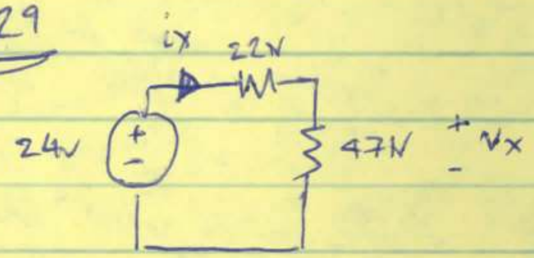
HW2 solutions

Amit Pandey

(1)

## 2.29



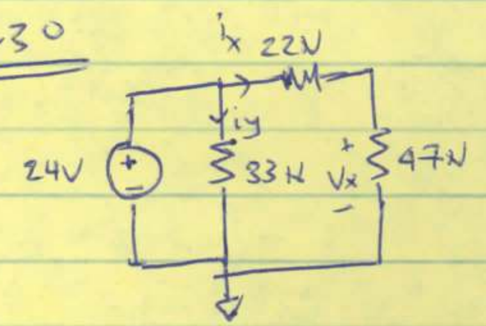

We start by finding ix,

$$i_x = \frac{24}{22K + 47K} = \underline{\underline{0.348\,mA}}$$

and now we can easily compute $V_x$

$$V_x = 47K \times i_x$$
$$= \underline{\underline{16.348\,V}}$$

## 2.30



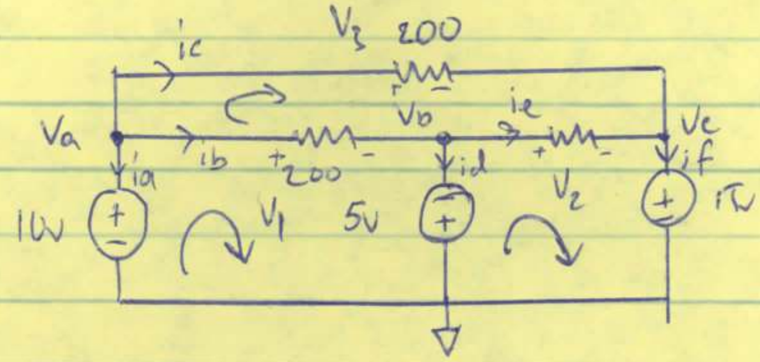

- We have two circuit elements in parallel with eachother where one element is the same circuit as we examined in the question above.

- Therefore, ix and Vx will be the exactly the same as they were in the previous question
- Compute iy:

$$i_y = \frac{24}{33K} = \underline{\underline{0.727\,mA}}$$

- The power supplied by the circuit will increase. The total power for the second circuit is $(i_x + i_y)24$, while the total power for the first circuit is $i_x(24)$

2.33




(a) • Assign three voltages $V_a, V_b, V_c$ as well as assigning ground (0V) as the bottom wire in our circuit diagram

• Assign currents $i_a, i_b, i_c, i_d, i_e, i_f$

(b) $V_a = 10V$ , $V_c = 15V$ } This follows automatically from the selection of ground

Let us now use KVL to find the voltage across each of the resistors

- $10 - V_1 + 5 = 0$

$\Rightarrow V_1 = \underline{15 \text{ volts}}$

$-5 - V_2 - 15 = 0$

$V_2 = \underline{-20 \text{ volts}}$

$-V_3 + V_2 + V_1 = 0$

$\Rightarrow V_3 = -5 \text{ volts}$

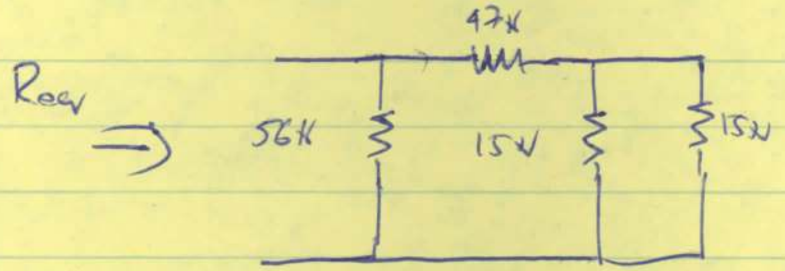
Now, we can find the currents.

$i_b = 15/200$ amps

$i_d = -20/200$ amps

$i_c = -5/200$ amps

## 2.41

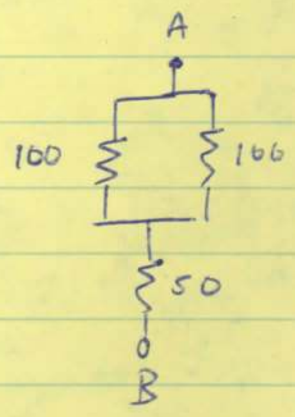



$$R_{eq} = \cancel{18}\ 56K \| (47K + 15K \| 15K)$$

$$= \underline{\underline{27619.91}}$$

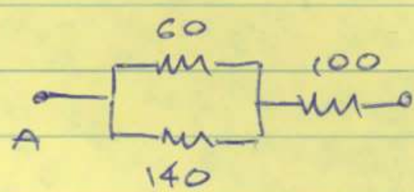
## 2.47

### A – B




$R_{eq} = 100$

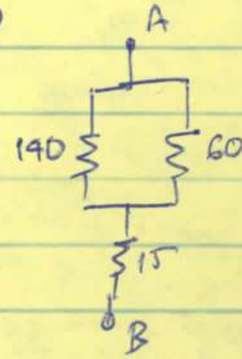
### A – C




$R_{eq} = 142$

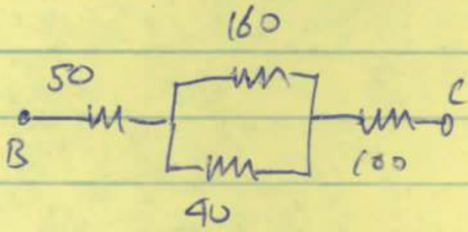
(4)

A-D



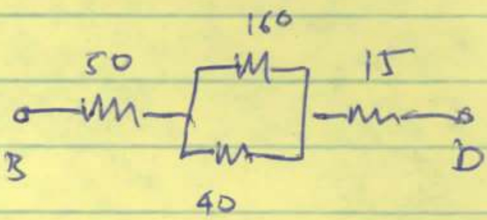

$R_{eq} = 57\Omega$

B-C



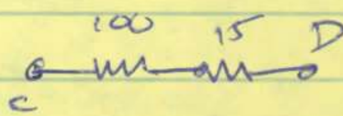

$R_{eq} = 182$

B-D



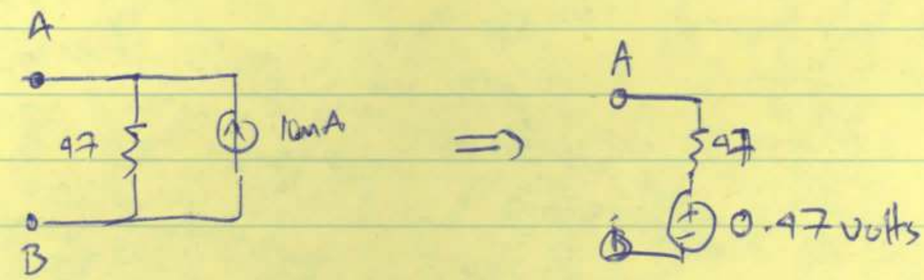

$R_{eq} = 97$

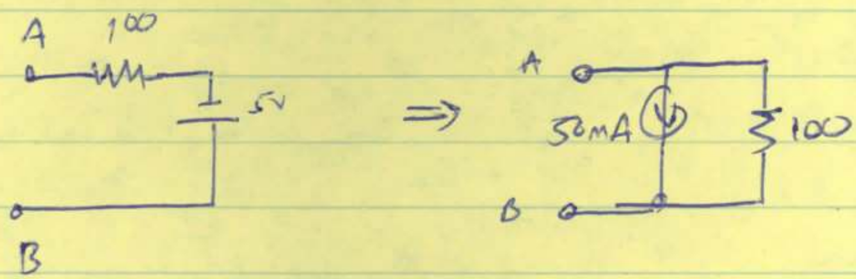
C-D



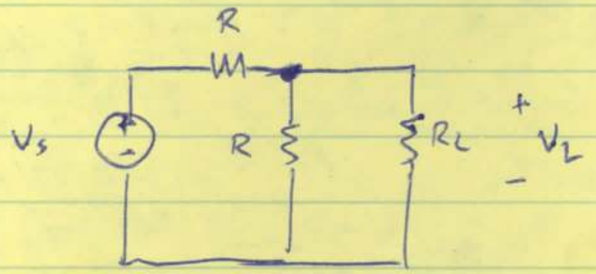

$R_{eq} = 115$

## 2-50

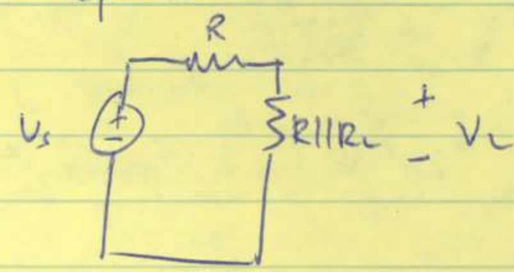



## 2-59




This is equivalent to




where

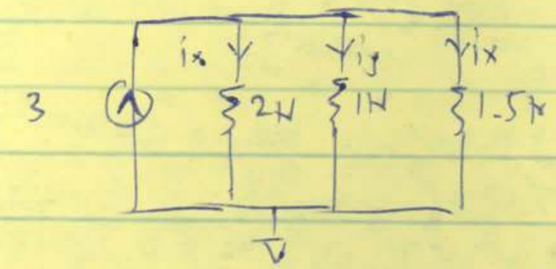
$$R \| R_L = \frac{RR_L}{R+R_L}$$

then

$$V_L = \left( \frac{V_s}{R + \frac{RR_L}{R+R_L}} \right) \frac{RR_L}{R+R_L}$$

$$= \frac{V_s \cdot RR_L}{R(R+R_L) + RR_L} = \frac{V_s RR_L}{R^2 + 2RR_L}$$

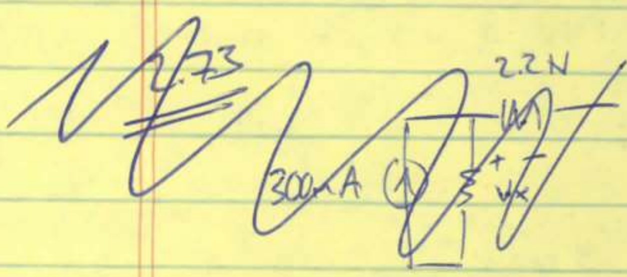
2-60



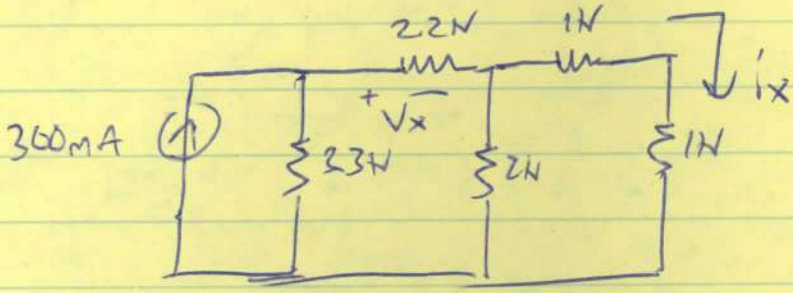

$$i_x = \frac{3 \cdot 600}{2600} = \cancel{0.387}\ 0.692$$

$$i_y = \frac{3 \cdot (2k \| 1.5k)}{1k + (2k \| 1.5k)} = 1.387$$

$$i_z = \frac{3 \cdot (2k \| 1k)}{(2k \| 1k) + 1.5k} = 0.923$$



2.73



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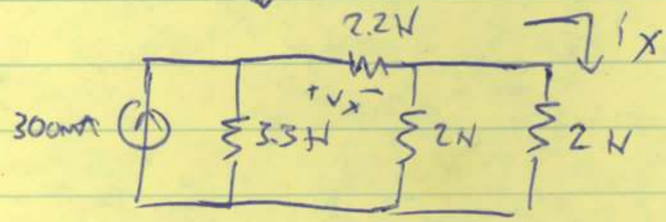

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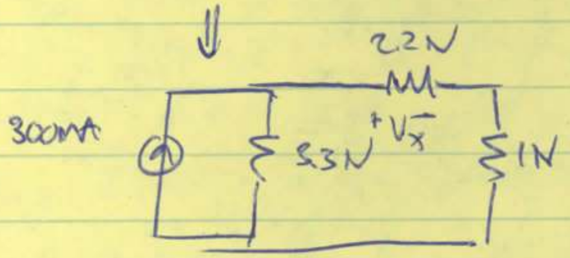

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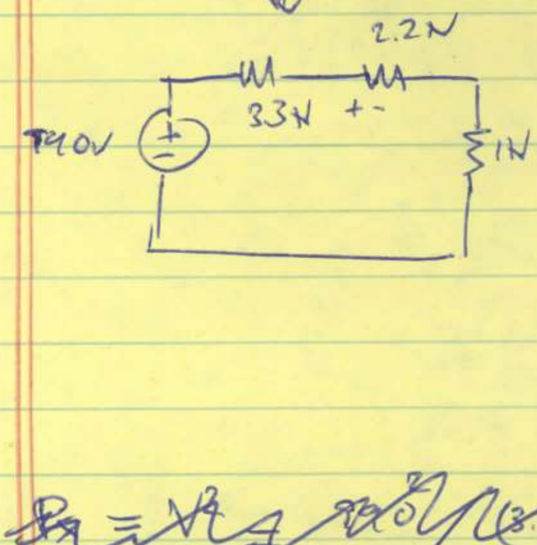


$$V_x = \left(\frac{990}{3.3N + 2.2N + 1N}\right) 2.2N$$

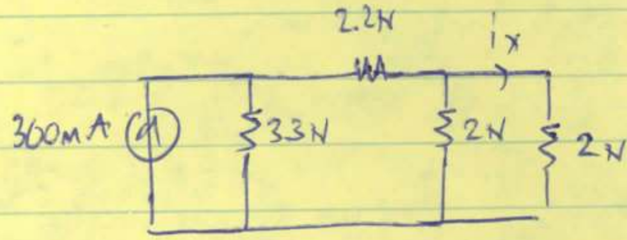
$= \cancel{152.31 \text{ volts}}$

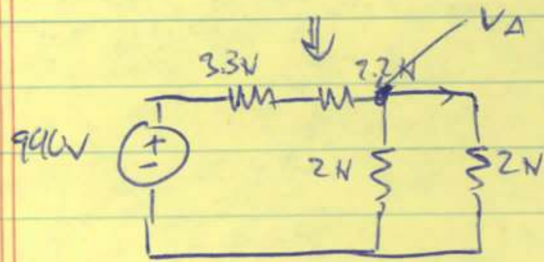
$= 335.1$ volts

~~$P_x = \frac{V^2}{R} = 990^2/(3.3N + 2.2N + 1N)$~~

~~$= 150.78W$~~

Now, we compute $i_x$



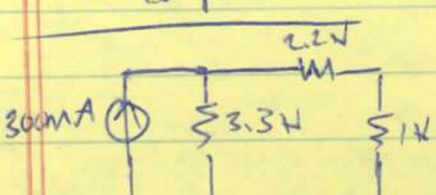




so, $I_x = \left(\dfrac{990}{6.5K}\right)\dfrac{1K}{2K} = \underline{\underline{76.154\,mA}}$

where $V_A = \dfrac{990}{6.5K} \cdot 1K$

and we have $i_x = \dfrac{V_A}{2K}$.

To compute $P_x$

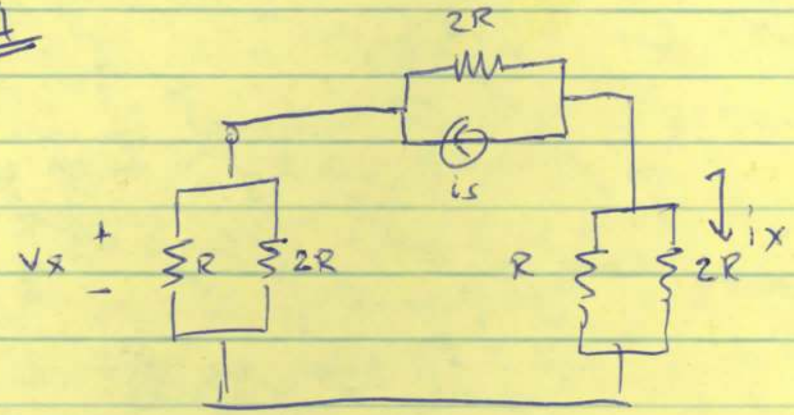



so $P = I^2 R$

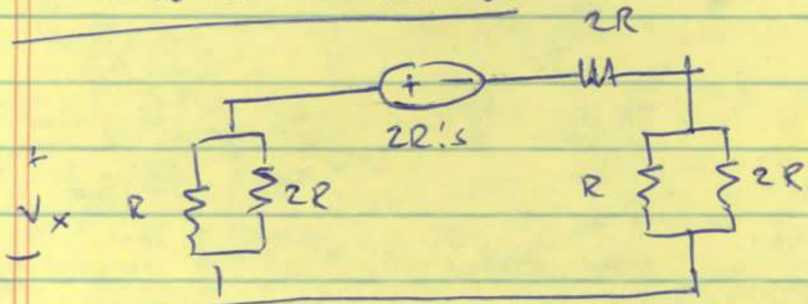
$= (300m)^2 \times (3.3K \,\|\, 3.2K)$

$= \underline{\underline{146.2 \text{ W}}}$

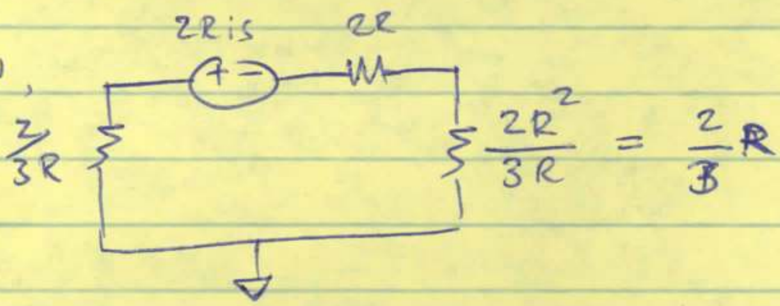
## 2.74




Do a source transformation




Now,




Now, to find $V_x$, we use a voltage divider

$$V_x = \frac{2Ri_s}{\frac{4}{3}R + 2R} \cdot \frac{2}{3}R = \frac{2Ri_s}{\frac{10}{3}R} \cdot \frac{2}{3}R$$

$$V_x = \frac{4}{10} Ri_s = \frac{2}{5} Ri_s$$

$$I_x = \frac{V_x}{2R} = \frac{1}{5} I_s$$