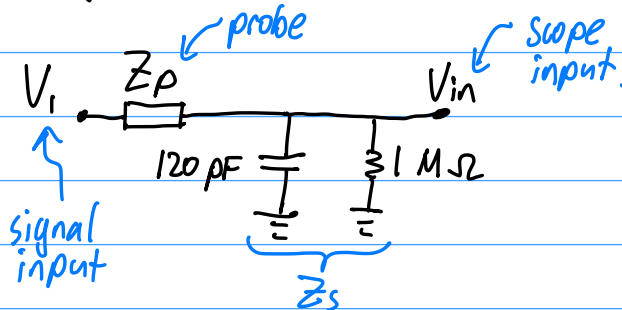


AOE Ex 1.44

Design a 10x oscilloscope probe.



$$V_{in} = \frac{V_1 Z_s}{Z_s + Z_p}$$

where $Z_s = 1 \text{ M}\Omega \parallel 120 \text{ pF}$.

Require 20 dB = $10^{20/20} = 10$ times attenuation.

$$\therefore \frac{V_{in}}{V_1} = \frac{1}{10} = \frac{Z_s}{Z_s + Z_p}$$

$$Z_s + Z_p = 10 Z_s$$

$$Z_p = 9 Z_s$$

Need to select a network where $Z_p = 9 Z_s$ at all frequencies. Propose $Z_p = \left[\begin{array}{c} C_p \\ R_p \end{array} \right]$ for some R_p & C_p .

To make a parallel combination larger by 9, increase both impedances by 9.

$$\left[\text{Proof: } 9Z_1 \parallel 9Z_2 = \frac{9Z_1 \times 9Z_2}{9Z_1 + 9Z_2} = \frac{9^2 Z_1 Z_2}{9(Z_1 + Z_2)} = 9(Z_1 \parallel Z_2) \right]$$

$\therefore R_p = 9 \text{ M}\Omega$. smaller C \Rightarrow larger impedance.

$$C_p = \frac{120}{9} \text{ pF} = 13.3 \text{ pF}$$

The 10x probe is:

