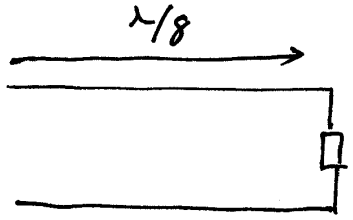
1. (30%) A lossless 50-Ω line λ/8 is terminated in an unknown impedance. If the input impedance is Z_{in} = -j60-Ω. Find the load Z_L.

Solution :



(1) $z_{in} = \frac{Z_{in}}{Z_0} = -j1.2$

(2) Find z_{in} point on Smith chart, point A

read out on WTG Scale 0.36λ

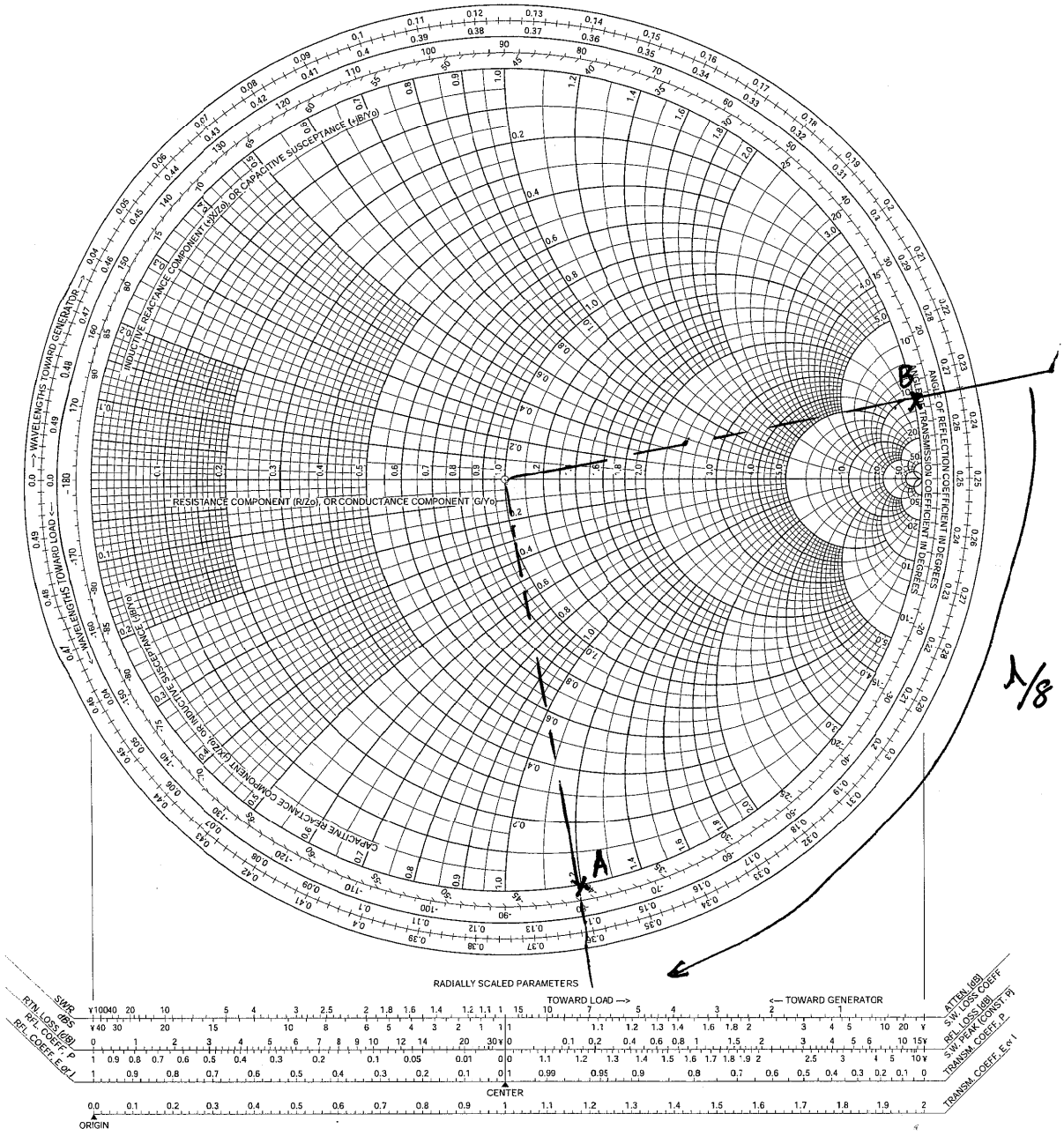
(3) the load should be

$0.36\lambda - 0.125\lambda = 0.235\lambda$

point B on Smith Chart

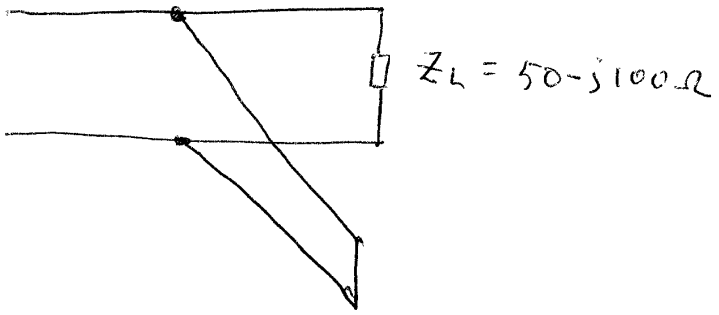
(4) read out Z_L value : j10

(5) $Z_L = z_L \cdot Z_0 = j500\Omega$


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
A
B
λ/8
RADIALLY SCALED PARAMETERS
TOWARD LOAD -->
<-- TOWARD GENERATOR
SWR
dBS
RTN. LOSS (dB)
REFL. COEFF. P
REFL. COEFF. E or I
ATTEN. (dB)
S.W. LOSS COEFF
REFL. LOSS (dB)
S.W. PEAK (CONST. P)
TRANSM. COEFF. E or I
CENTER
ORIGIN

2. (35%) On a lossless 50-Ω transmission line terminated with a Z_L = 50-j100 Ω. 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.

Solution:



(1) normalize : $Z_L = \frac{Z_L}{Z_0} = 1-j2$, point A

(2) Find the admitance point B.

(3). Find out Cross section of the SWR circle & the $r_L = 1$ Circle, point C

(4) read out $d = 0.186\lambda - 0.062\lambda = 0.124\lambda$

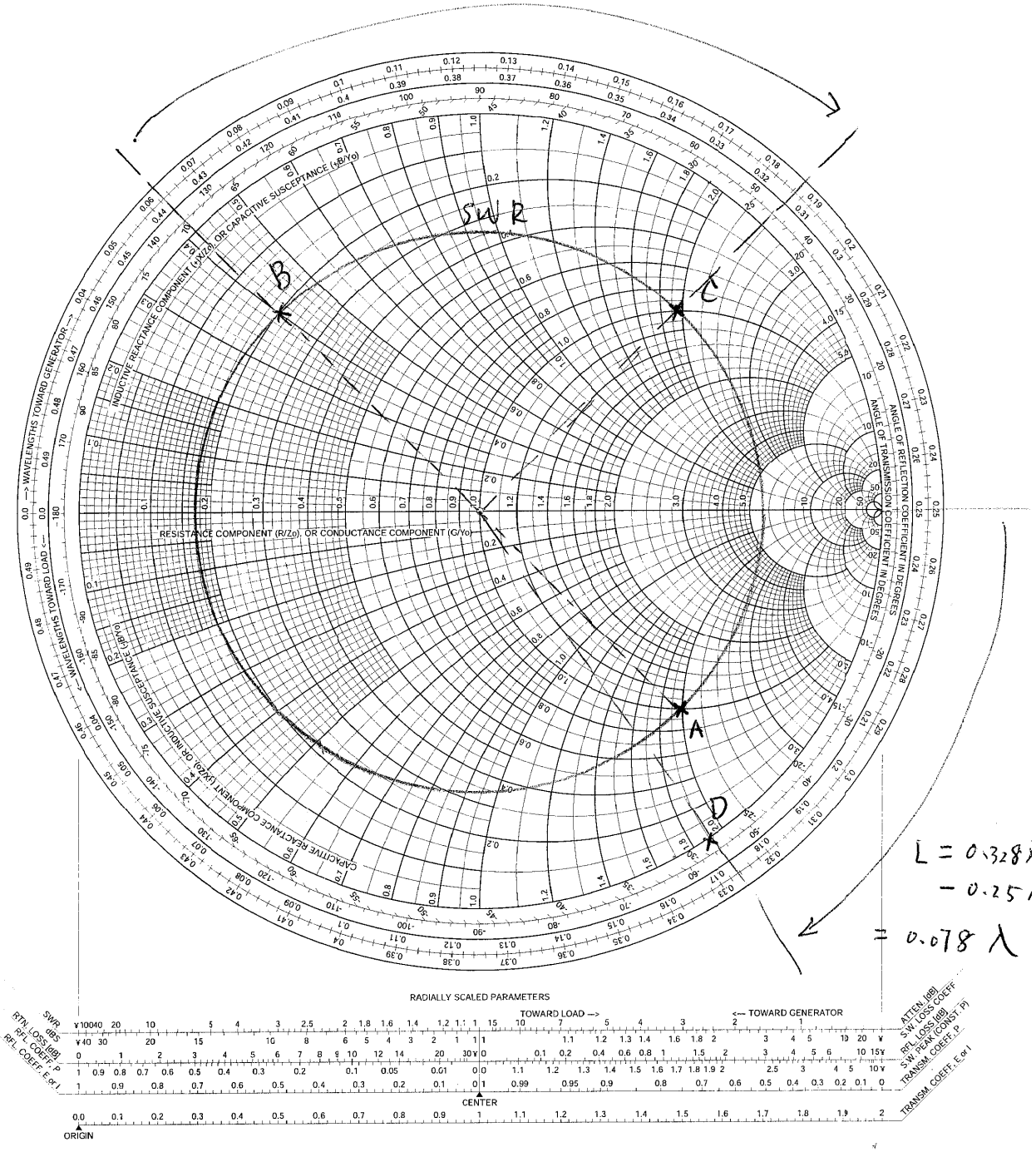
(5) read out X_L Value of Point C, j1.9

(6) Find the negative of point C, -j1.9, Point D

(7) read out $l = 0.328\lambda - 0.250\lambda$

$= 0.078\lambda$

$d = 0.186\lambda - 0.062\lambda = 0.124\lambda$



$L = 0.328\lambda$

$- 0.250\lambda$

$= 0.078\lambda$

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 5cm; (2) distance from the first voltage maximum from the load is 9cm; (3) S=4. Find Z_L.

Solution: (1) distance between $|V|_{max}$ & $|V|_{min} = 9\,cm - 5\,cm = 4\,cm$

$\Rightarrow \frac{\lambda}{4} = 4\,cm, \quad \lambda = 16\,cm$

(2) $S = 4$. draw SWR circle

(3) Mark the $|V|_{min}$ point, A

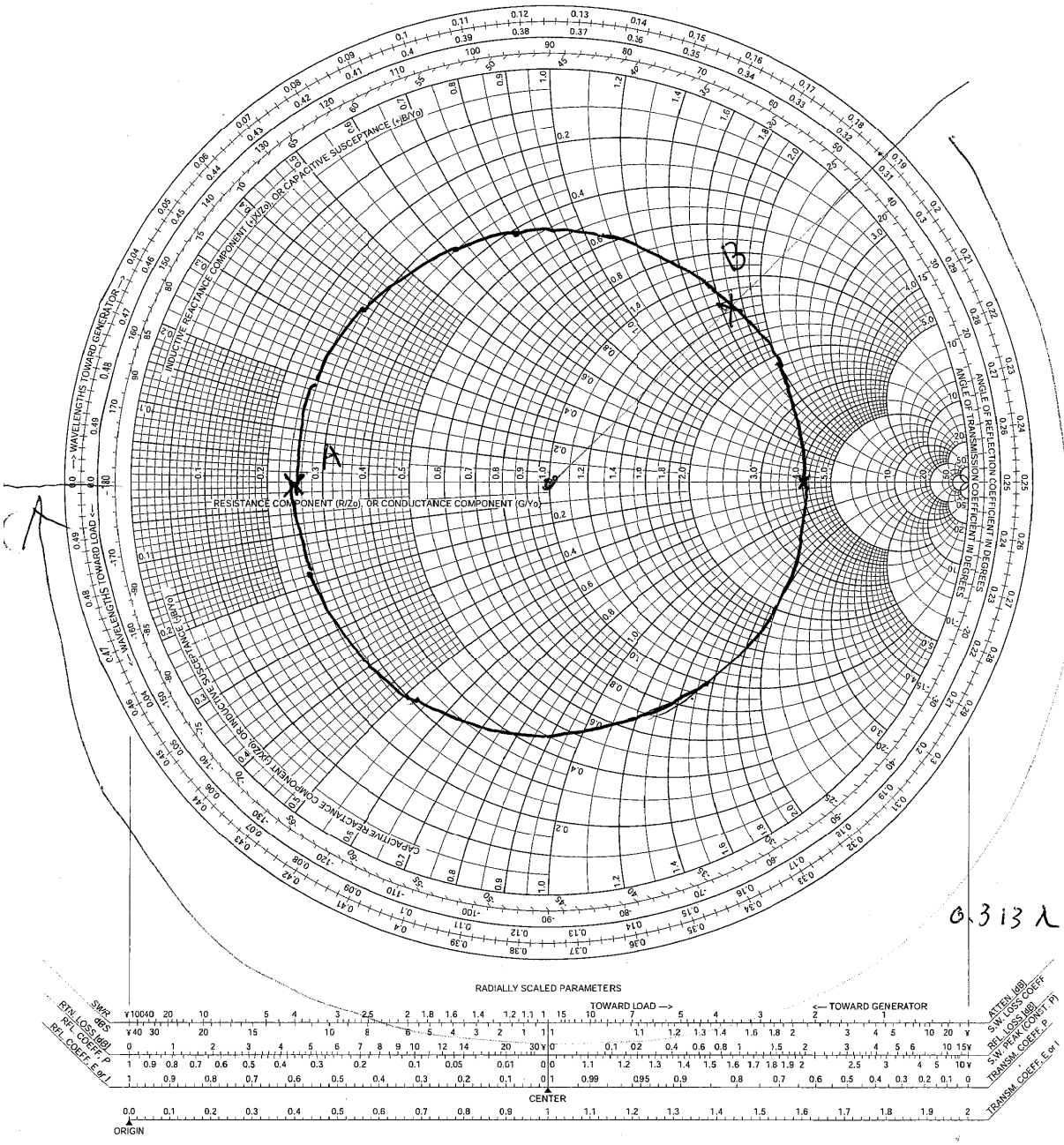
(4) $|V|_{min}$ point is $\frac{5}{16}\lambda$ from the load 0.313λ from the load.

(5) the load is at ~~0.313λ − 0~~

$0.5\lambda - 0.313\lambda = 0.187\lambda$ point B

(6) read out z_L @ B : $Z_L = 1.3 + j1.7$

(7) $Z_L = Z_0 \cdot z_L = 65 + j85\ \Omega$


A
B
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)
REFL. COEFF. E or I
REFL. COEFF. P
ATTEN (dB)
S.W.R. LOSS COEFF
REFL. LOSS (dB)
S.W. PEAK (CONST. P)
TRANSM. COEFF. P
TRANSM. COEFF. E or I
CENTER
ORIGIN

0.313 λ