2.23 A slotted-line experiment is performed with the following results: distance between successive minima = 2.1 cm; distance of first voltage minimum from load = 0.9 cm; SWR of load = 3. If $Z_0 = 50\ \Omega$, find the load impedance.

- Using 'SWR (VSWR)' at below Smith chart on left, set compass to SWR = 3.
- Draw a circle, centered on the Smith chart. This circle represents all possible impedances on the transmission line.
- As everything repeats every $\lambda/2$ on a Smith chart, the distance between voltage minima = $\lambda/2$ = 2.1 cm $\Rightarrow$ λ = 4.2 cm.
- Voltage minima occur at $r_{\min}$, i.e., where the circle intersects the real axis to the left of center. Mark this location on Smith chart.
- The distance from the closest voltage minima to the load in terms of wavelengths is $\ell_{\min} / \lambda = 0.9 / 4.2$ $\Rightarrow$ $\ell_{\min} / \lambda = 0.2143$.
- Draw radial line from center of Smith chart to 0.2143 on the 'WAVELENGTHS TOWARD LOAD' scale.
- Move $\ell_{\min} / \lambda = 0.2143$ in the 'WAVELENGTHS TOWARD LOAD' direction from the $r_{\min}$ point to the location of z_L on the circle of constant SWR = 3.
- Read-off the normalized load resistance $r_L = 2.15$ and reactance $x_L = -1.25$. This yields $z_L = 2.15 - j\,1.25\ \Omega/\Omega$.
- Find load impedance by multiplying z_L with Z_0 to get

  $Z_L = Z_0\, z_L = 50\,(2.15 - j\,1.25)$ $\Rightarrow$ **$Z_L = 107.5 - j\,62.5\ \Omega$**.

2.23 mod 1

Simple Smith Chart

$Z_0 = 50\Omega$
$\lambda = 4.2cm$