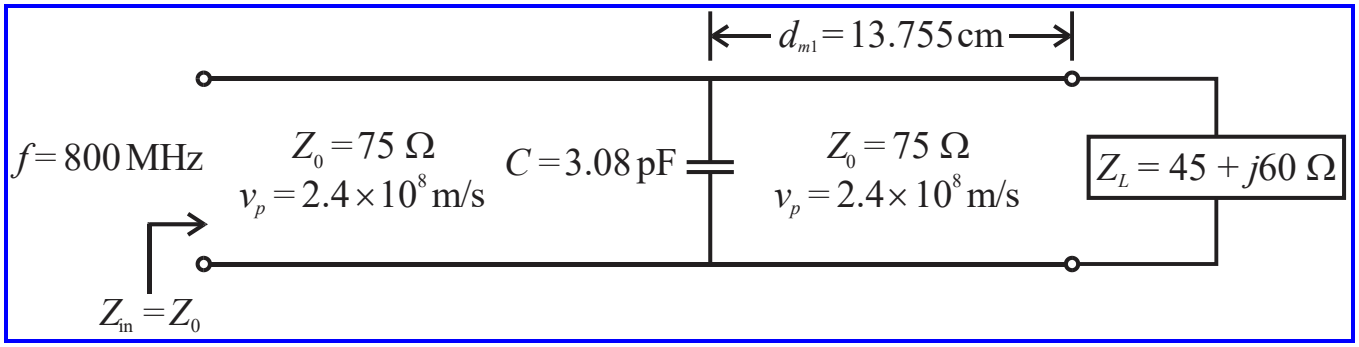
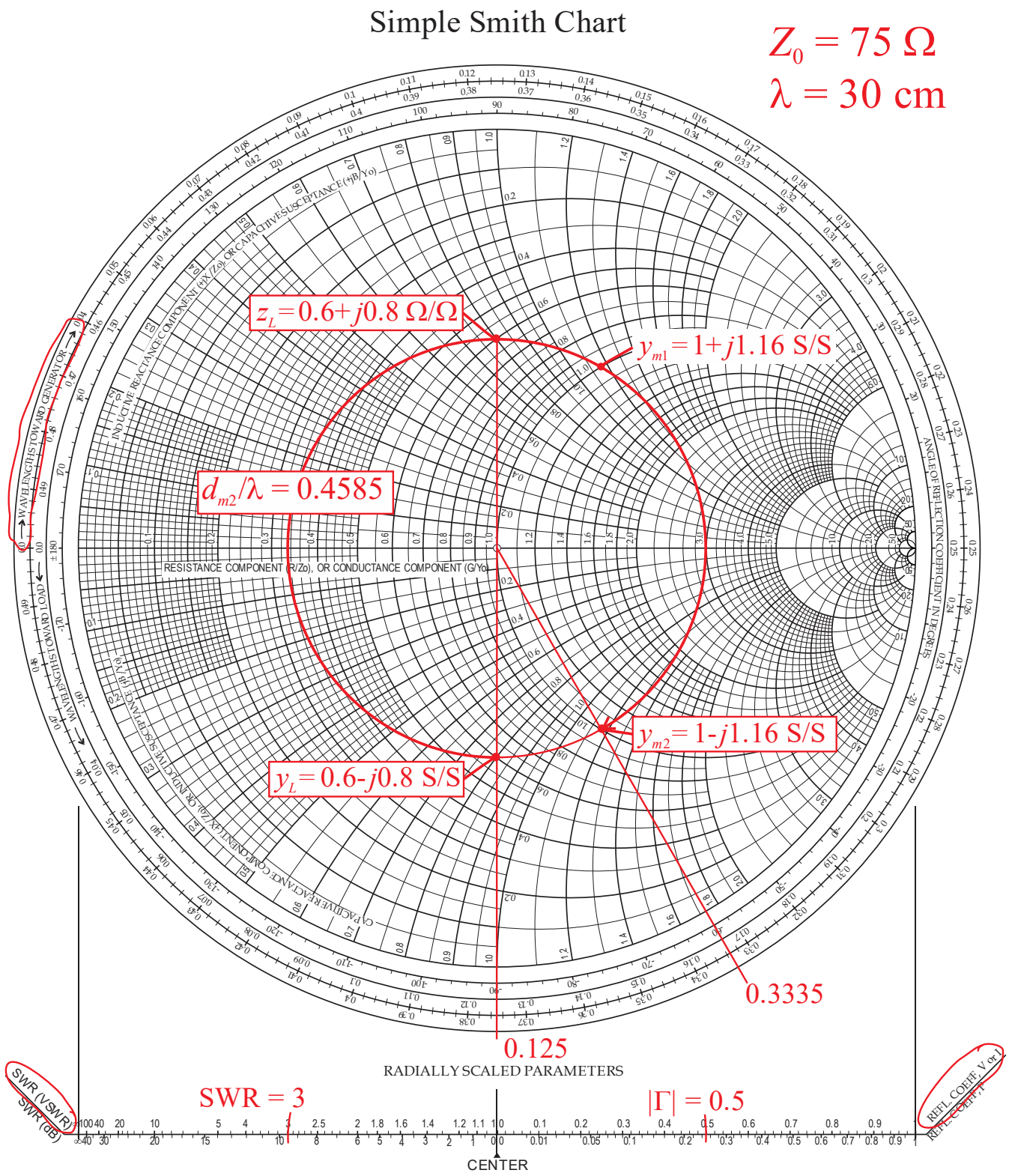
For a circuit operating at 800 MHz, design and sketch a single parallel capacitor matching network for a load $Z_L = 45 + j60\ \Omega$ connected to a lossless transmission line ($75\ \Omega$, 2.4×10^8 m/s). Use Smith chart solution method.

- Calculate wavelength $\lambda = v_p / f = 2.4 \times 10^8 / 800 \times 10^6 \Rightarrow$ **$\lambda = 0.3$ m $= 30$ cm**.
- Calculate the normalized load impedance $z_L = Z_L / Z_0 = (45 + j60) / 75$ $\Rightarrow$ **$z_L = 0.6 + j0.8\ \Omega/\Omega$**. Plot z_L on Smith chart.
- Use compass to draw a circle through z_L, centered on Smith chart. Use a straight edge to draw line through center of Smith chart & z_L to outer rings of Smith chart.
- Move 180° around circle of constant $|\Gamma|$ from z_L point to **$y_L = 0.6 - j0.8$ S/S**.
- Note the match points where the circle of constant $|\Gamma| = 0.5$ intersects the circle of $g = 1$ S/S at $y_{m1} = 1 + j1.16$ S/S and **$y_{m2} = 1 - j1.16$ S/S.** Choose y_{m2} as it has a negative (inductive) susceptance that can be canceled by a parallel capacitor.
- Find distance in the "WAVELENGTHS TOWARD GENERATOR" direction from y_L to y_{M2} as $d_{m2} = 0.125\lambda + 0.3335\lambda \Rightarrow$ **$d_{m2} = 0.4585\lambda = 13.755$ cm**.
- Set the susceptance of the parallel capacitance as $\omega C = 1.16/75 = 0.0154667$ S. Calculate $C = 1.16/[75(2\pi)800 \times 10^6] \Rightarrow$ **$C = 3.077 \times 10^{-12}$ F $= 3.08$ pF**.




Simple Smith Chart
$Z_0 = 75\ \Omega$
$\lambda = 30$ cm
$z_L = 0.6 + j0.8\ \Omega/\Omega$
$y_{m1} = 1 + j1.16$ S/S
$d_{m2}/\lambda = 0.4585$
$y_{m2} = 1 - j1.16$ S/S
$y_L = 0.6 - j0.8$ S/S
0.3335
0.125
RADIALLY SCALED PARAMETERS
SWR = 3
$|\Gamma| = 0.5$
CENTER
RESISTANCE COMPONENT (R/Zo), OR CONDUCTANCE COMPONENT (G/Yo)
WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
SWR (V SWR)
SWR (dB)
REFL. COEFF. V or I
REFL. COEFF. P