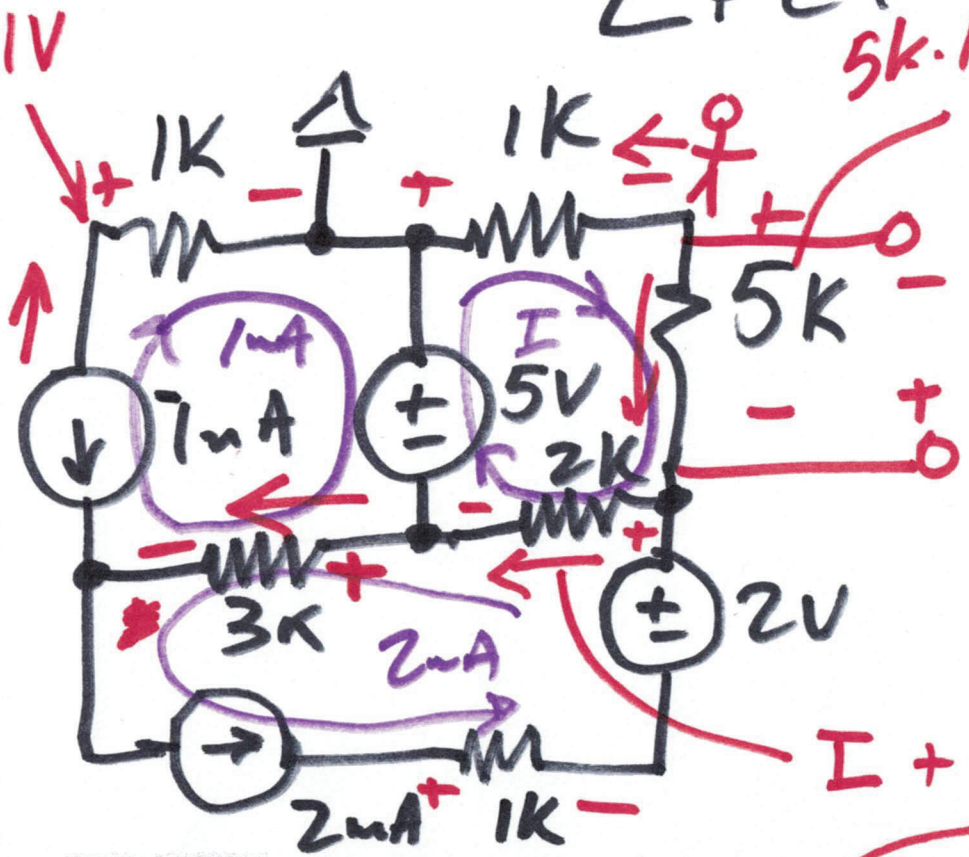
EE 220 Circuits 1

Sept. 28, 2020

Lecture 10



5k · 125μA = 1.625V

1) label currents
2) Label + and −
3) go running (KVL)

$1K \cdot I - 5 + 2K(I + 2mA) + 5K \cdot I = 0$

$I(8K) = 1$

$I + 2mA$

$I = 125\mu A$

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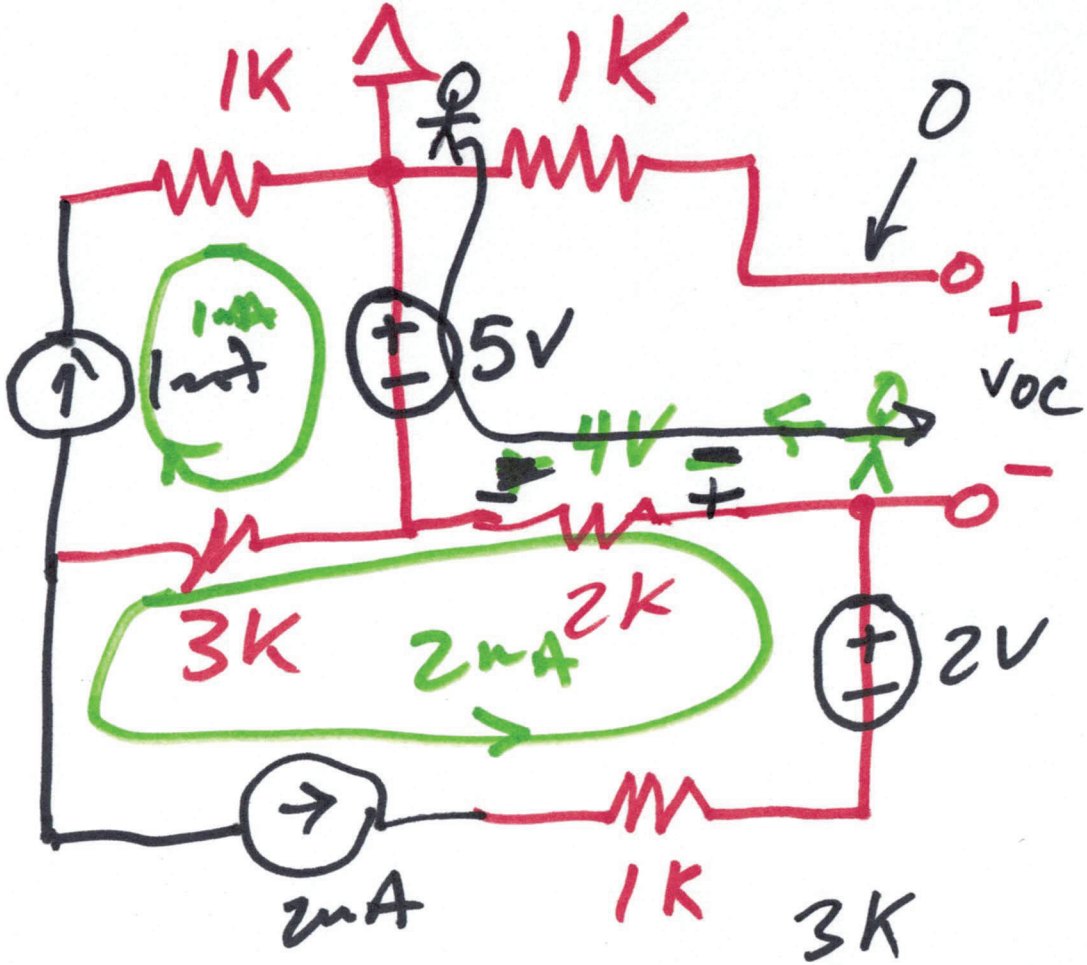
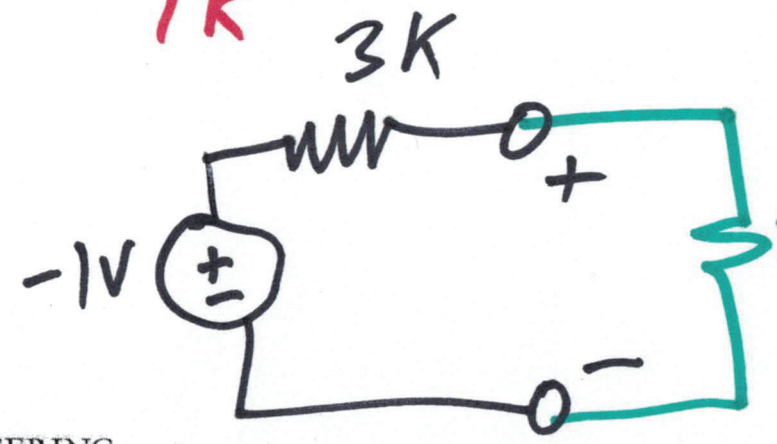
1)



$R_{TH} = 3k$

$V_{OC} = -5 + 4$

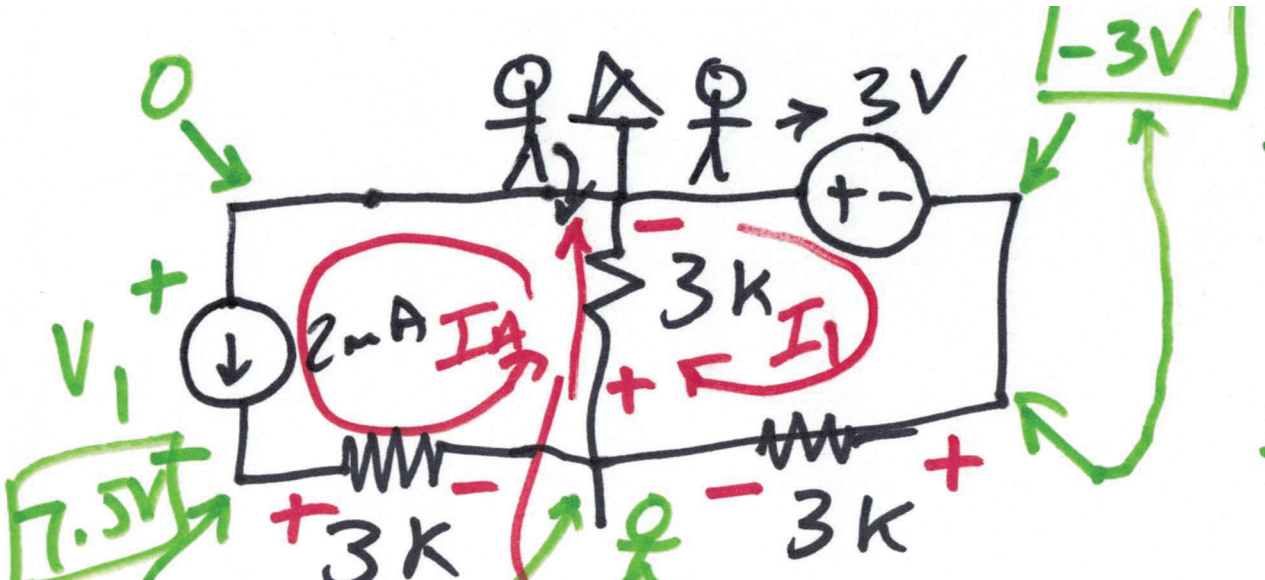
$V_{TH} = -1 = V_{OC}$



$+ \quad -1 \frac{5}{3+5}$

$- \quad = \frac{-5}{8}$

$= -.625V$



$I_A = 2mA$

$-3 - 3kI_1 - 3kI_A - 3kI_1 = 0$

$3kI_A + 3kI_1 + 3kI_A + V_1 = 0$

$I_1 = -1.5mA$

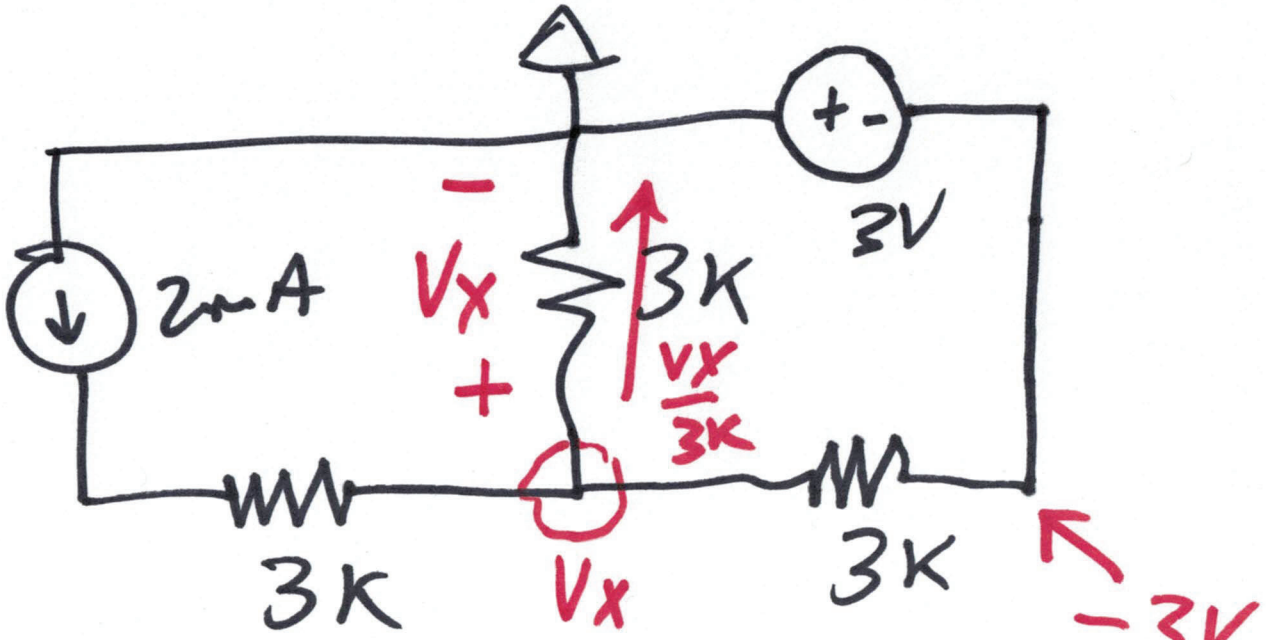
$-3 - 6kI_1 - 6V = 0, \quad I_1 = \frac{9}{6}mA$

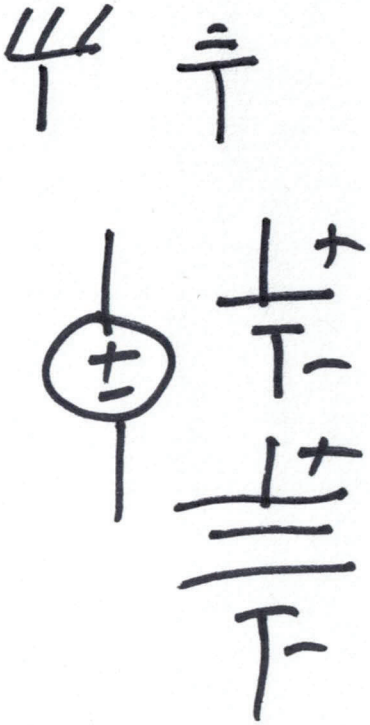
$6 + 6 + 3kI_1 + V_1 = 0$

$12 + (-4.5V) + V_1 = 0$

$V_1 = -7.5V$

3)



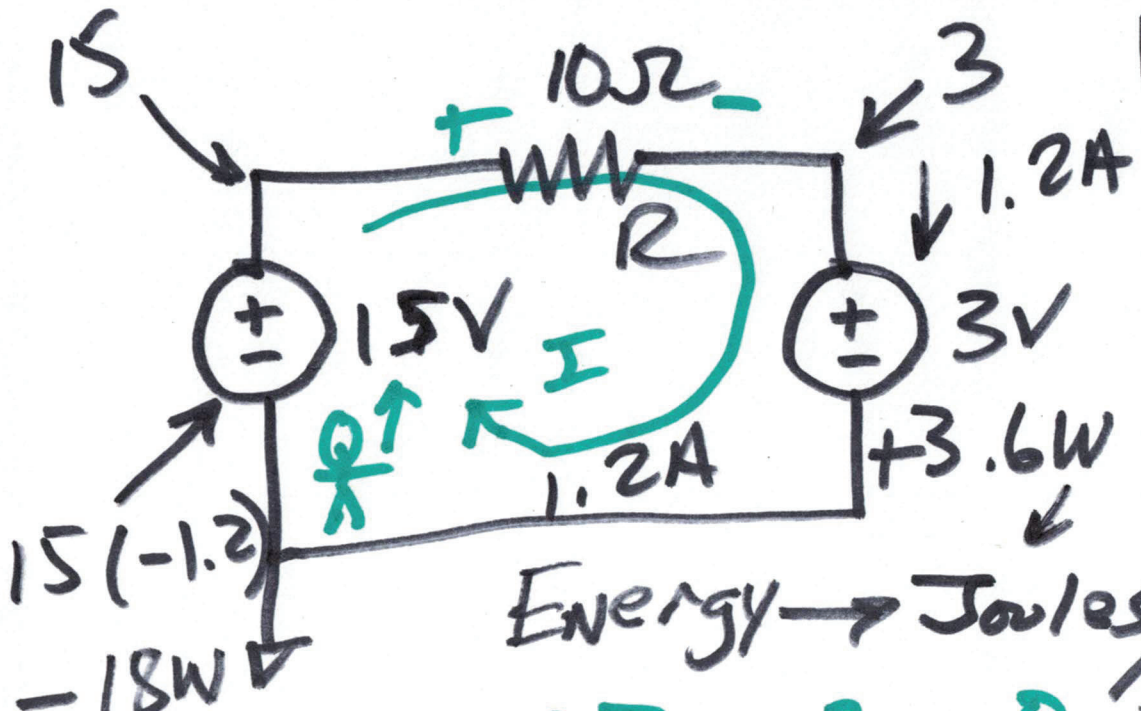


$$\frac{V_x - (-3)}{3k}$$

$$2mA = \frac{V_x}{3k} + \frac{V_x + 3}{3k}$$

$$V_x = 1.5V$$

$$6 = 2V_x + 3$$



Det. power dis. By R

$P = V \cdot I$

$= \frac{V^2}{R} = I^2 R$

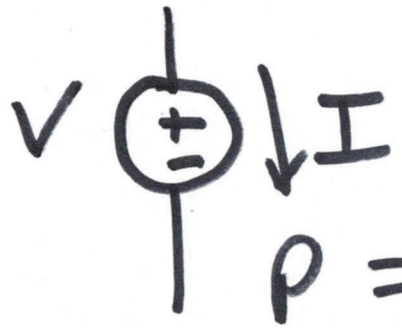
Energy → Joules/s

$+15 - 10I - 3 = 0$

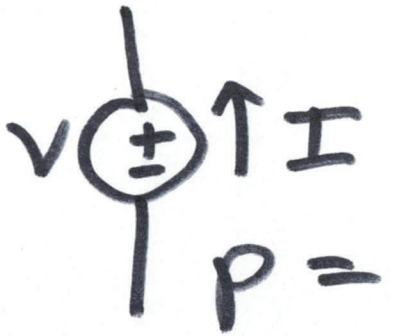
$\boxed{I = 1.2\,A}$

$P = \frac{12^2}{10} = 14.4\,W$

$P = \frac{V^2}{R} = I^2 R$

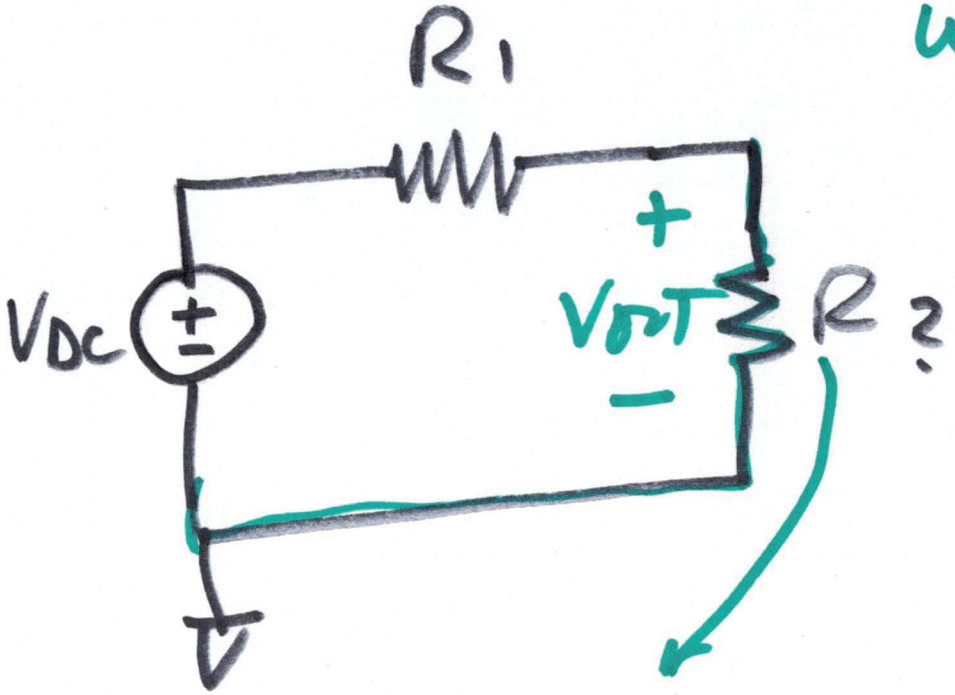


$P = VI$



$P = V(-I)$

5)



what R results in max power diss. in R

$$P = \frac{V_{OUT}^2}{R} \xrightarrow{R \to \infty} 0$$

$$P = \left(\frac{V_{DC}}{R_1}\right)^2 \cdot R \xrightarrow{R \to 0} 0$$

$$V_{OUT} = \frac{R}{R+R_1} \cdot V_{DC} = R(R+R_1)^{-1} \cdot V_{DC}$$

$$P_{MAX} \rightarrow \frac{R^2(R+R_1)^{-2} \cdot V_{DC}^2}{R} = \frac{V_{OUT}^2}{R}$$

$$\frac{d}{dR}\left(\frac{1}{R}\right) = 0$$

$$\frac{d}{dR} R(R+R_1)^{-2} = 0$$

$\frac{dx^{-2}}{dx} = -2x^{-3}$

$$(R+R_1)^{-2} + (-2)R(R+R_1)^{-1} = 0$$

$\frac{A \cdot B}{y(D+c)} = \frac{1}{5X}$

$$1 + \frac{-2R}{R+R_1} = 0$$

$$1 = \frac{2R}{R+R_1}$$

$$R + R_1 = 2R$$

$$\boxed{R_1 = R}$$

MAX power