

58. This circuit contains no reactances, so  $\mathcal{E}_{\text{rms}} = I_{\text{rms}} R_{\text{total}}$ . Using Eq. 33-71, we find the average dissipated power in resistor  $R$  is

$$P_R = I_{\text{rms}}^2 R = \left( \frac{\mathcal{E}_m}{r + R} \right)^2 R .$$

In order to maximize  $P_R$  we set the derivative equal to zero:

$$\frac{dP_R}{dR} = \frac{\mathcal{E}_m^2 [(r + R)^2 - 2(r + R)R]}{(r + R)^4} = \frac{\mathcal{E}_m^2 (r - R)}{(r + R)^3} = 0 \implies R = r$$