

#1

(a) 800

(b) $P = \sqrt{3} \times 208 \times 2.92 = 1051 \text{ W}$

(c) $\left. \frac{\partial I}{\partial Q} \right|_{\text{left}} = \frac{-0.08}{200}$ $\left. \frac{\partial I}{\partial Q} \right|_{\text{right}} = \frac{+0.03}{200}$ Slope is bigger on left, so $Q=800$ is too low

#2

$$240 \angle \theta = jx \frac{50k}{240} \angle -36.87^\circ + 240x.96 \angle 0$$

(a) $1.152 \angle \theta + 36.87^\circ = jx + 1.1059 \angle 36.87^\circ$

$$1.152 \cos(\theta + 36.87^\circ) = 1.1059 \cos(36.87^\circ) = 0.8847$$

$$\theta + 36.87^\circ = 39.8^\circ \quad \theta = 2.93^\circ$$

$$1.152 \sin(39.8^\circ) = x + 1.1059 \sin(36.87^\circ) \quad x = 0.074$$

$$\%Z = \frac{0.074}{240/50k} \times 100 = \underline{6.4\%}$$

(b) $I_{sc} = \frac{50k}{240} \times \frac{1}{0.064} = \underline{3,243 \text{ A}}$

#3



$$13 = \frac{3 \times \left(\frac{230}{\sqrt{3}} \right)^2 \frac{5}{r_2'}}{2060 \times \frac{1}{3}}$$

(a) $S = \frac{1200 - 1080}{1200} = 0.1$

$$r_2' = 3.24 \Omega$$

$$\bar{I} = \frac{230}{j40} + \frac{230}{\sqrt{3}} \frac{1}{3.24/1} = 4.1 - j3.32 \quad |\bar{I}| = \underline{5.3 \text{ A}}$$

(b) $PF = \cos(\angle V - \angle \bar{I}) = \cos(0 + \tan^{-1} \frac{-3.32}{4.1}) = \underline{0.78 \text{ lag}}$

#4

(a) DC TEST $K_f \times 1200 \times 2 = 120 \quad K_f = .05$

SC TEST $.05 \times 1200 \times 1 = 6 X_s \quad X_s = 10 \Omega$

$$.05 \times 1200 \times I_f \angle \delta = j10 \times 6 \angle 0 + 120 \angle 0 = 120 + j60 = 134 \angle 26.5^\circ$$

$$I_f = 2.23 \text{ A}$$

(b) $\delta = 90^\circ \quad 2100 = \frac{3 \times 120 \times .05 \times 1200 I_f}{10} \quad I_f = 0.97 \text{ A}$

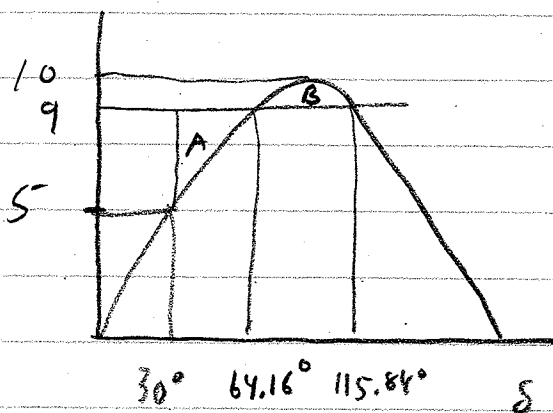
#5

$$\delta(.02) = \pi/6 + (w(.01) - 377) \times .01 = \pi/6 \text{ rad}$$

$$w(.02) = 377 + (9 - 10 \sin \pi/6) \times .01 = 377.04 \text{ rad/s}$$

$$\delta(.03) = \pi/6 + (377.04 - 377) \times .01 = \pi/6 - .0004 = 0.5231988 \text{ rad}$$

$$w(.03) = 377.04 + (9 - 10 \sin \pi/6) \times .01 = 377.08 \text{ rad/s}$$



$$A = \int_{30^\circ}^{64.16^\circ} (9 - 10 \sin \delta) d\delta$$

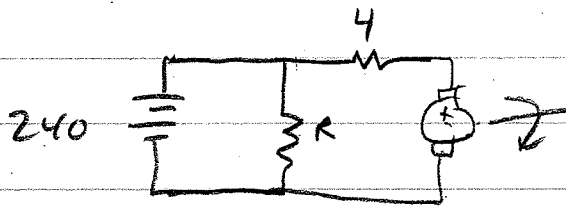
$$B = \int_{64.16^\circ}^{115.84^\circ} (10 \sin \delta - 9) d\delta$$

$$A - B = \int_{30^\circ}^{115.84^\circ} (9 - 10 \sin \delta) d\delta = 9\delta + 10 \cos \delta \Big|_{30^\circ}^{115.84^\circ} = 9(2.0218 - 0.5236) + 10(-.4358 - .866)$$

$$= +0.4658 \quad \underline{\underline{NO}}$$

#6

(a)



$$k_f \times 1000 \times \frac{240}{200} = 240 \quad k_f = 0.2$$

$$0.2 \times 1200 \times \frac{240}{R} = 240 \quad \underline{R = 240 \Omega}$$

(b) Real power is transferred from the AC source into the Grid

$$P_{\text{Transfer}} = 0.2 \times 1200 \times \frac{240}{275} \times \left(\frac{240 - 0.2 \times 1200 \times \frac{240}{275}}{4} \right) = \underline{1600 \text{ W}}$$