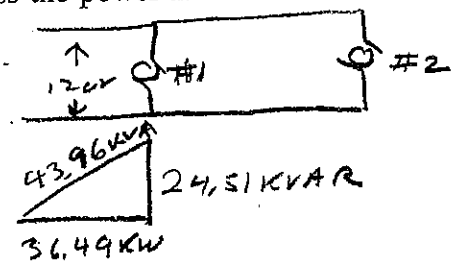
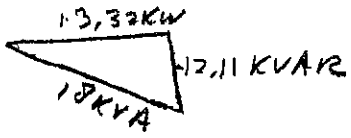
ECE 252 | **Introduction to Electrical Engineering** | **Quiz 12P**
100 Points | **Show your work.** | **Practice Solution**

Two machines are connected in parallel to a 120V, 60 Hz line. The first puts out 45 HP of mechanical power; it is 92% efficient and has a power factor of 0.83 lagging. The second machine uses 18 KVA at 0.74 leading.

a) Draw the power triangle for the first machine.
b) Draw the power triangle for the second machine.
c) Find the current in the line feeding these two machines.
d) A 10 KVAR capacitor is connected across the power line. What is the new current in the line?

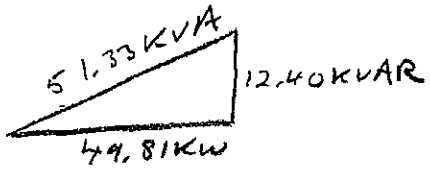


a) $45HP \times 746W/HP = 33.57KW$ of output power
$P_{in} = P_{out}/eff = 33.57K/0.92 = 36.49KW$
$S = P/\cos\theta = 36.49K/.83 = 43.96KVA$
$Q = \sqrt{S^2 - P^2} = 24.51KVAR$



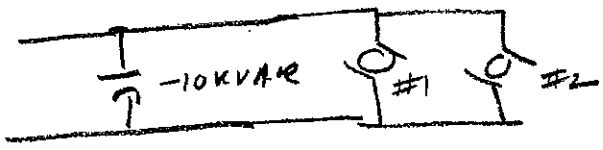
b) $P = S\cos\theta = 18K\ (0.74) = 13.32KW$
$Q = \sqrt{S^2 - P^2} = (\text{minus})\ 12.11KVAR$

c) Combined power triangles:

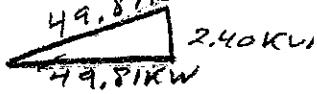


$P = P_1 + P_2 = 36.49KW + 13.32KW = 49.81KW$
$Q = Q_1 + Q_2 = 24.51K - 12.11K = 12.40KVAR$
$S = \sqrt{P^2 + Q^2} = 51.33KVA$
$I = S/V = 51.33 \times 10^3/120 = \underline{\underline{428A}}$

d)



It must be remembered that capacitors always have negative reactive power.



$Q = Q_{machines} + Q_{cap} = 12.40K - 10K = 2.40\ KVAR$
$S = \sqrt{P^2 + Q^2} = 49.87\ KVA$
$I = S/V = 49.87 \times 10^3/120 = \underline{\underline{416A}}$