



$$V_{OUT} = \frac{R_L}{(R_L + R_S)} \times V$$

$$I_{OUT} = \frac{R_L}{(R_L + R_S)} \times \frac{V}{R_L}$$

$$P_{OUT} = V_{OUT} \times I_{OUT} = \frac{V^2 R_L}{(R_L + R_S)^2}$$

from Quotient rule

$$\frac{d}{dx} \left[\frac{u(x)}{v(x)} \right] \text{ is } \frac{u \frac{dv}{dx} - v \frac{du}{dx}}{v^2}$$

$$\text{Let } u = V^2 R_L$$

$$v = (R_L + R_S)^2 = R_L^2 + 2R_L R_S + R_S^2$$

DIFFERENTIATING
WRT VARIABLE
OF R_L

$$\frac{du}{dR_L} = V^2$$

$$\frac{dv}{dR_L} = 2R_L + 2R_S + 0$$

$$\Rightarrow \frac{d}{dR_L} \left[\frac{u}{v} \right] \text{ gives } \frac{V^2 R_L (2R_L + 2R_S) - (R_L + R_S)^2 V^2}{(R_L + R_S)^4}$$

$$= 0 \quad \text{GIVES} \quad \cancel{V^2} R_L (2R_L + 2R_S) - (R_L + R_S)^2 \cancel{V^2}$$

$$\Rightarrow 2R_L^2 + 2\cancel{R_L} R_S - R_L^2 - 2\cancel{R_L} R_S - R_S^2$$

$$\Rightarrow R_L^2 = R_S^2 \quad - \text{FOR MAX POWER TRANSFER.}$$