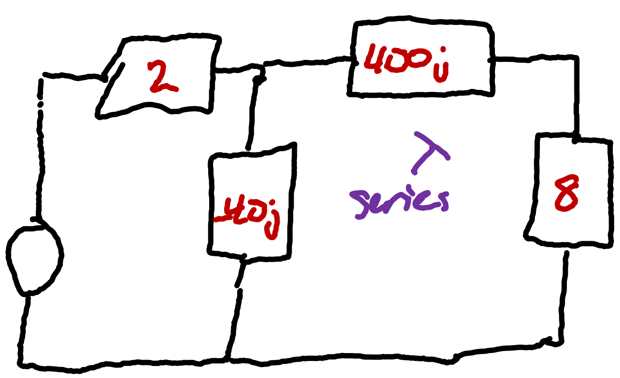
$Z=2$

$Z = j\omega L = j(100)(4) = 400j$

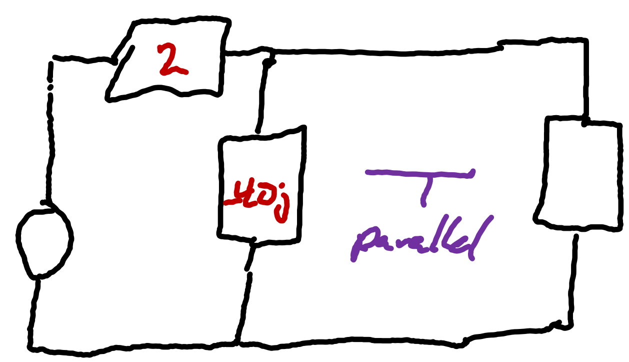


$Z=8$

$$Z = \frac{1}{j\omega L} = \frac{1}{j(100)(.25\times10^{-3})} = -40j$$

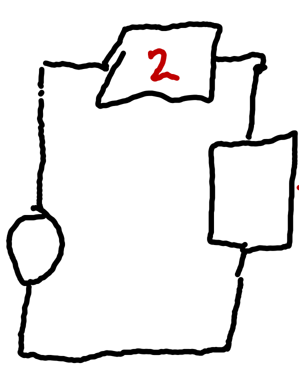


$Z = 8+400j$



$8+400j$

$$Z = \frac{1}{\frac{1}{-40j}+\frac{1}{8+400j}} = \frac{-40j(50j+1)}{45j+1}$$



$$\frac{-40j(50j+1)}{45j+1}$$

$$Z = \frac{-40j(50j+1)}{45j+1} + 2 = \frac{-8}{81(45j+1)} - \frac{400j}{9} + \frac{170}{81}$$

idk how to convert