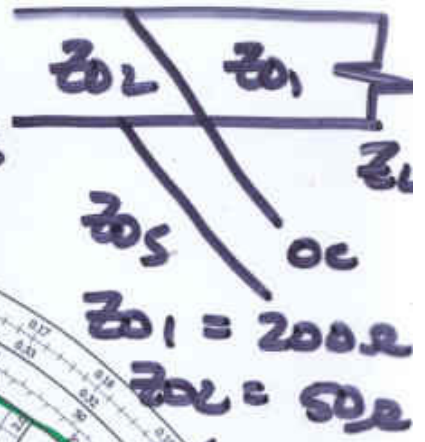


①  $Z_L = 300 + j300 \Omega$  UNEQUAL  
 $Z_{01} = 200 \Omega$   
 $Z_L = 1.5 + j1.5$   
 The Complete Smith Chart  
 Black Magic Design LINES



② MATCH CIRCLE

$a = Y_{02}/Y_{01}$   
 $= 200/50$   
 $= 4$

CANT DO...

①  $Z_{01} = 200 \Omega$

$B_L = 3 + j3$

② CIRCLE

$a = 100/50$

$= 2$

③  $jX = j2.8$

Denorm by

LINE 1

$Y_L' = (2 + j2.8) \cdot Y_{01}$

$= .02 + j0.28 \Omega^{-1}$

Renorm by stub

$Z_{0s} = 25 \Omega$

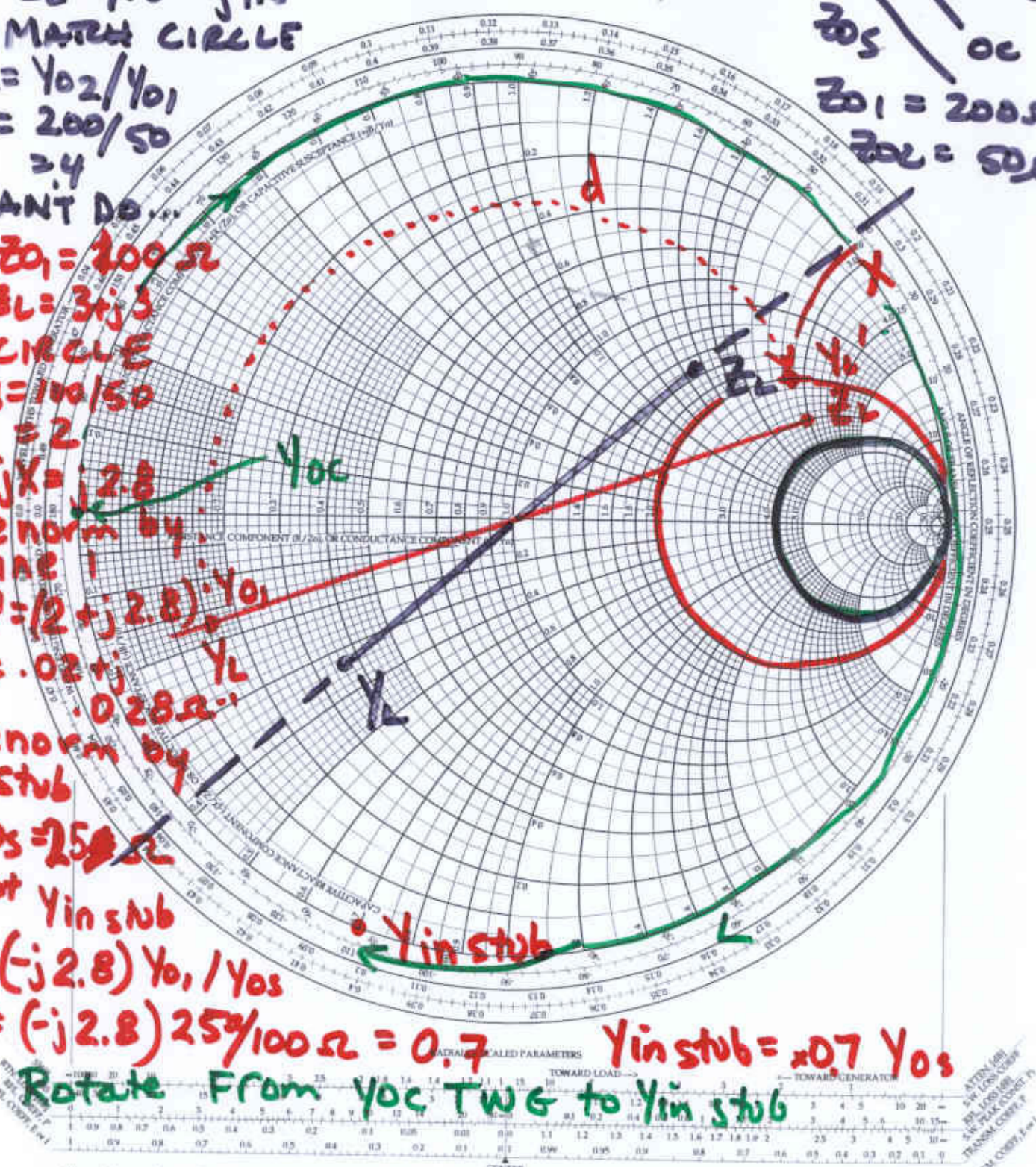
Plot  $Y_{in stub}$

$= (-j2.8) Y_{01} / Y_{0s}$

$= (-j2.8) 25 / 100 \Omega = 0.7$   $Y_{in stub} = \times 0.7 Y_{0s}$

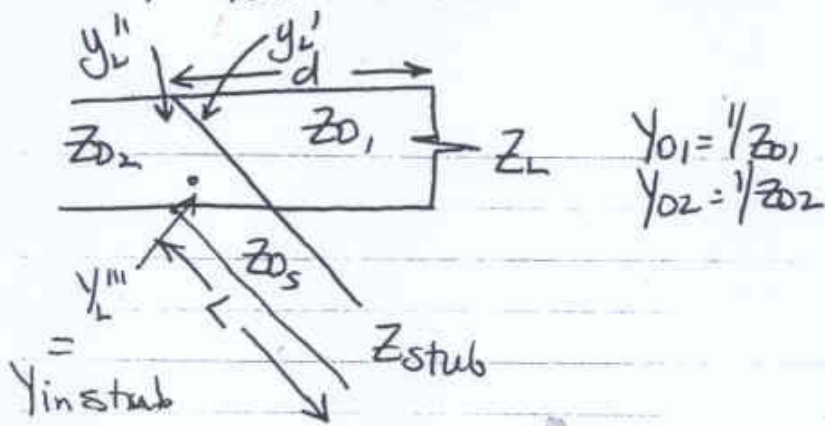
Rotate From  $Y_{oc}$  TWS to  $Y_{in stub}$

$Y_{in} = Y_L' + Y_{in stub} = (.02 + j0.28 \Omega^{-1})$   $Z_{in} =$   
 $\Rightarrow 0.7 / 25 \Omega = .028 \Omega^{-1} \Rightarrow 50 \Omega$



# EXAMPLES OF SINGLE STUB MATCH

w/ NON-UNIFORM LINES



- (1) Normalize  $Z_L$  by line 1 & plot  $Z_L = Z_L / Z_{01}$
- (2) Since stub is parallel, convert to  $y_L$  by reflecting through center of chart.
- (3) Rotate TWG to matching circle. Which matching circle? See part (7) - circle is  $Y_{02}/Y_{01}$ . New point  $y_L'$  is  $= a + jb$  Distance rotated is "d"
- (4) Read  $y_L' = a + jb$
- (5) Denormalize  $Y_L' = (a + jb) Y_{01} = Y_{01}a + Y_{01}b$  (by line 1)
- (6) Renormalize by line 2  $y_L'' = \frac{Y_L'}{Y_{02}} = a \frac{Y_{01}}{Y_{02}} + j b \frac{Y_{01}}{Y_{02}}$
- (7) For match  $y_L'' = 1 + j0$   
Therefore  $a \frac{Y_{01}}{Y_{02}} = 1 \rightarrow a = \frac{Y_{02}}{Y_{01}}$
- (8) Back to (4)  $y_L' = a + jb$  ;  $Y_L' = a Y_{01} + j b Y_{01}$
- (9) Normalize by stub  $y_L''' = \frac{Y_L'}{Y_{02}} = \frac{a Y_{01}}{Y_{02}} + j \frac{b Y_{01}}{Y_{02}}$   
to remove imaginary part  $\rightarrow j b \frac{Y_{01}}{Y_{02}}$
- (10) Plot  $y_L''' = -j b \frac{Y_{01}}{Y_{02}} = Y_{in\ stub}$
- (11) Also plot  $Y_{stub}$  (oc on left, sc on right)
- (12) Rotate TWG from  $Y_{stub}$  to  $Y_{in\ stub}$   
This distance is L

choosing stub  $Y_{in}$  choosing circle

①  $Z_L = 100j / 100\Omega / 200\Omega = 1/2 + j1/2$   
 $Z_{01} = 200\Omega$

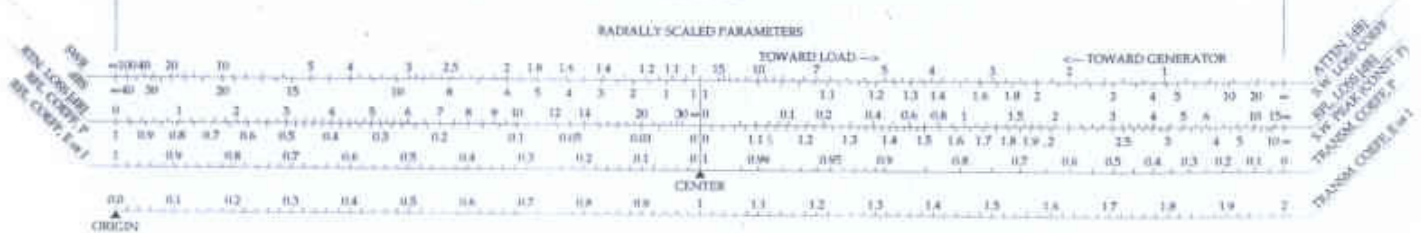
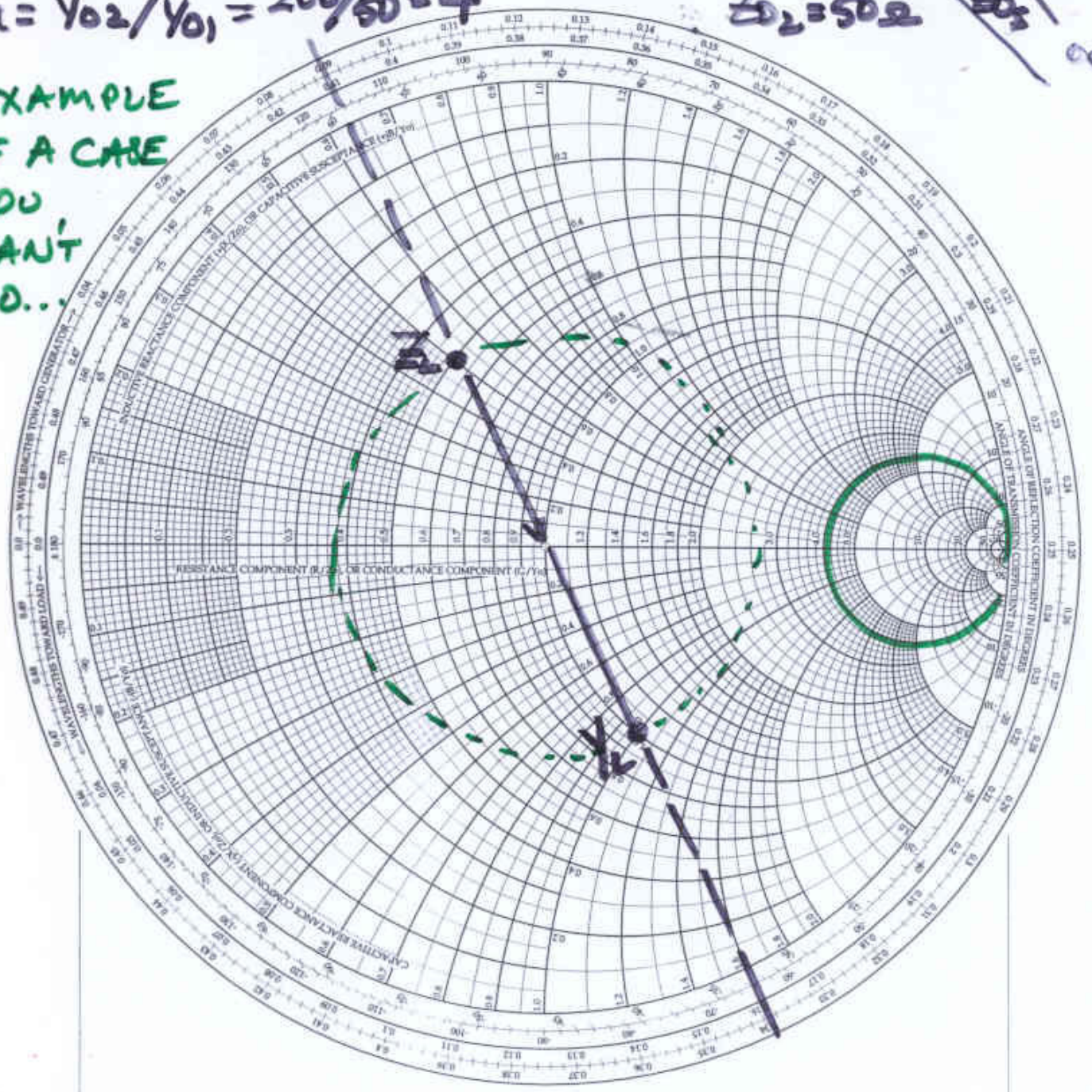
# The Complete Smith Chart

Black Magic Design



② MATCH. CIRCLE  
 $a = Y_{02} / Y_{01} = 200 / 50 = 4$

EXAMPLE  
 OF A CASE  
 YOU  
 CAN'T  
 DO...



ATTN: IBI  
 144 - LOG COPY  
 100 - LOSS COPY  
 100 - TRANSM. COEFF. IT  
 TRANSM. COEFF. IT

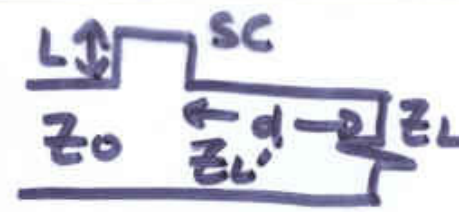
$Z_L = 100 + j100 \Omega$   
 $Z_0 = 200 \Omega$   
 $Z_L = 1/2 + j1/2$

# SERIES STUB MATCH

## The Complete Smith Chart

Black Magic Design

$d = .161 - .081 = .082$

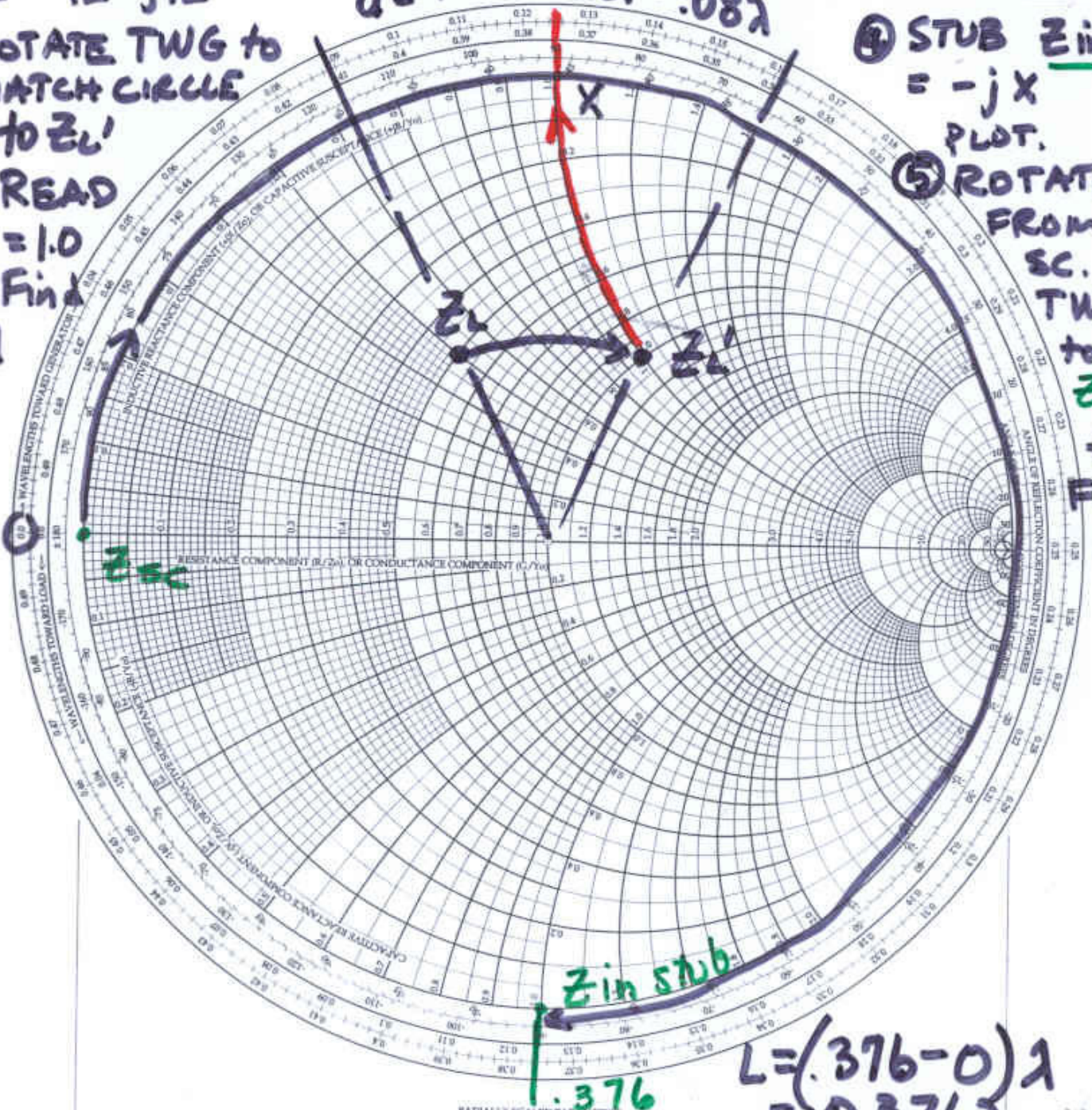


① ROTATE TWG TO MATCH CIRCLE TO  $Z_L'$

③ READ  $X=1.0$  to Find  $d$

④ STUB  $Z_{in}$  =  $-jX$  PLOT.

⑤ ROTATE FROM SC. TWG TO  $Z_{in}$  to FIND  $L$



$L = (376 - 0) \lambda$   
 $= 0.376 \lambda$



THE ONLY DIFFERENCE BETW.  $\parallel$  and SERIES STUBS IS  $Y$  OR  $Z$  USE.