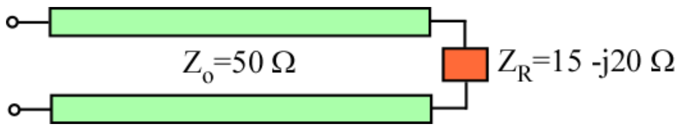
Smith Chart



Find

1) Reflection coefficient at load

$$z_R = 0.3 - j0.4 \Rightarrow \Gamma_R = 0.6e^{j227°}$$

2) SWR on the line

SWR=4.0

3) d_{min}

$$d_{min} = (0.5 - 0.435)\lambda = 0.065\lambda$$

4) Line impedance at 0.05λ to the left

$$50(0.26 - j0.09) = 13 - j4.5\Omega$$

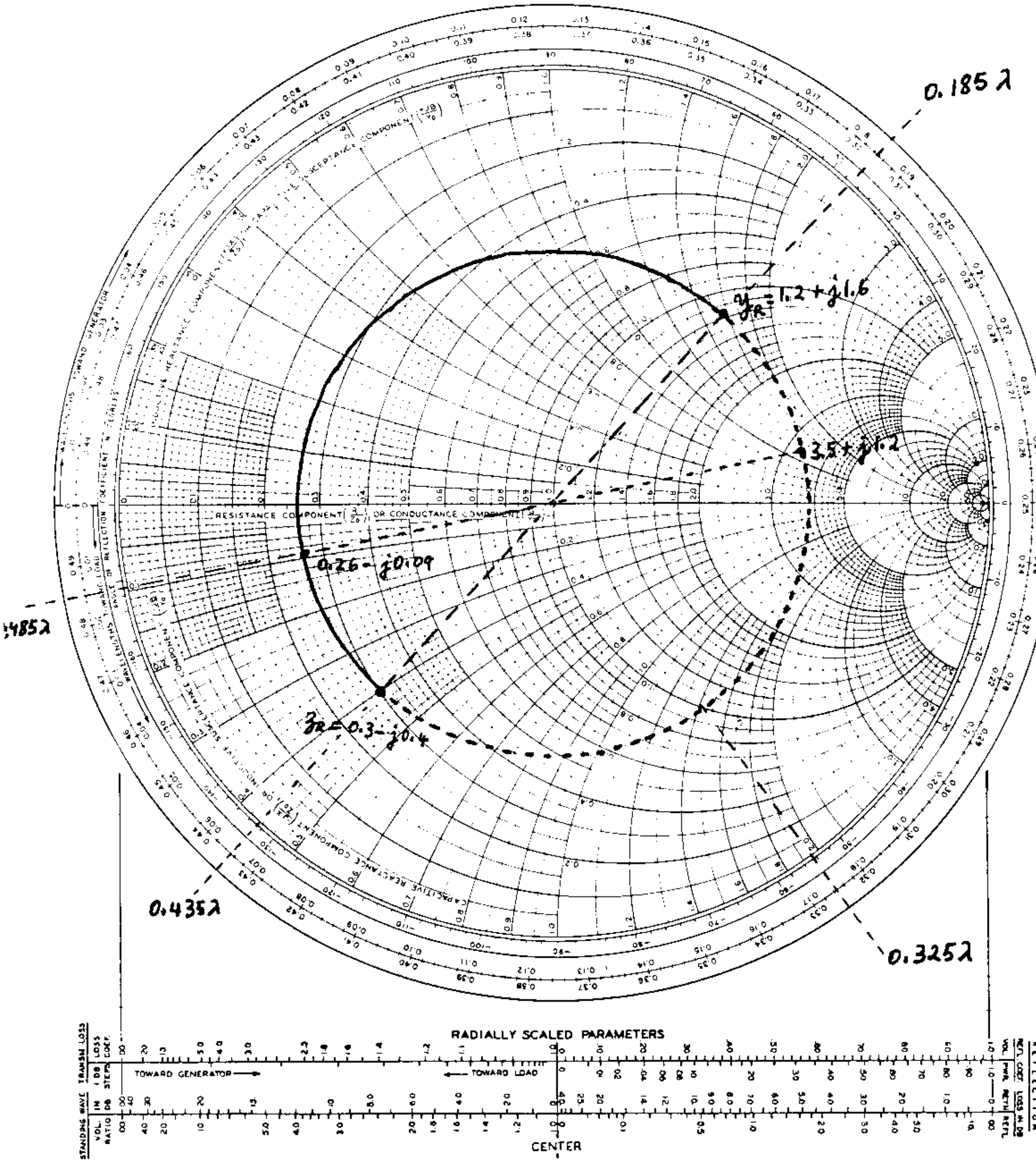
5) Line admittance at 0.05λ

$$(3.5 + j1.2)/50 = 0.068 + j0.025\ \mho$$

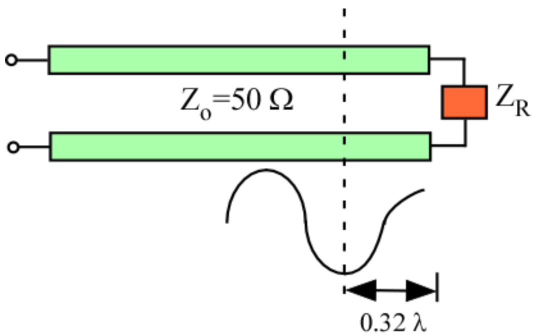
6) Location nearest to load where Real[y]=1

$$0.14\lambda = 0.325\lambda - j0.185\lambda = 0.14\lambda$$

IMPEDANCE OR ADMITTANCE COORDINATES



VSW minimum occurs at 0.30λ from the termination of a lossless 50-Ω line. Find angle of reflection coefficient



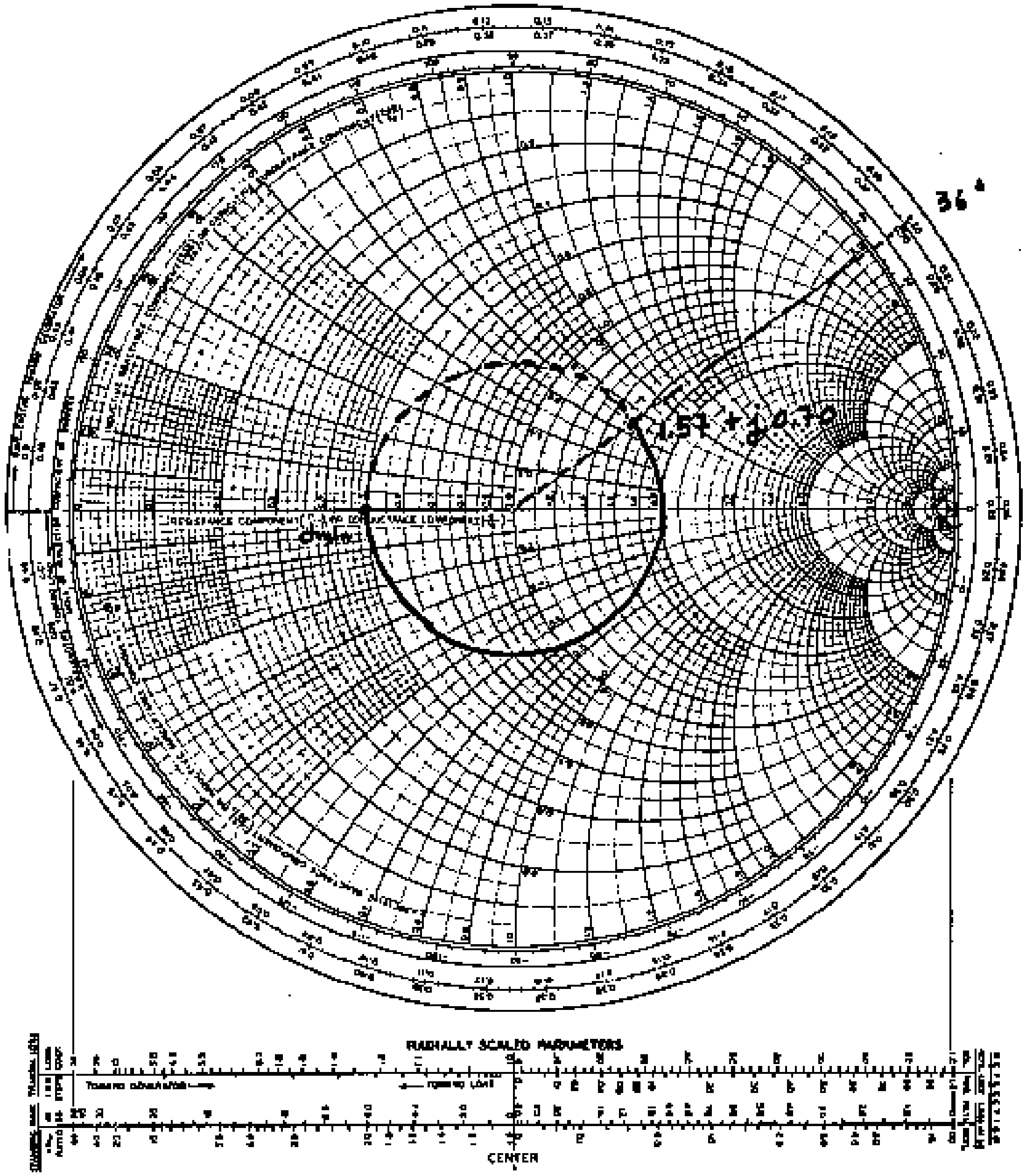
Answer: 36°

If the VSWR is 2.0 what is z_R?

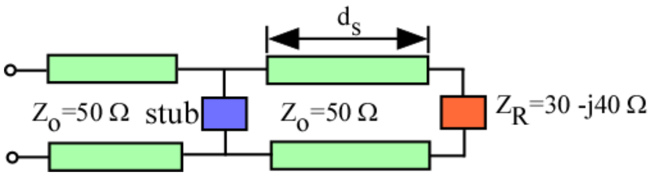
Answer: z_R =1.57+j0.7

Problem 2

IMPEDANCE OR ADMITTANCE COORDINATES



Single Stub



Find location and length of stub

$z_R = Z_R/50 = 0.6 - j0.8$

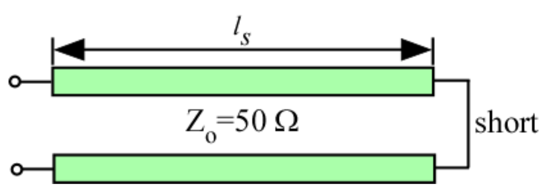
$y_R = 0.6 + j0.8$

First Method

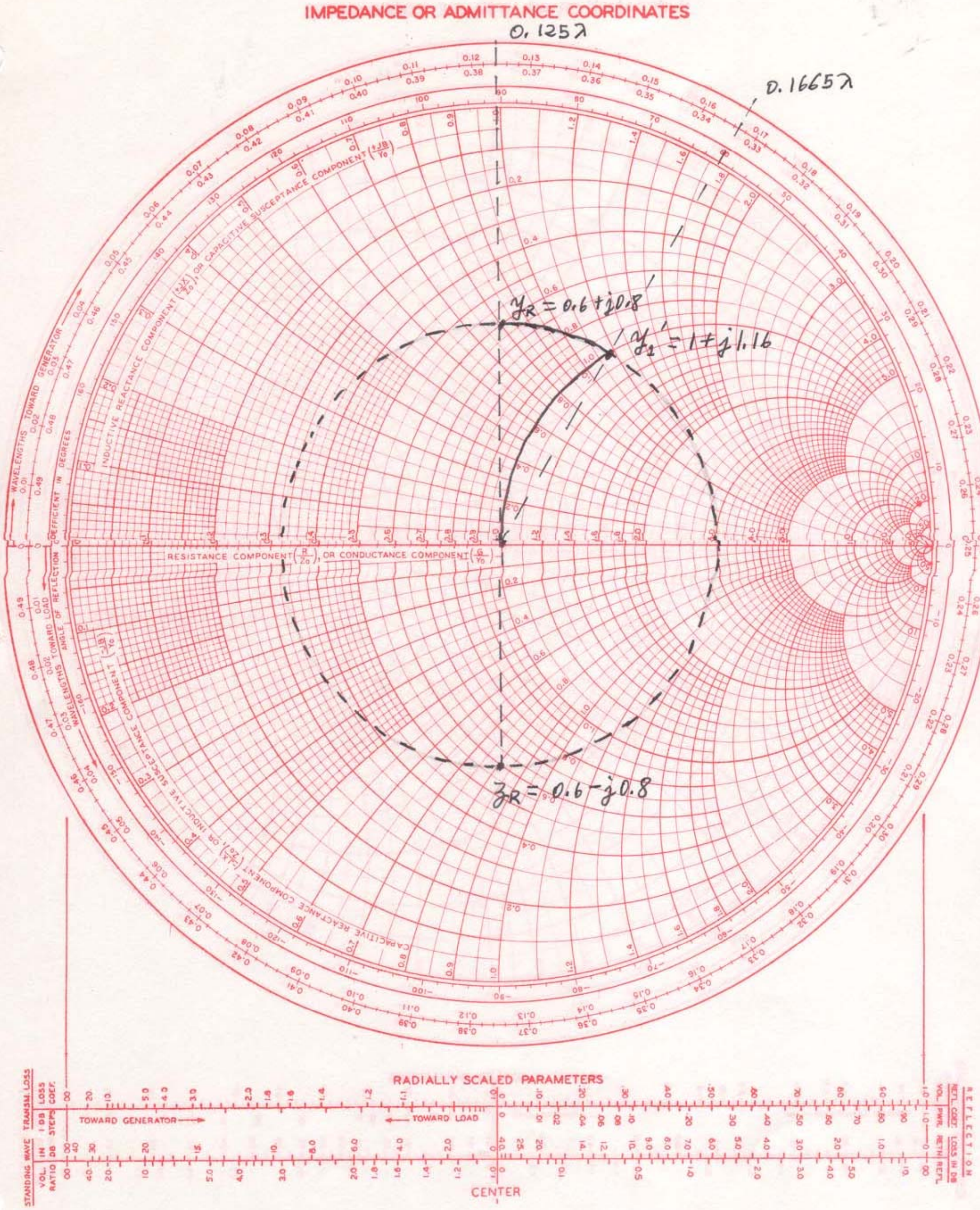
Rotate on constant VSWR circle from 0.125λ to 0.1665λ until intersection with unit conductance circle at $y_1' = 1 + j1.16$. Distance $d_s = (0.1665\lambda - 0.125\lambda) = 0.0415\lambda$ Move toward center of chart. Change in susceptance: j(0-0.16)=-j1.16

The length of the stub is such that

$$\frac{1}{tan\beta l_s} = -1.16 \text{ or } l_s = (0.363 - 0.25)\lambda = 0.113\lambda$$

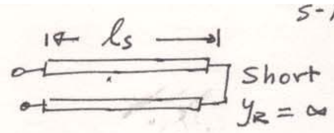


Single Stub
1st method.

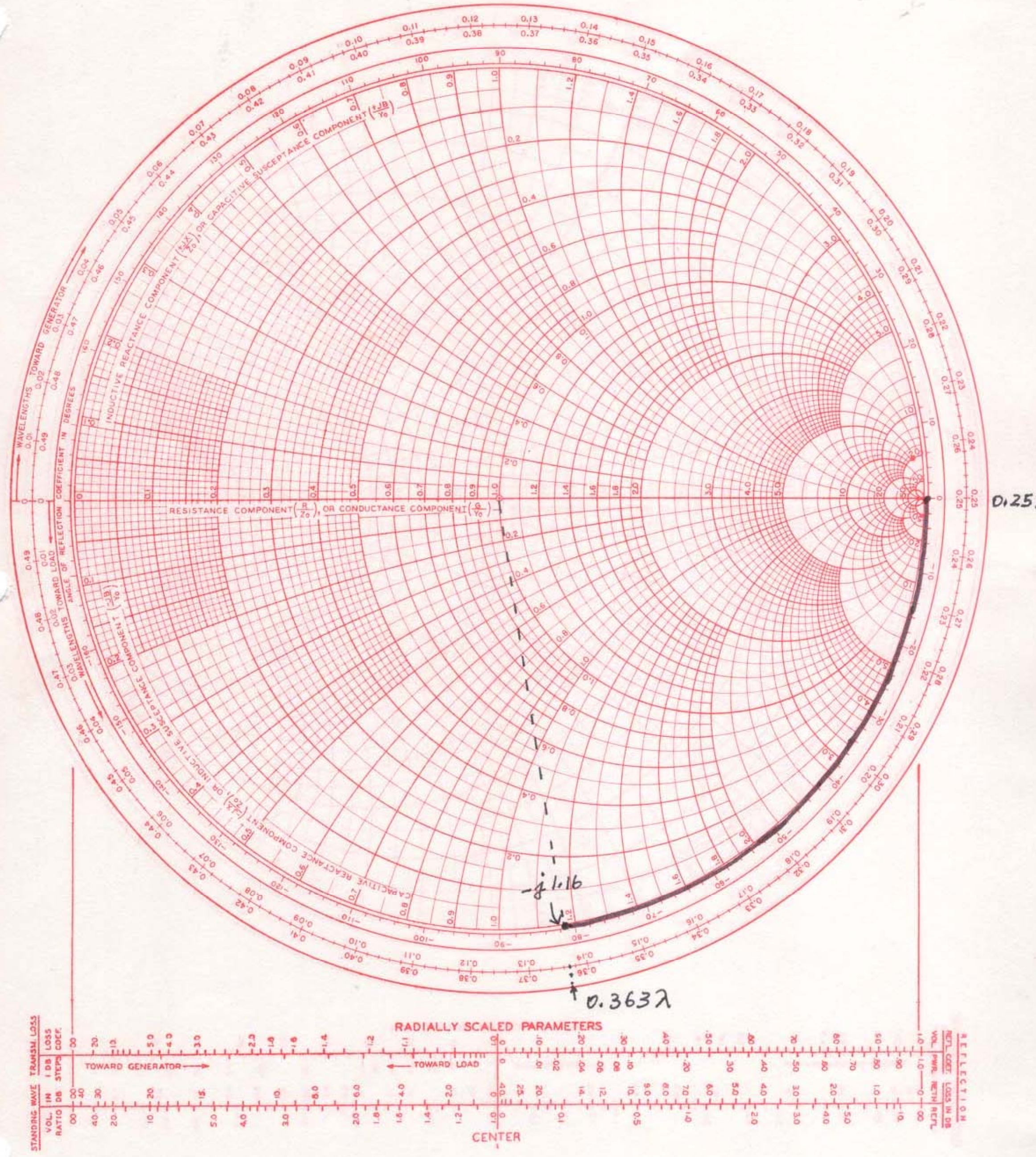


STUB

Determining length of stub



IMPEDANCE OR ADMITTANCE COORDINATES



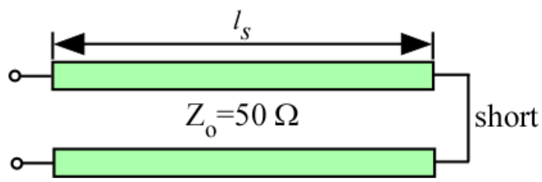
Second Method

y_R = 0.6+j0.8

Rotate on constant VSWR circle from until intersection with unit conductance circle at 0.335λ at $y_1' = 1 - j1.16$. $d_s = (0.335\lambda - 0.125\lambda) = 0.210\lambda$ Move toward center of chart.

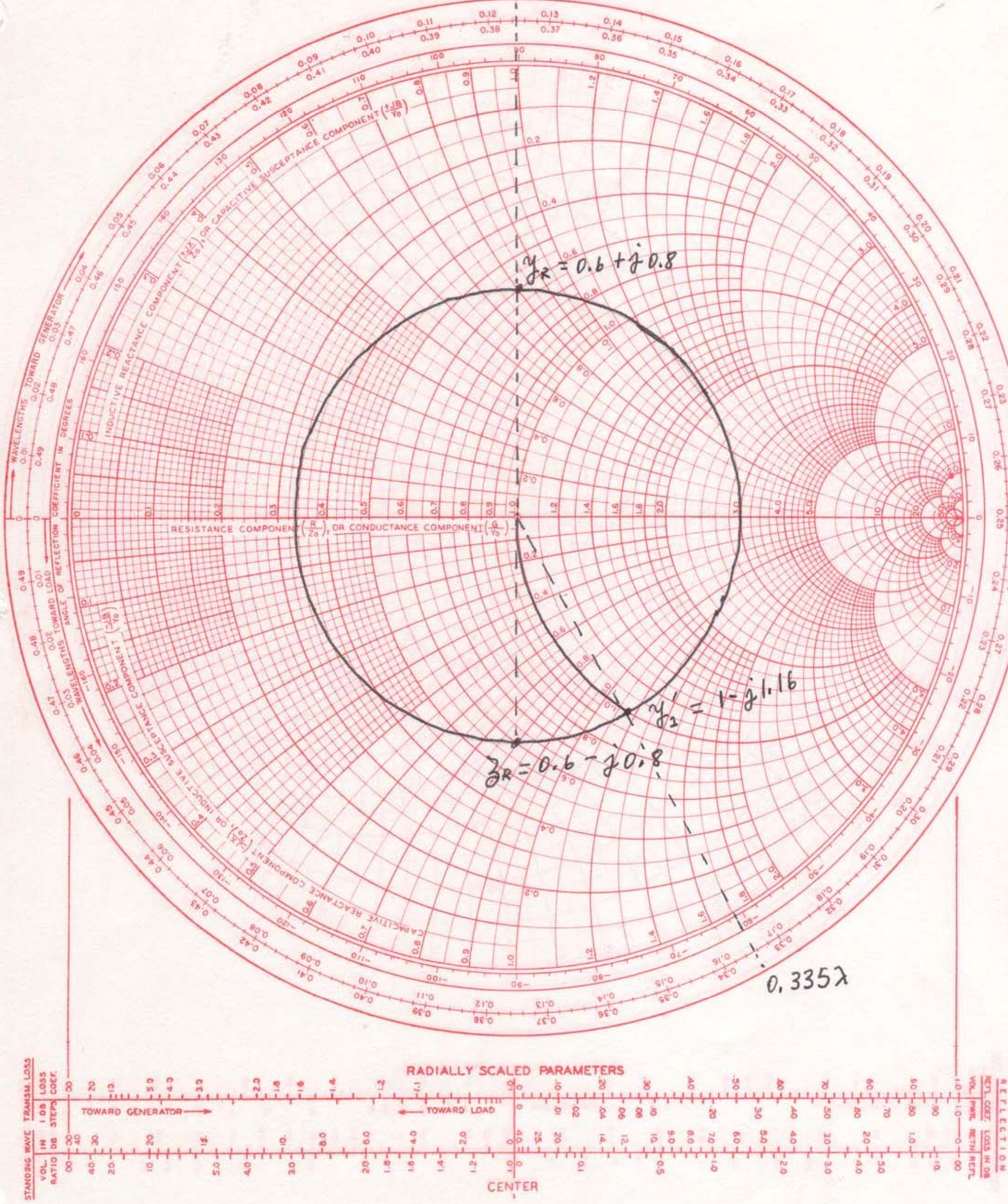
Change in susceptance: is +j1.16. Therefore, the length of the stub is such that

$$\frac{1}{tan\,\beta l} = +1.16 \text{ or } l_s = (0.632 - 0.25)\lambda = 0.382\lambda$$



2nd Method.
Single stub.

IMPEDANCE OR ADMITTANCE COORDINATES

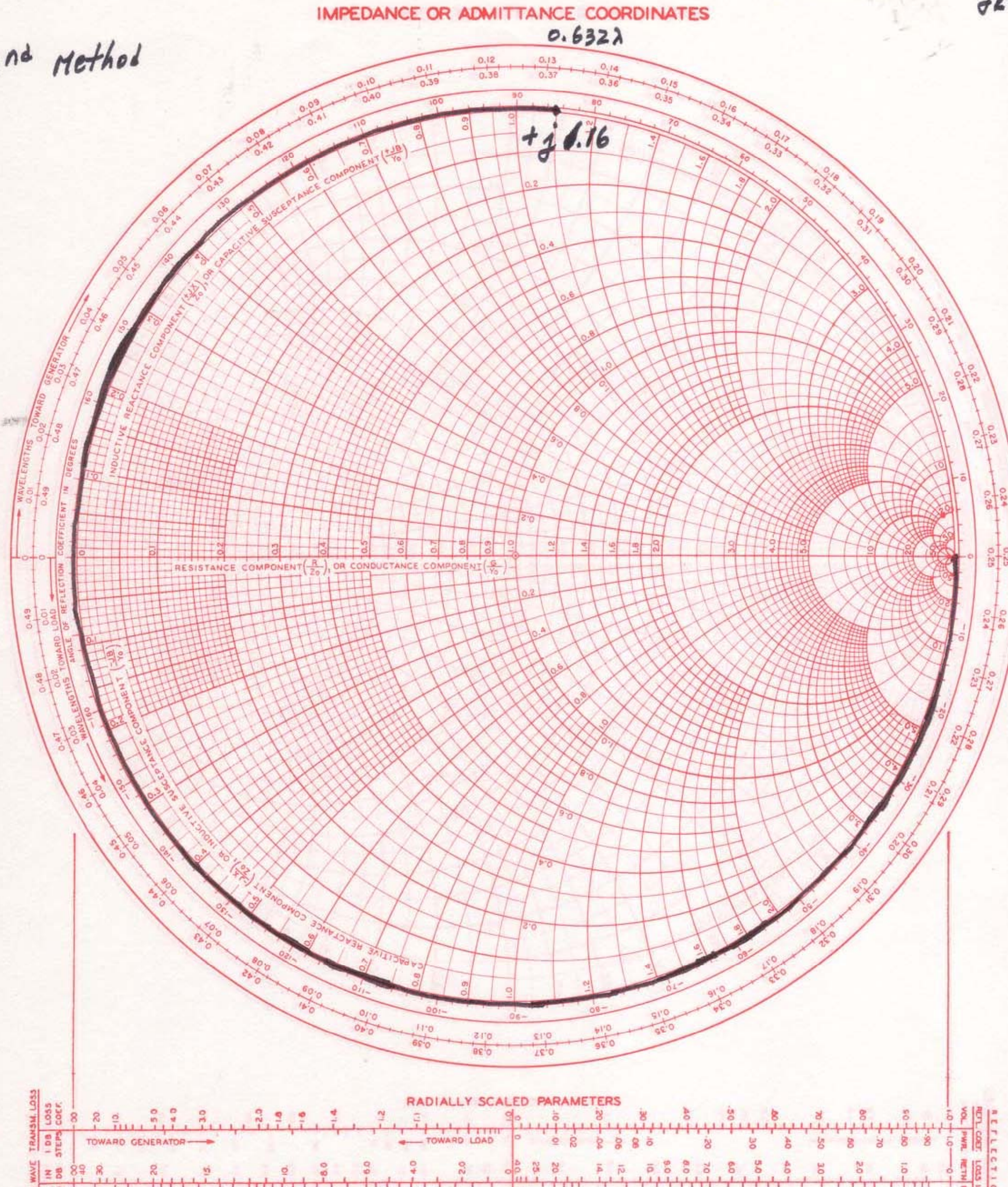


STUB

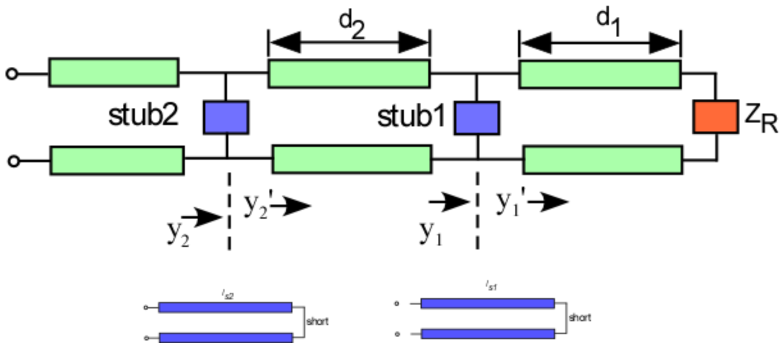
determining length of stub

5-14A

2nd Method



Analysis of double stub



1) Get y_R from Z_R

2) Rotate on constant VSWR circle by d_1 to get y_1'

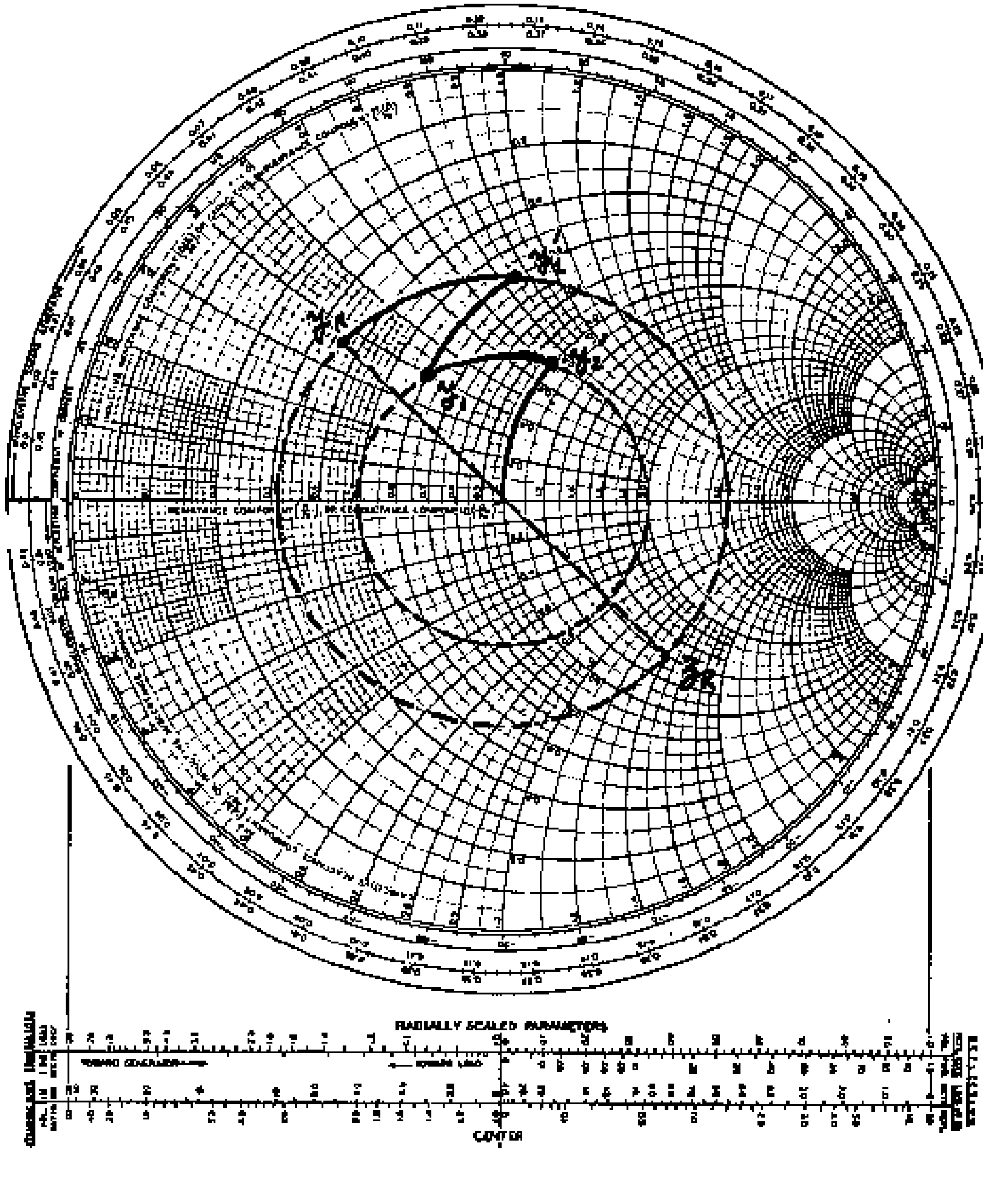
3) Move on constant g circle by susceptance of stub1 to get to $y_{1.}$

4) Rotate on constant VSWR circle by d_2 until intersection with g =1 circle.

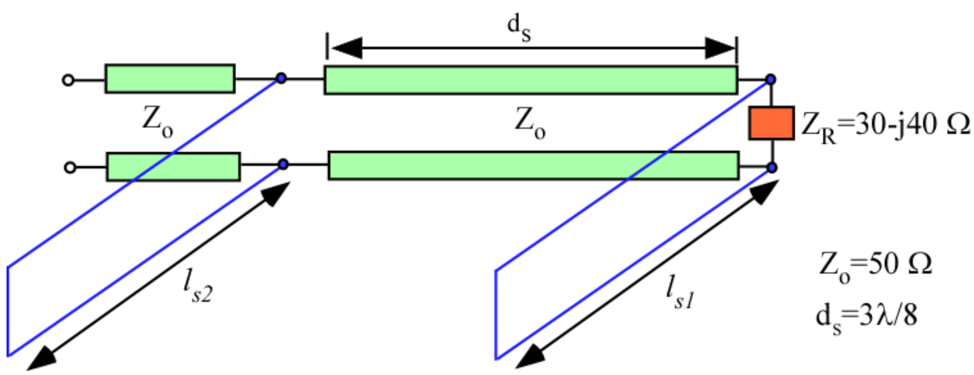
5) Move toward center of chart.1

Double-stub circuit (Generalization)

IMPEDANCE OR ADMITTANCE COORDINATES



Double Stub – Example 1

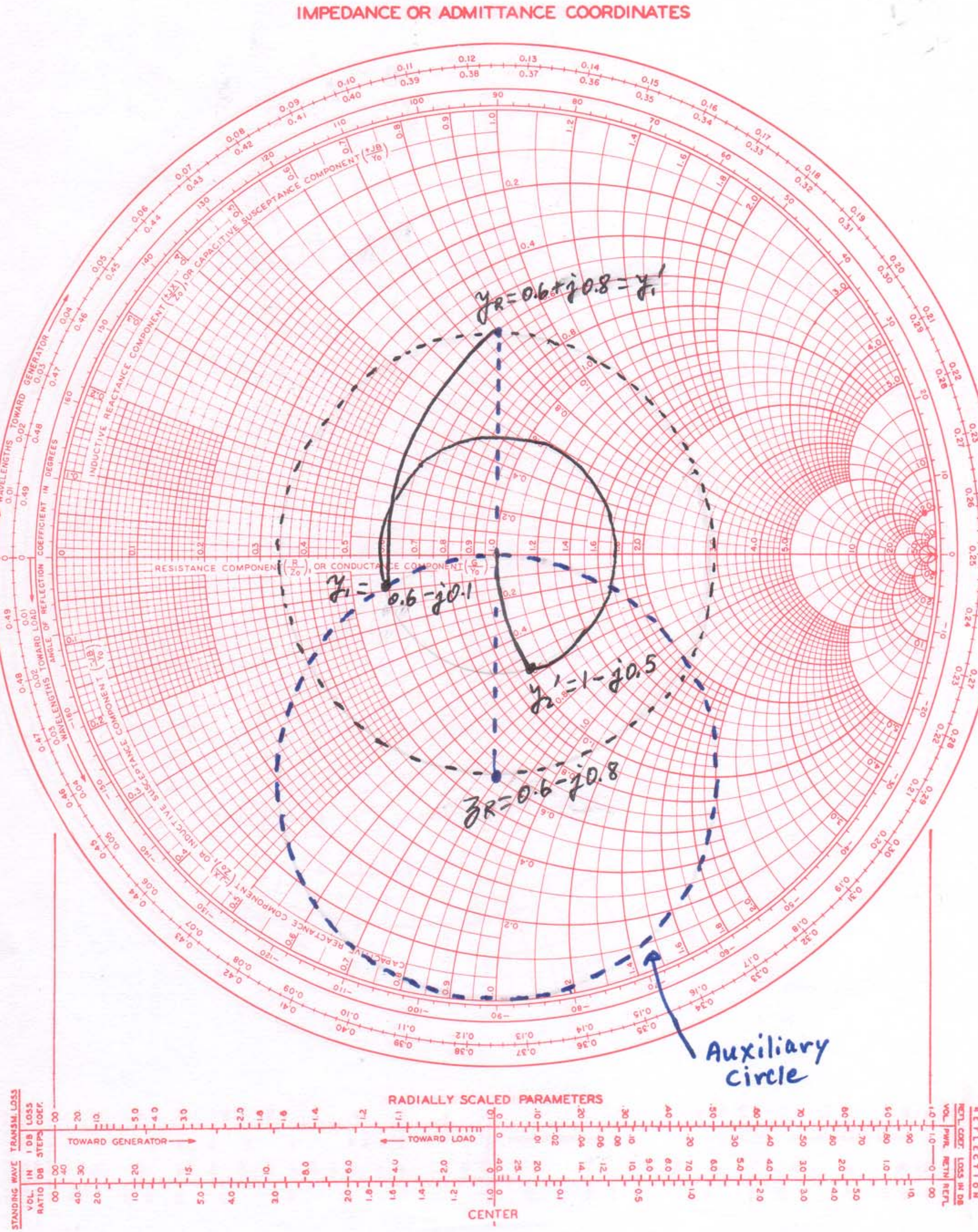


Find l_{s1} and l_{s2}

$$z_R = (30 - j40)/50 = 0.6 - j0.8$$

1st Solution	**2nd Solution**
1) Convert to y_R by rotating by 180 degrees. $y_R = 0.6 + j0.8$ (y_R=y_1' since d_1=0) 2) Draw auxiliary circle (g=1 circle rotated by 3λ/8) 3) Auxiliary circle intersects g=0.6 circle at 0.6-j0.1=y_1. 4) Rotate by 3λ/8 until intersection at g=1 circle; y_2'=1-j0.5. 5) Move along constant conductance circle until center. Calculate l_{s1}: $\frac{1}{j\tan\beta l_{s1}} = j(-0.1-0.8) = -j0.9$ $l_{s1} = (0.384-0.25)\lambda = 0.134\lambda$ $\frac{1}{j\tan\beta l_{s2}} = j[0-(-0.5)] = +j0.5$ $l_{s2} = (0.574-0.25)\lambda = 0.324\lambda$	1) Convert to y_R by rotating by 180 degrees. $y_R = 0.6 + j0.8$ (y_R=y_1' since d_1=0) 2) Draw auxiliary circle (g=1 circle rotated by 3λ/8) 3) Auxiliary circle intersects g=0.6 circle at 0.6-j1.9=y_1. 4) Rotate by 3λ/8 until intersection at g=1 circle; y_2'=1+j2.5. 5) Move along constant conductance circle until center. Calculate l_{s1}: $\frac{1}{j\tan\beta l_{s1}} = j(-1.9-0.8) = -j2.7$ $l_{s1} = (0.307-0.25)\lambda = 0.057\lambda$ $\frac{1}{j\tan\beta l_{s2}} = j[0-2.5] = -j2.5$ $l_{s2} = (0.31-0.25)\lambda = 0.06\lambda$

S-18

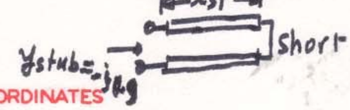


IMPEDANCE OR ADMITTANCE COORDINATES
$y_R = 0.6 + j0.8 = y_1'$
$y_1 = 0.6 - j0.1$
$y_2' = 1 - j0.5$
$z_R = 0.6 - j0.8$
Auxiliary Circle
RADIALLY SCALED PARAMETERS
TOWARD GENERATOR
TOWARD LOAD
CENTER

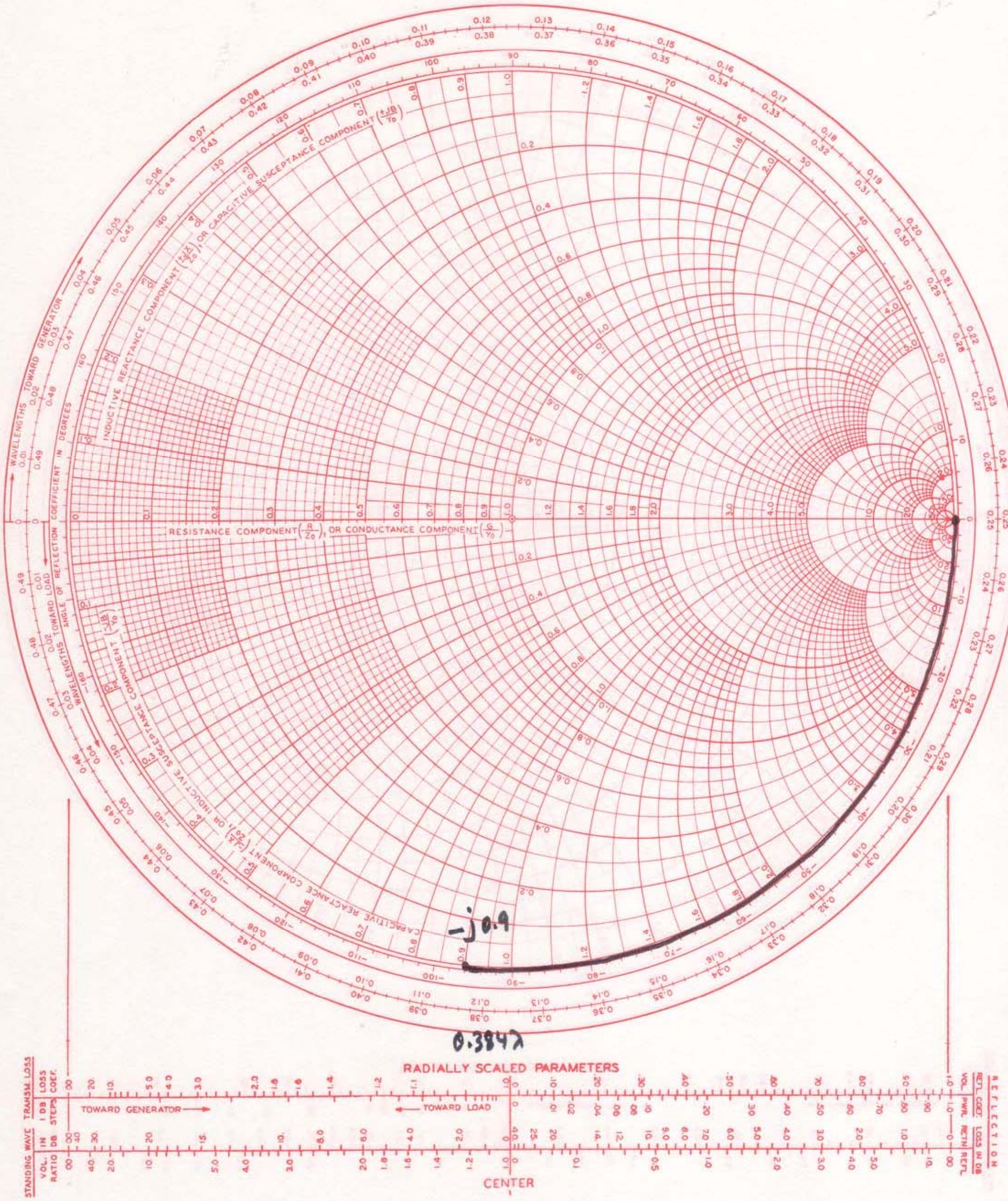
1st Method

Determining length of 1st stub

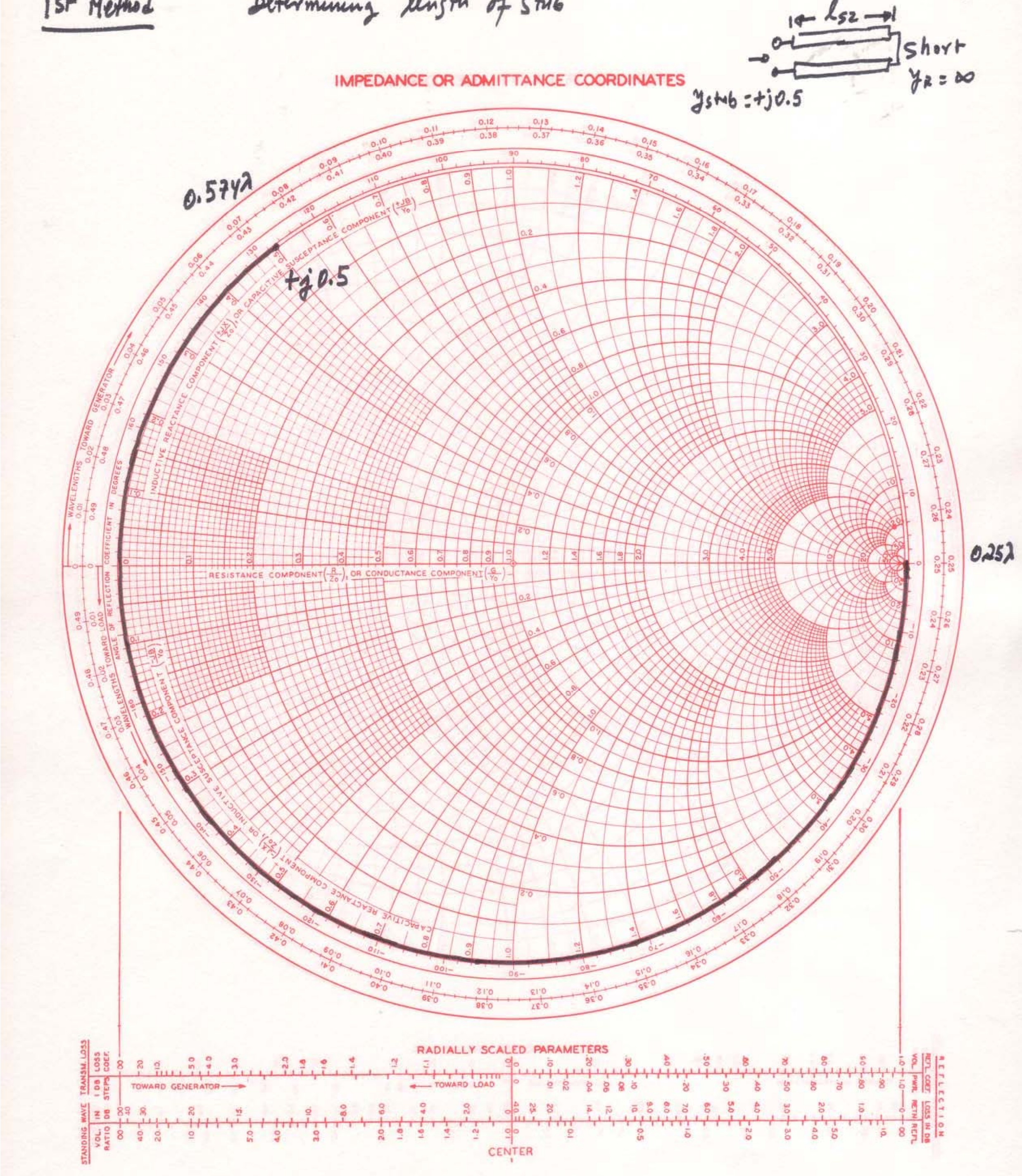
S-18A



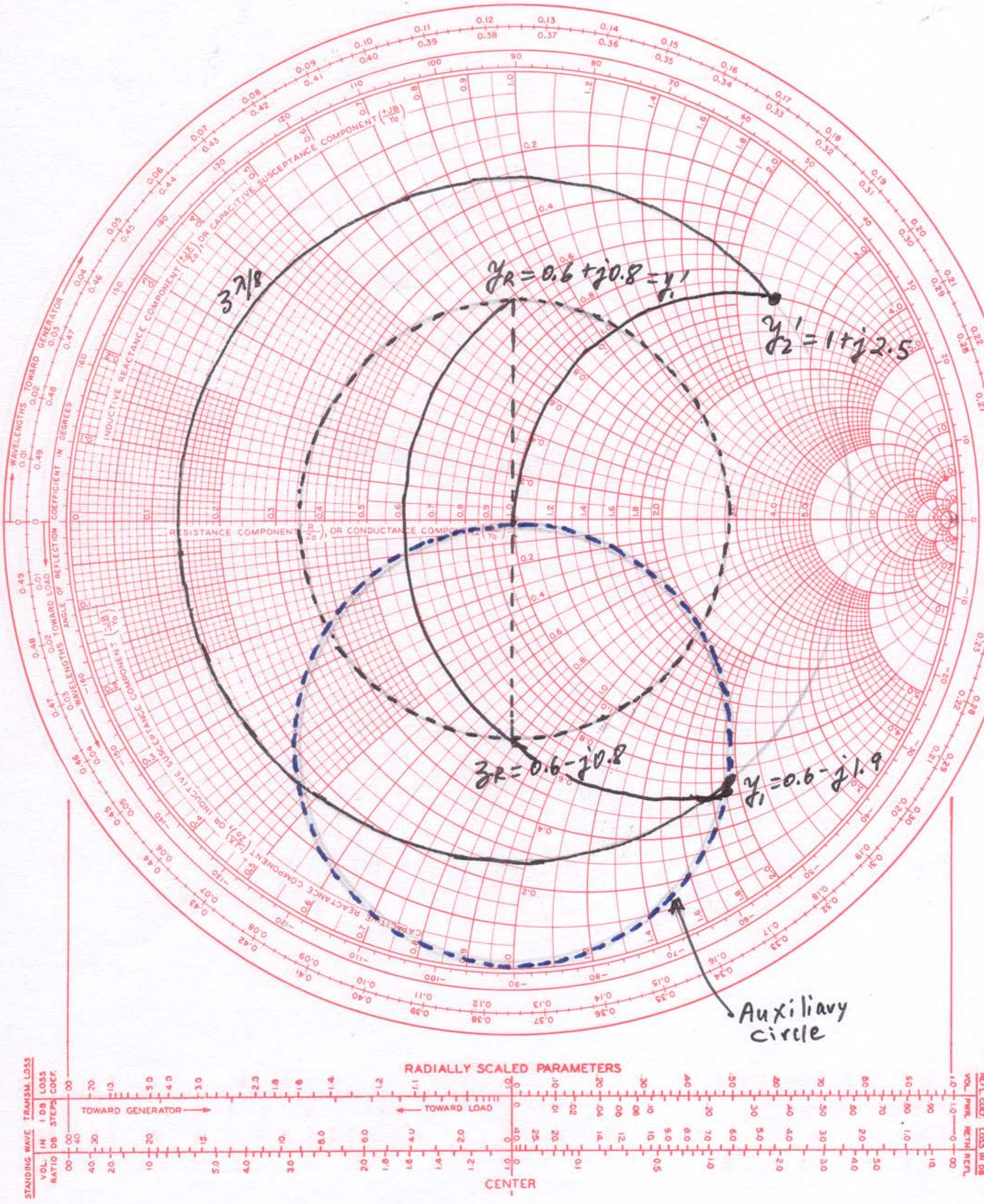
IMPEDANCE OR ADMITTANCE COORDINATES



1st Method   Determining length of 2nd Stub   5-18B

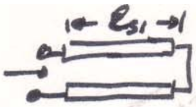


IMPEDANCE OR ADMITTANCE COORDINATES

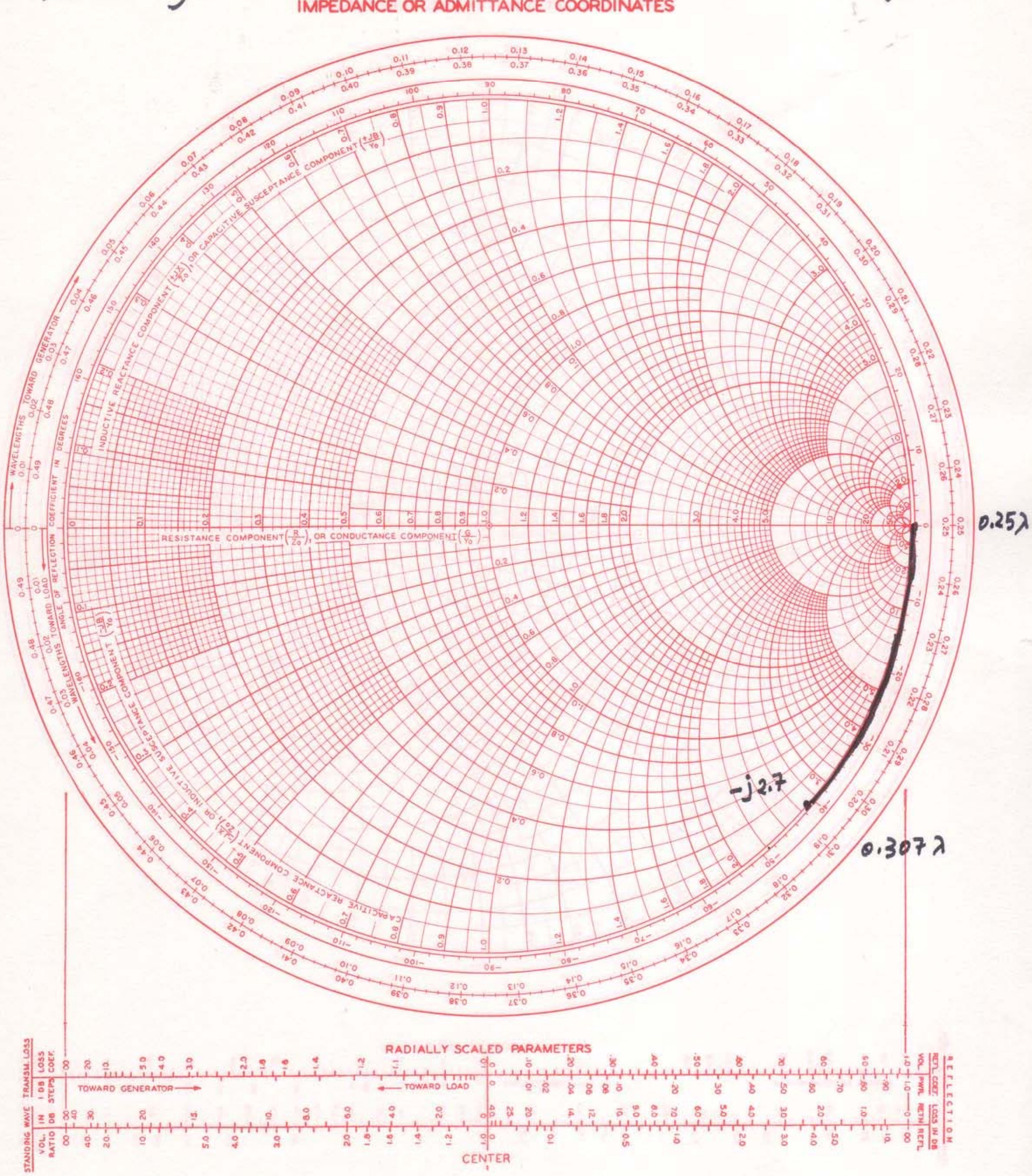


2^{nd} Method

Determining length of 1st Stub $\quad y_{stub} = -j2.7$



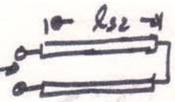
S-14A

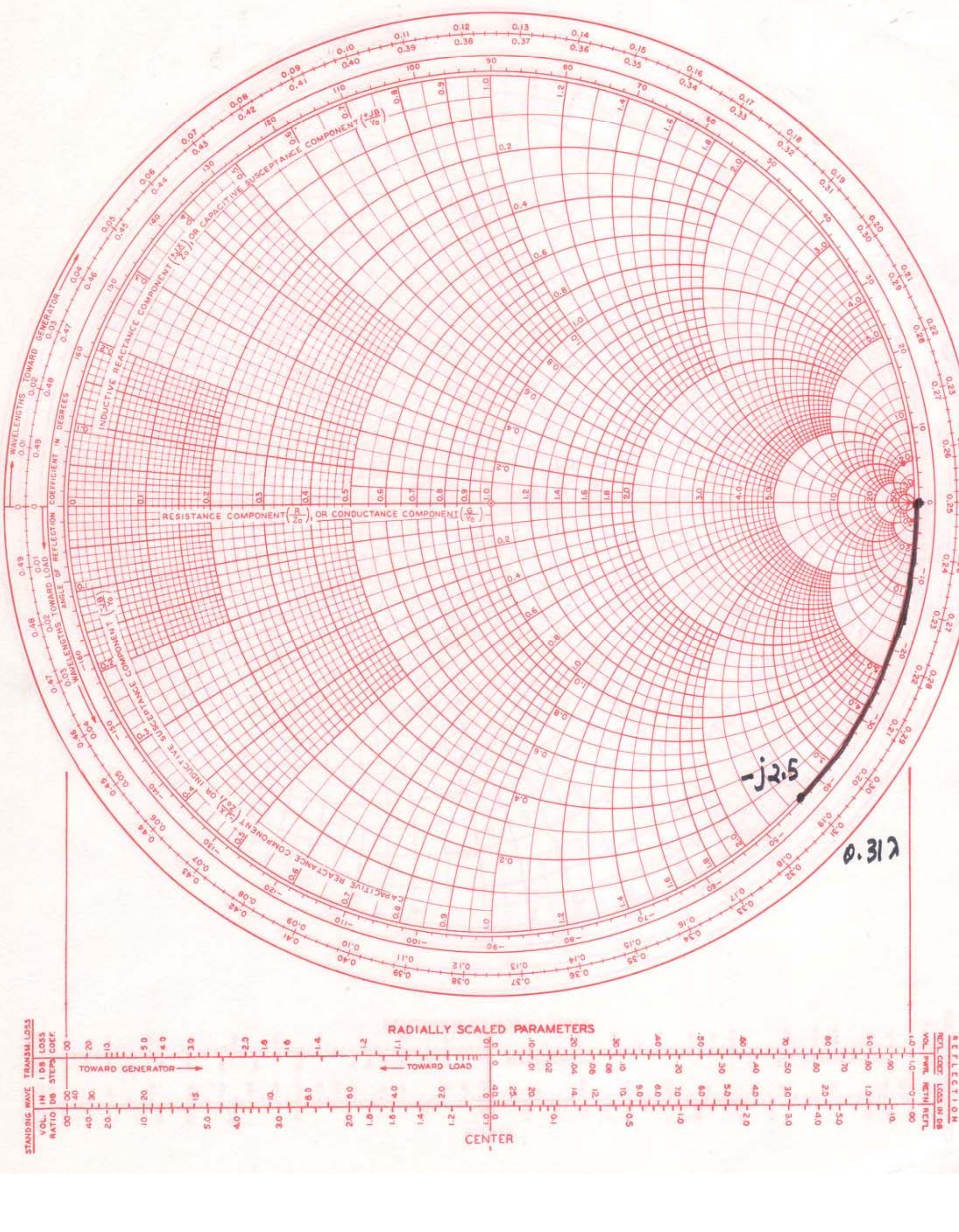


2nd Method

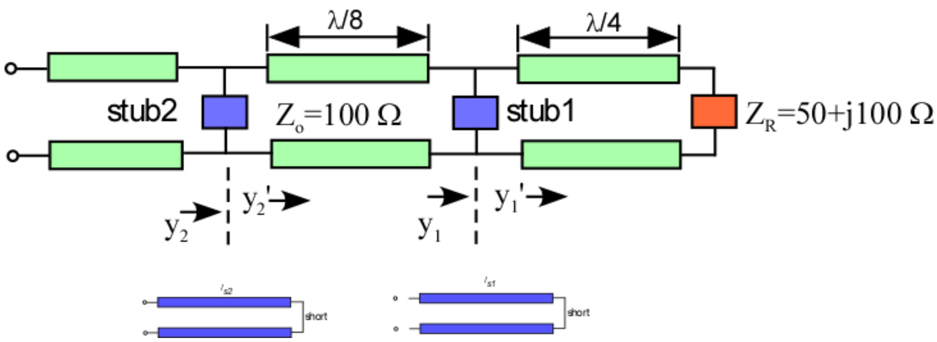
5-14B

Determining length of 2nd Stub $y_{stub} = -j2.5$





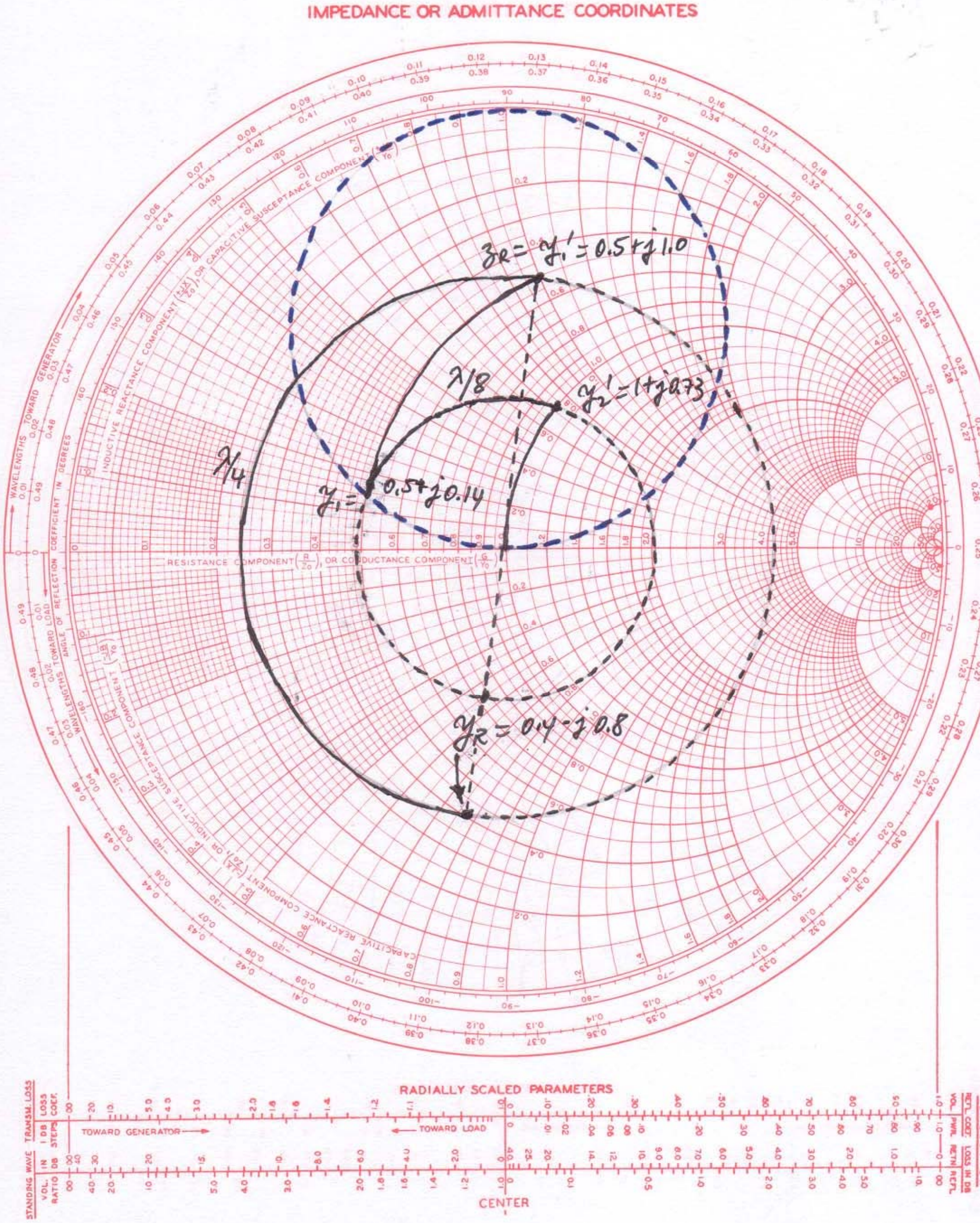
Double Stub – Example 2



Find l_{s1} and l_{s2}

$$z_R = (50 + j100)/100 = 0.5 + j1.0$$

1) Normalize admittance, $y_R = 0.4 - j0.8$
2) Rotate by λ/4 toward source $y_1' = 0.5 + j1.0$
3) Draw auxiliary circle (g=1 circle rotated by λ/8)
4) Auxiliary circle intersects g = 0.5 circle at y_1 = 0.5+j0.14.➔ $change = j(0.14 - 1.0) = -j0.86$,
5) Add stub $(0.388 - 0.25)\lambda = 0.138\lambda$
6) Rotation by λ/8 must end on g = 1 circle, $y_2' = 1 + j0.73$
7) Add stub2 such that $\dfrac{1}{j\,tan\,\beta l_{s2}} = -j0.73$
8) $l_{s2} \simeq (0.4 - 0.25)\lambda = 0.15\lambda$


IMPEDANCE OR ADMITTANCE COORDINATES
$z_R = y_1' = 0.5+j1.0$
$\lambda/8$
$y_2' = 1+j0.73$
$\lambda/4$
$y_1 = 0.5+j0.14$
$y_R = 0.4-j0.8$
RADIALLY SCALED PARAMETERS
TOWARD GENERATOR
TOWARD LOAD
CENTER