1. (30%) A lossless 100-Ω line λ/8 is terminated in an unknown impedance. If the input impedance is Z_{in} = -j25-Ω. Find the load Z_L.

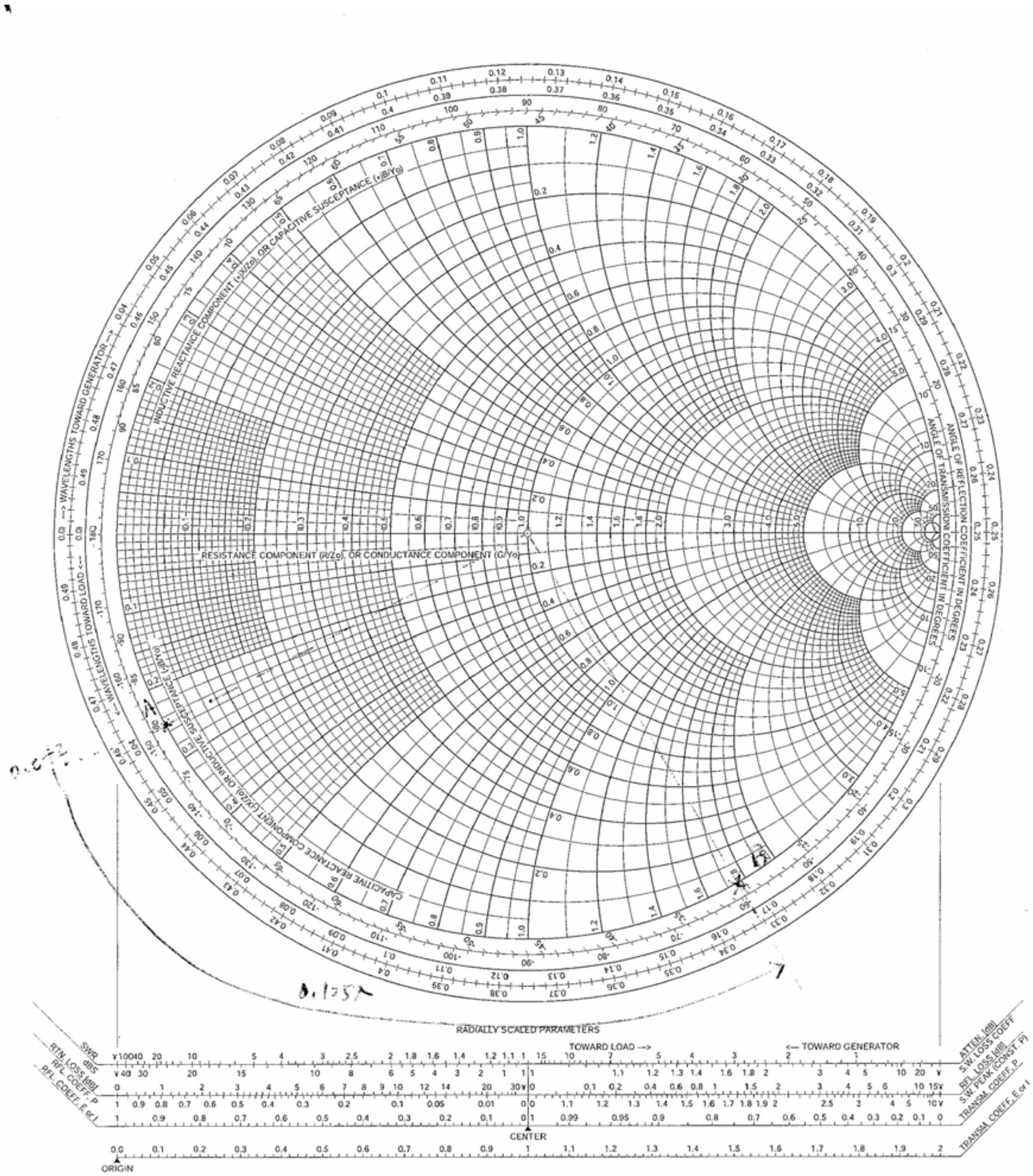
$z_{in} = \frac{Z_{in}}{Z_0} = -j0.25$ point A

0.042 on WTL scale:

z_L should be $0.042\lambda + 0.125\lambda = 0.167\lambda$ on WTL scale. point B.

$z_L = -j1.75$

$Z_L = Z_0 \cdot z_L = -j175\ \Omega$


RESISTANCE COMPONENT (R/Zo), OR CONDUCTANCE COMPONENT (G/Yo)
INDUCTIVE REACTANCE COMPONENT (+jX/Zo), OR CAPACITIVE SUSCEPTANCE (+jB/Yo)
CAPACITIVE REACTANCE COMPONENT (-jX/Zo), OR INDUCTIVE SUSCEPTANCE (-jB/Yo)
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
ANGLE OF TRANSMISSION COEFFICIENT IN DEGREES
WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
RADIALLY SCALED PARAMETERS
TOWARD LOAD —>
<— TOWARD GENERATOR
SWR
RTN. LOSS [dB]
RFL. COEFF, P
RFL. COEFF, E or I
ATTEN. [dB]
S.W. LOSS COEFF
RFL. LOSS [dB]
S.W. PEAK (CONST. P)
TRANSM. COEFF, P
TRANSM. COEFF, E or I
CENTER
ORIGIN

2. (35%) On a lossless 50-Ω transmission line terminated with a $Z_L = 120+j100\ \Omega$. If this transmission line is be matched to the load using a shorted load stub. Determine the stub length and distance between the load and stub. Two possible answers. You only need to show one of them.

$z_L = \frac{Z_L}{Z_0} = 2.4 + j2$ point A

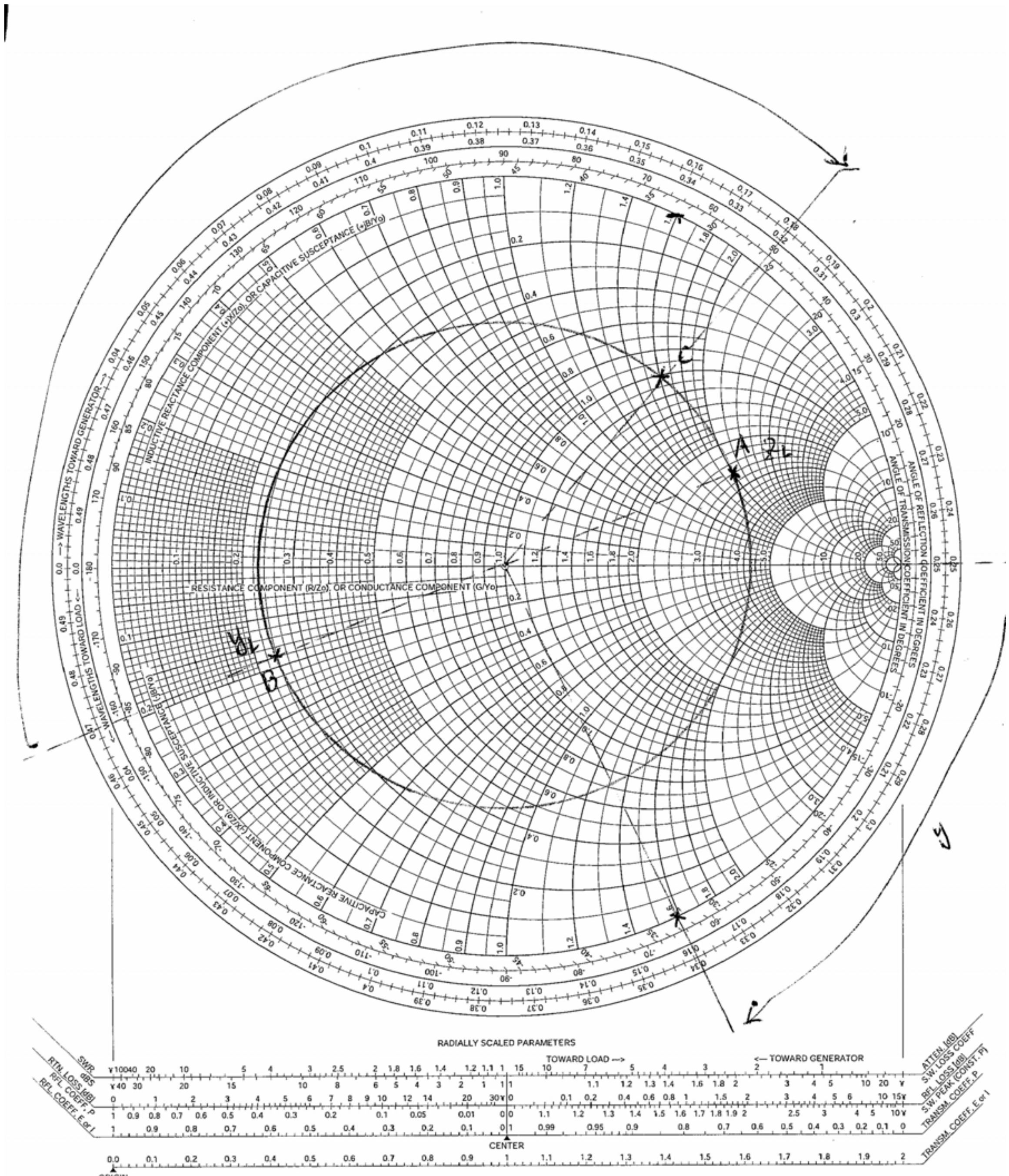
y_L is at point B.

SWR circle and $r_L = 1$ circle point C

distance between the load & stub

$d = 0.18\lambda + 0.5\lambda - 0.47\lambda = 0.21\lambda$

$L = 0.34 - 0.25\lambda = 0.09\lambda$


WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
INDUCTIVE REACTANCE COMPONENT (+jX/Zo), OR CAPACITIVE SUSCEPTANCE (+jB/Yo)
CAPACITIVE REACTANCE COMPONENT (-jX/Zo), OR INDUCTIVE SUSCEPTANCE (-jB/Yo)
RESISTANCE COMPONENT (R/Zo), OR CONDUCTANCE COMPONENT (G/Yo)
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
ANGLE OF TRANSMISSION COEFFICIENT IN DEGREES
A
zL
B
yL
C
RADIALLY SCALED PARAMETERS
TOWARD LOAD —>
<— TOWARD GENERATOR
SWR
dBS
RTN. LOSS [dB]
RFL. COEFF, P
RFL. COEFF, E or I
ATTEN. [dB]
S.W. LOSS COEFF
RFL. LOSS [dB]
S.W. PEAK (CONST. P)
TRANSM. COEFF, P
TRANSM. COEFF, E or I
CENTER
ORIGIN

3. (35%) On a lossless transmission line with characteristic impedance $Z_0 = 50\text{-}\Omega$, the following observation was noted: (1) distance of the first voltage minimum from the load is 4cm; (2) distance from the first voltage maximum from the load is 9cm; (3) S=2. Find Z_L.

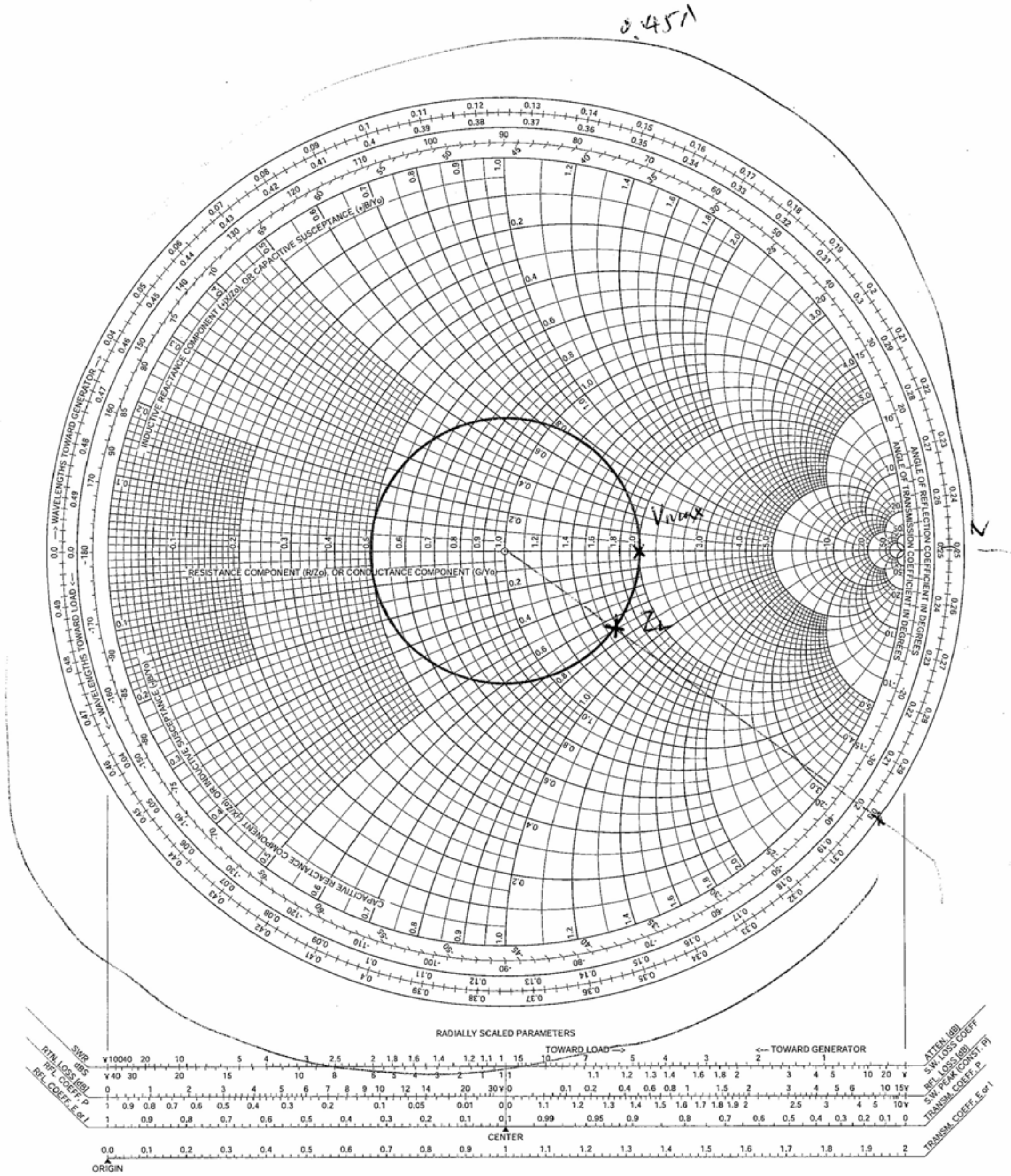
$$\frac{\lambda}{4} = 9\text{ cm} - 4\text{ cm} = 5\text{ cm} \Rightarrow \lambda = 20\text{ cm}$$

distance from Load to the first $V_{max} = 9$

$$= \frac{9}{20} = 0.45\lambda.$$

$$z_L = 1.6 - j0.7$$

$$Z_L = 50 \cdot z_L = 80 - j35\,\Omega$$


0.451
Vmax
ZL
WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
INDUCTIVE REACTANCE COMPONENT (+jX/Zo), OR CAPACITIVE SUSCEPTANCE (+jB/Yo)
CAPACITIVE REACTANCE COMPONENT (-jX/Zo), OR INDUCTIVE SUSCEPTANCE (-jB/Yo)
RESISTANCE COMPONENT (R/Zo), OR CONDUCTANCE COMPONENT (G/Yo)
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
ANGLE OF TRANSMISSION COEFFICIENT IN DEGREES
RADIALLY SCALED PARAMETERS
TOWARD LOAD —>
<— TOWARD GENERATOR
SWR
dBS
RTN. LOSS [dB]
RFL. COEFF, P
RFL. COEFF, E or I
ATTEN. [dB]
S.W. LOSS COEFF
RFL. LOSS [dB]
S.W. PEAK (CONST. P)
TRANSM. COEFF, P
TRANSM. COEFF, E or I
CENTER
ORIGIN