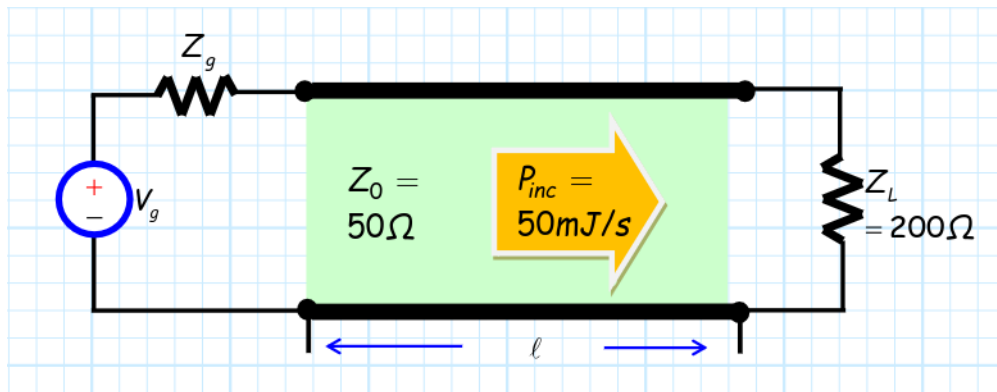# EECS 622: Homework #10

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Problem 1

In the circuit below, the power associated with the **wave incident** on the load is **50 mW**.

$$Z_0 = 50\,\Omega, \quad P_{\text{inc}} = 50\,\text{mJ/s}, \quad Z_L = 200\,\Omega$$

Determine the **power delivered** by the source (it's **not** 50 mW!).

Solution:
P^{del} is given by the difference of P^{inc} and P^{ref}. We may know the reflected power by the reflection coefficient:

$$\Gamma_0 = \frac{Z_L - Z_0}{Z_L + Z_0} = 0.6$$

The two are related by:

$$P^{ref} = |\Gamma_0|^2 P^{inc} = 18 \text{ mJ/s}$$

The actual delivered power is then the difference:

$$50 \text{ mJ/s} - 18 \text{ mJ/s} = 32 \text{ mJ/s}$$

Problem 2

In the circuit below, **all the available power from the source is delivered to the load**.
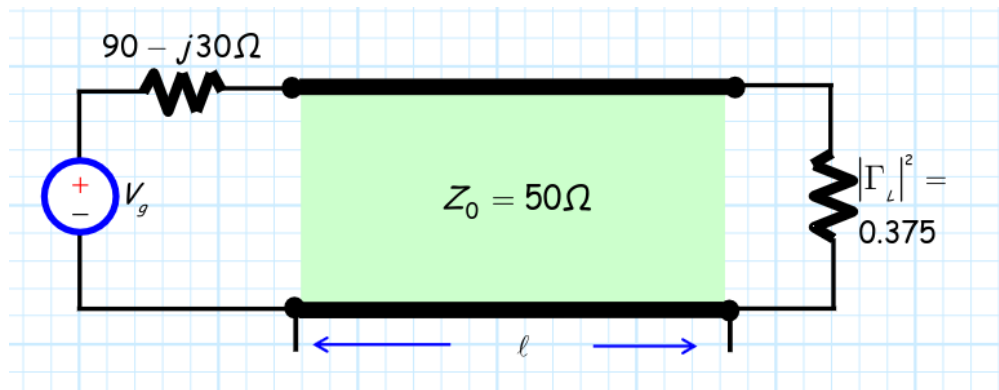The power of the wave incident on the load is **20 mW**.
The magnitude-squared of the load reflection coefficient is

$$|\Gamma_L|^2 = 0.375.$$

The length ℓ of the transmission line is **not zero** (i.e., $\ell \neq 0$).
Otherwise, the length ℓ of the transmission line is both **unknown and unknowable** (i.e., don't attempt to determine ℓ).

$$Z_g = 90 - j30\,\Omega, \quad Z_0 = 50\,\Omega$$

Determine the magnitude of the voltage source (i.e., find $|V_g|$).

Solution:
We know

$$P_g^{avl} = P_g^{del} = P_L^{abs} \quad \text{if} \quad Z_{in} = Z_g^*$$

Since all power is delivered, $\Gamma_0 = 0$, and the power absorbed on the load $P^{abs} = P_L^{inc}(1 - |\Gamma_L|^2) = 12.5$ mW

$$P_g^{avl} = \frac{|V_g|^2}{8\,\text{Re}(Z_g)}$$
$$|V_g|^2 = 12.5 \text{ mW} \cdot 8(90\,\Omega)$$
$$|V_g| = 3 \text{ V}$$