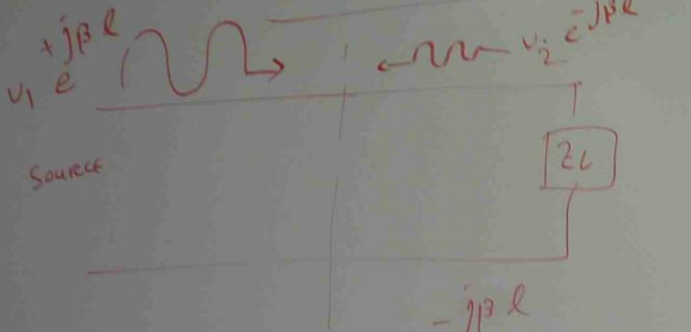
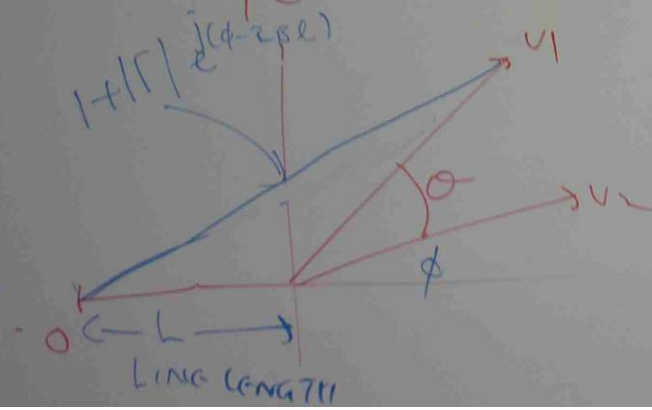
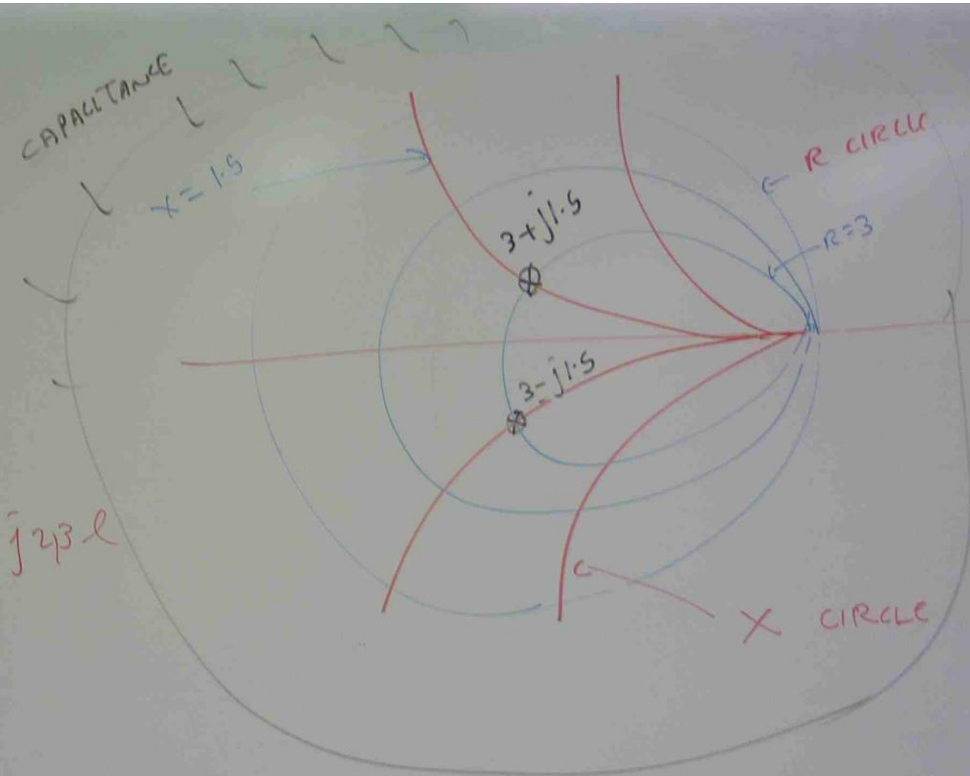
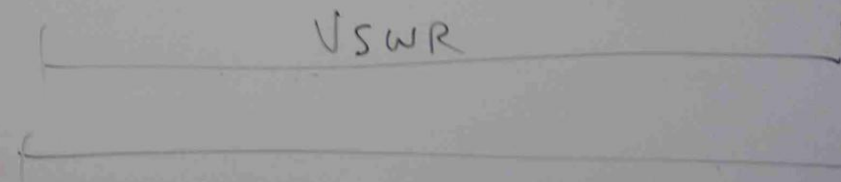
CONCEPT OF SMITH CHART



$$\Gamma = \text{REFLECTION COEFFICIENT} = \frac{V_2 e^{-j\beta l}}{V_1 e^{+j\beta l}} = \frac{V_2}{V_1} e^{-j2\beta l}$$







Z_{in} FOR WAVE LENGTH BY SMITH CHART

pb ① FIND THE INPUT IMPEDANCE AND VSWR (VOLTAGE STANDING WAVE RATIO) OF A TRANSMISSION LINE 4.3 λ LONG WHEN $Z_0 = 100\ \Omega$ AND

STEP ① $Z_L = 200 - j150\ \Omega$.

NORMALIZE LOAD $= \frac{Z_L}{Z_0} = \frac{200 - j150}{100} = 2 - j1.5$

STEP ② LOCATE → $Z = 2 - j1.5$

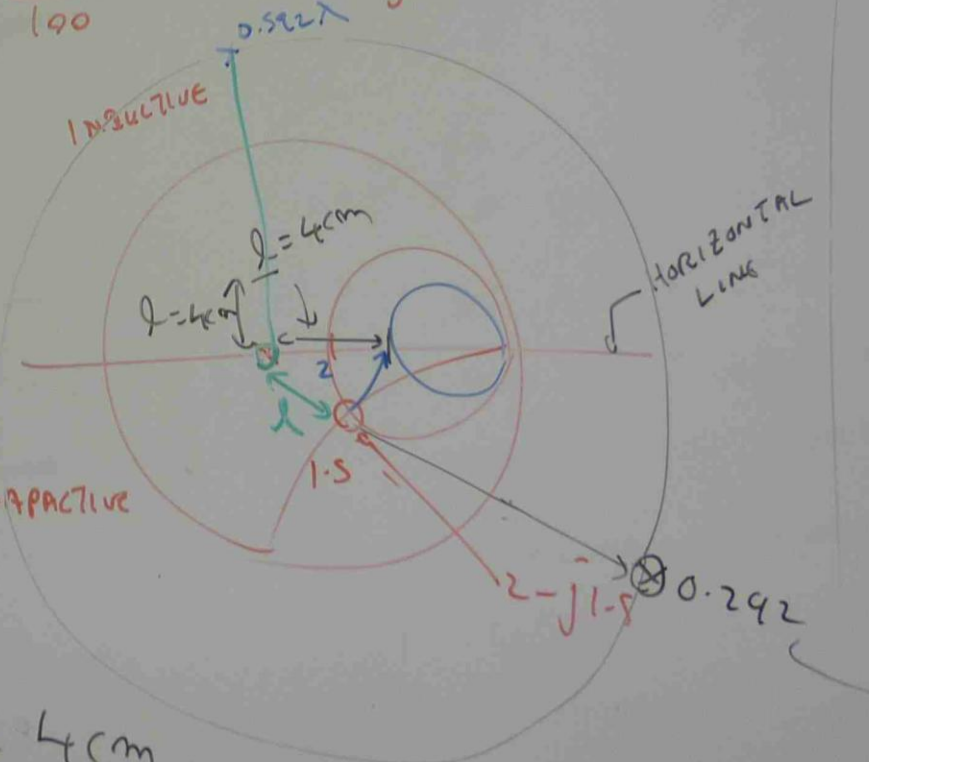
$Z^* = 2 + j1.5$

STEP ③

MEASURE

THE DISTANCE BETWEEN CENTRE TO $2 - j1.5$

$l = 4cm$



STEP 4

ON HORIZONTAL LINE
FROM CENTER
MEASURE 4 cm (l)
AND LOCATE THE MARK.

STEP 5

AT THIS MARK
SEE THE NUMBER ON THE
THE CIRCLE WHICH PASSES
THROUGH THIS MARK
IT IS VSWR.

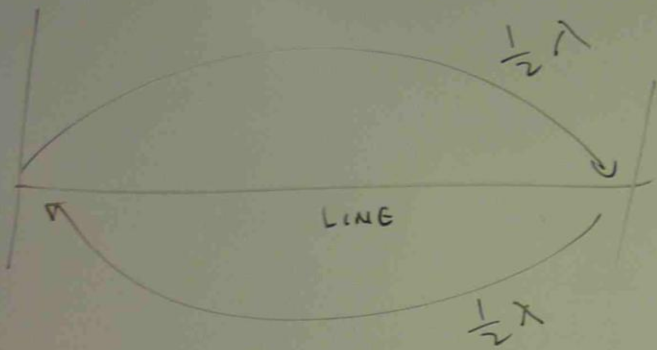
STEP 6

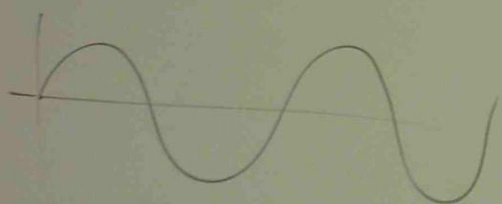
JOIN CENTRE & 2-j1.5
AND THEN CONTINUE TO DRAW THE
LINE UNTIL IT MEETS THE
OUTER MOST CIRCLE

READ THE SCALE ON THE
OUTER MOST CIRCLE.

WAVE LENGTH AFFECTED BY
REFLECTION

0.292λ





THE WHOLE LINE LENGTH $= 0.5\lambda$

4.3λ — ? NO CYCLE

$$\frac{4.3\lambda}{0.5\lambda} = \quad 5\,\overline{)\,43\,}^{\,8} \quad \begin{array}{r} 43 \\ 40 \\ \hline 3 \end{array}$$

$$\frac{4.3\lambda}{0.5\lambda} = 8 \text{ CIRCLE} + \underline{\underline{0.3\lambda}}$$

↑ REMAINDER

$$0.3\lambda + 0.292\lambda = \underline{\underline{0.592\lambda}}$$

STEP 7 FROM 0.292λ TRAVEL CLOCKWISE ON THE OUTER MOST CIRCLE UNTIL IT REACHES 0.592λ POINT.

STEP 8 MARK 0.592λ POINT.

STEP 9 JOIN CENTRE AND 0.592λ POINT

STEP (10)

ON THE LINE JOINING THE CENTRE AND

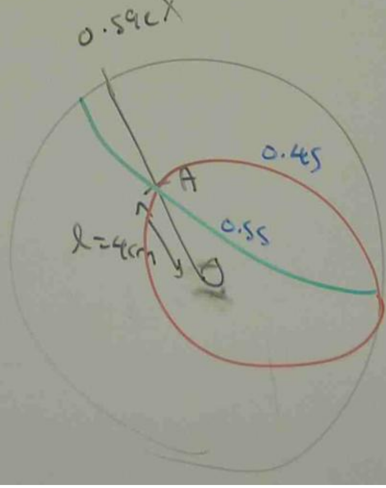
0.592 λ.

MARK $l = 4cm$ FROM CENTRE. POINT (A)

STEP (11)

FIND THE CIRCLE & CURVE NUMBER WHICH PASSES THROUGH

THAT POINT (A)



$0.45 + j0.55$

$Z_{IN} = 0.45 + j0.55$

NORMALIZED

$Z_{IN} = Z_{IN} \times Z_0 = (0.45 + j0.55) \times 100$

NORMALIZED

$= 45 + j55 \, \Omega$

The Complete Smith Chart

Black Magic Design

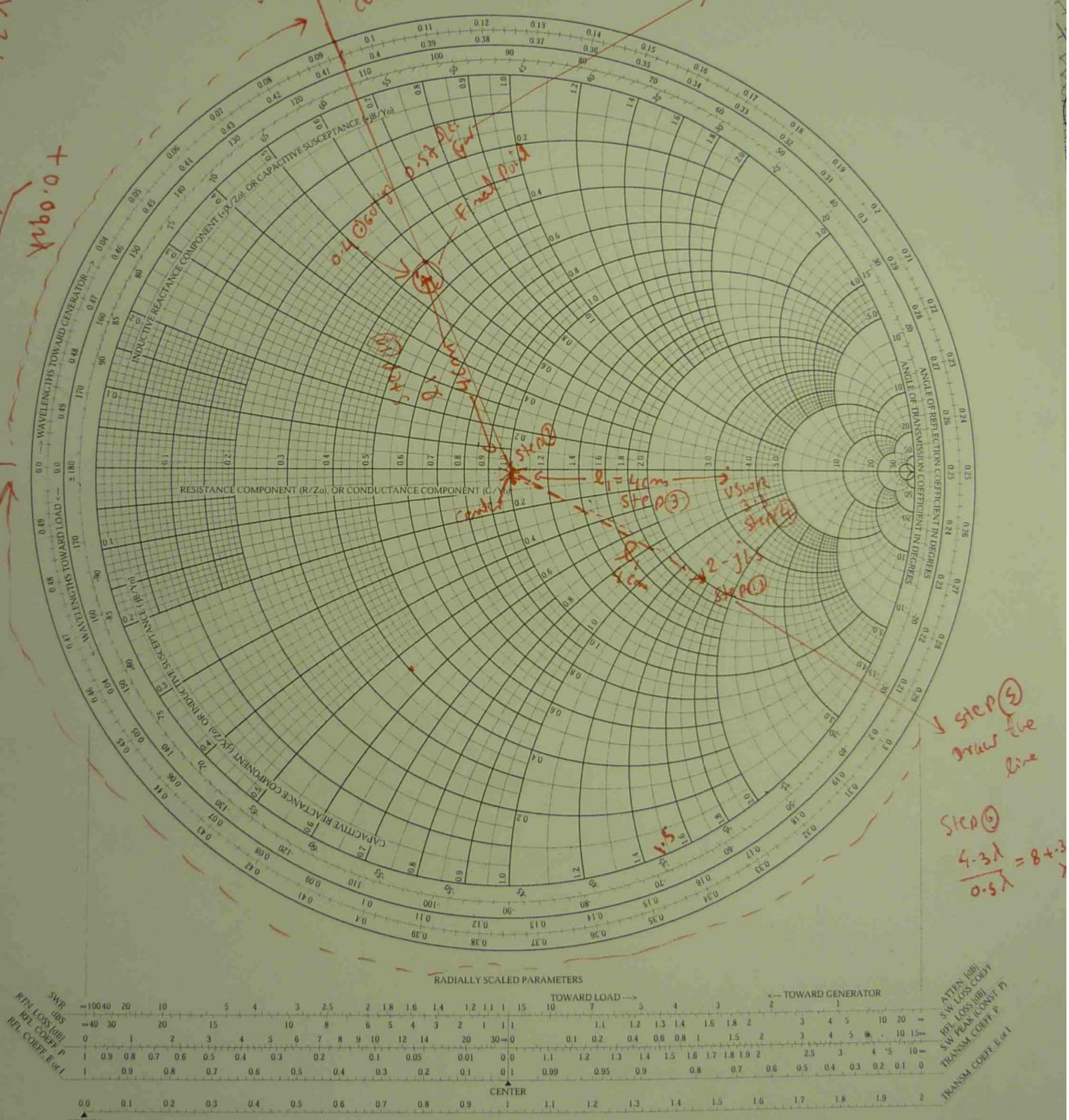
LINE (2)

step ⑧ 0.592 λ

0.5 λ

+ 0.092 λ

$0.4 + j0.57 = 3m$



step ⑦
.3 λ
+ .292 λ
.592 λ

step (4) on horizontal line measure 4cm
∴ VSWR point > 3.2

step (0) Normalize $\frac{200 - j150}{20} = \frac{200 - j150}{100} \to 2 - j1.5$

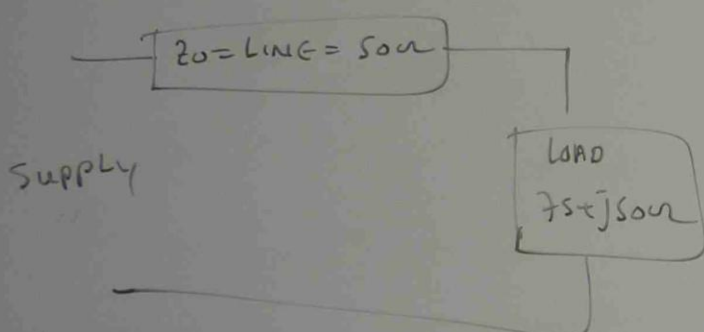
step (1) Put $2 - j1.5$

step (3) $2 - j1.5$ & centre are joined, measure the distance from centre to $2 - j1.5$ point → 4c

MATCHING OF IMPEDANCE BY SMITH CHART

Pb(2) A LOAD OF $75 + j50\ \Omega$ IS TO BE MATCHED TO A $50\ \Omega$ TRANSMISSION LINE USING A $\frac{\lambda}{4}$ MATCHING SECTION.

DETERMINE THE PROPER LOCATION AND CHARACTERISTICS IMPEDANCE OF THE MATCHING SECTION.



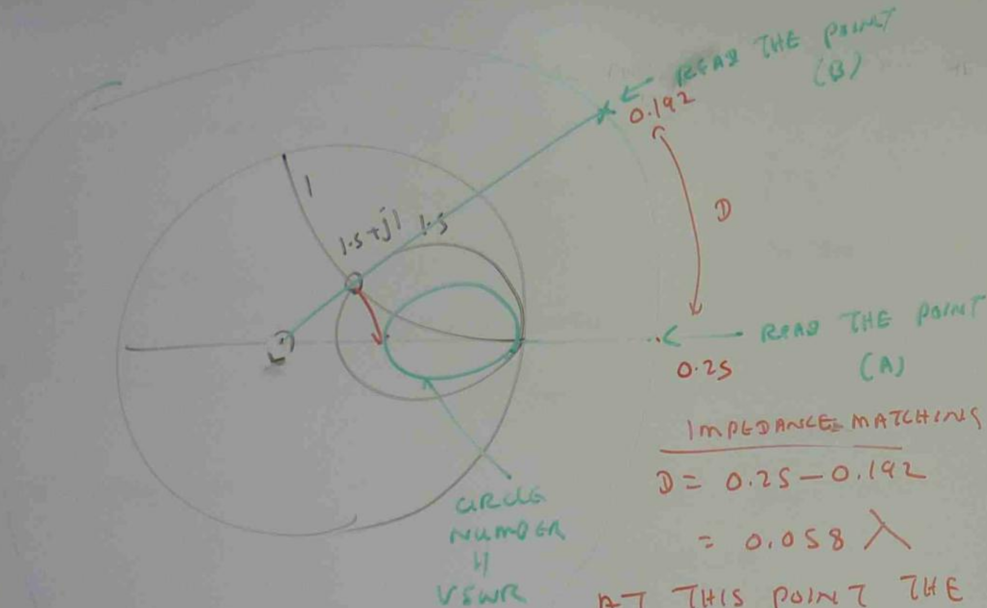
STEP(1) NORMALIZE $= \frac{75 + j50}{50} = 1.5 + j1$

STEP(2)
LOCATE $1.5 + j1$ ON SMITH CHART

STEP(3)
JOIN THE CENTRE TO $1.5 + j1$ POINT

EXTEND THE LINE UNTIL IT MEETS

THE OUTER MOST CIRCLE.



IMPEDANCE MATCHING

$D = 0.25 - 0.192$

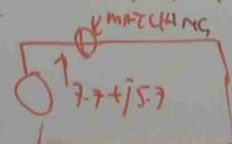
$= 0.058\lambda$

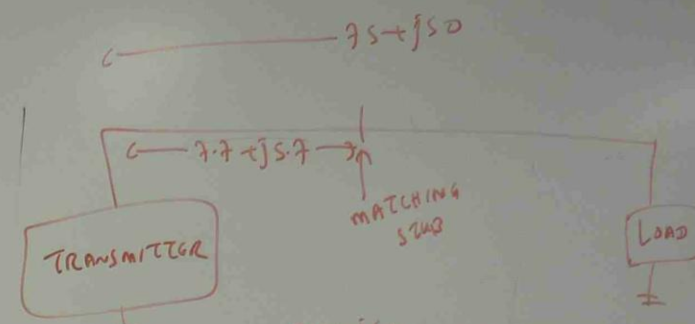
AT THIS POINT THE LINE IS TO BE CUT & $\frac{\lambda}{4}$ SECTION IS TO BE INSERTED.

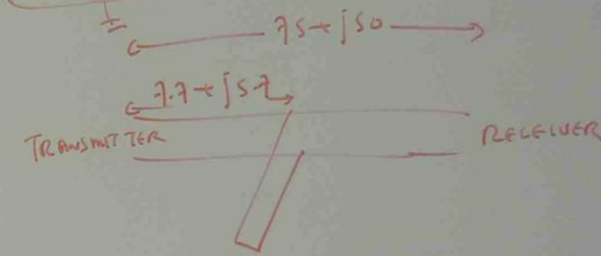
$0.5\lambda \Rightarrow 75 + j50\,\Omega$

0.058λ — ?

$75 + j50 \times \frac{0.058\lambda}{0.5\lambda} \simeq 7.7 + j5.7\,\Omega$







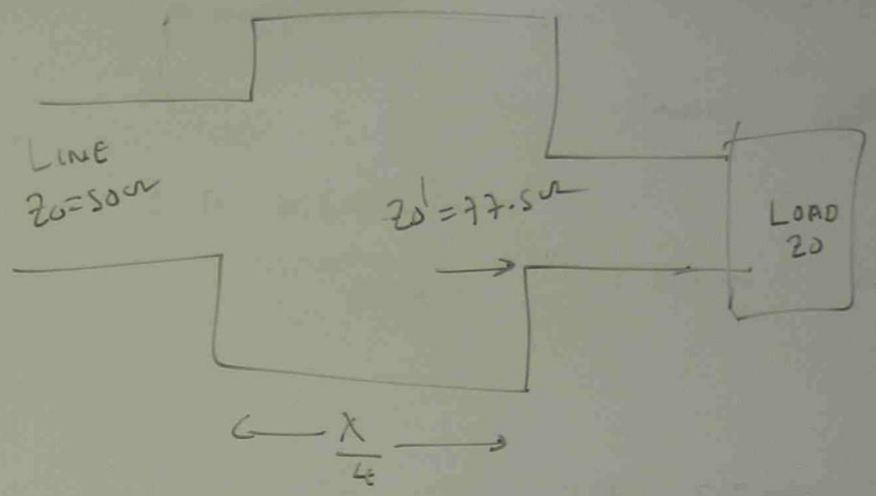
IMPEDANCE OF MATCHING STUB = ?

MEASURE THE DISTANCE BETWEEN CENTER & $1.5 + j1\,\Omega$. USE IT AS RADIUS. DRAW AN ARC: NOTE THE NUMBER ON CIRCLE PASSING IT. IT IS VSWR

VSWR = 2.4

IMPEDANCE OF MATCHING SECTION

$$Z_0' = \sqrt{Z_0 \times R_L}$$



$$R_L = VSWR \times Z_0$$

$$= 2.4 \times 50 = 120\Omega$$

$$Z_0' = \sqrt{50 \times 120} = 77.5\Omega$$