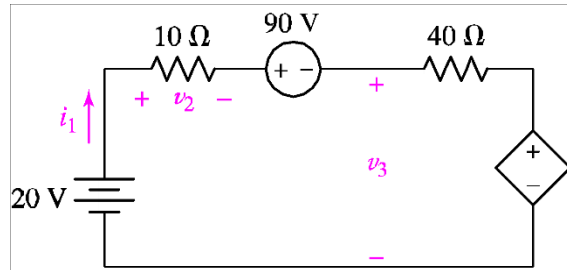# Part 1 (Practice Problems):

1) Refer to the circuit of figure below and label the dependent source αv_3. Find v_3 and α if (a) the 90 V source generates 180 W; (b) the 90 V source absorbs 180 W.

(a) Since the 90V source generates power, $P = -180W$, $i_1 = \dfrac{P}{90} = -2A$.

$$V_3 = 20 - 90 - (-2) * 10 = -50V$$

Since we know the voltage of dependent source is $\alpha V_3 = -50\alpha$,

$$i_2 = -2A = \frac{20 - 90 - (-50\alpha)}{10 + 40}$$
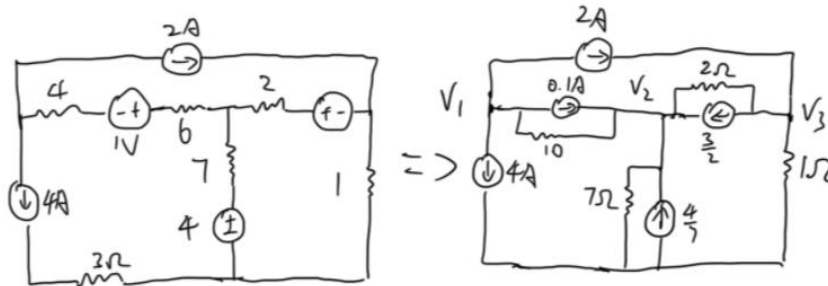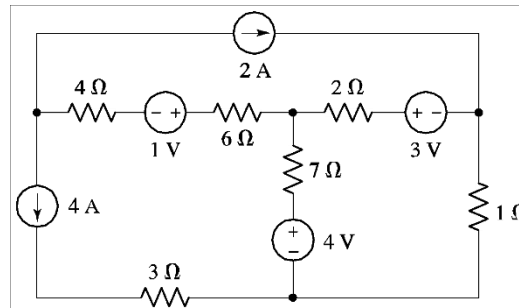
$$\alpha = -0.6.$$

(b) Similar to a, when 90V source absorbs power. $P = 180W$, $i_1 = \dfrac{P}{90} = 2A$.

$$V_3 = 20 - 90 - (2) * 10 = -90V$$

$$i_2 = 2A = \frac{20 - 90 - (-90\alpha)}{10 + 40}$$

$$\alpha = \frac{17}{9}$$

2) Determine the power supplied by the 2 A source in the circuit below. (Use source transformations)

When current source in series with resistor, we can eliminate the resistor. Then transform all the voltage source to current source.

At this point, we can't simplify the circuit anymore, so use KCL/KVL.

$$2 + 4 + 0.1 = \frac{V_2 - V_1}{10} \rightarrow V_2 - V_1 = 61V \ldots (1)$$

Plug in (1)

$$0.1 + \frac{4}{7} + \frac{3}{2} = 6.1 + \frac{V_2 - V_3}{2} + \frac{V_2}{7} \rightarrow -55 = 9V_2 - 7V_3 \ldots (2)$$

$$2 + \frac{V_2 - V_3}{2} = \frac{3}{2} + V_3 \rightarrow V_2 = 3V_3 - 1 \ldots (3)$$
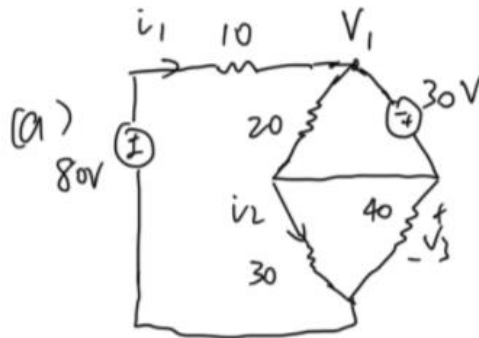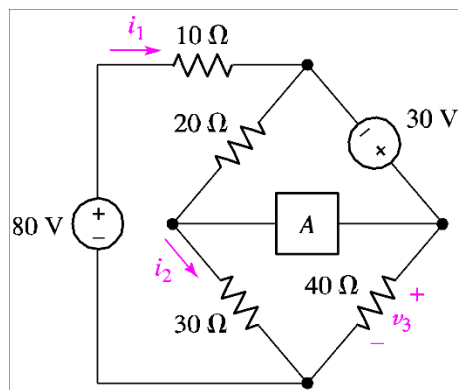
$$Combine\ (2)and\ (3),$$
$$-55 = 27V_3 - 9 - 7V_3$$
$$V_3 = -2.3\ put\ it\ back\ to\ (1)and\ (2)$$
$$V_2 = -7.9, V1 = -68.9$$
$$P = (V_3 - V_1) * 2 = 133.2W$$

3) Find v_3 in the circuit below if element A is (a) a short circuit; (b) a 9 V independent voltage source, with positive reference on the left.

(a) When A is a short circuit, the voltage at A is V_3, use KVL and KCL

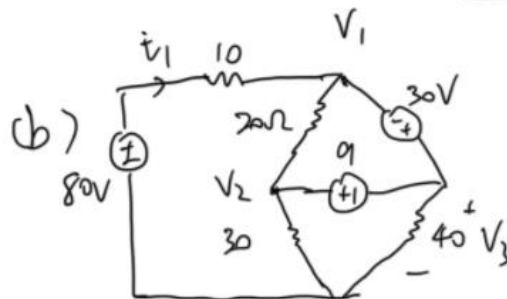$$V_3 = V_1 + 30 \ldots (1)$$

$$\frac{80 - V_1}{10} = \frac{V_3}{30} + \frac{V_3}{40} \ldots (2)$$

Combine (1) and (2) we get

$$\frac{110 - V_3}{10} = \frac{V_3}{30} + \frac{V_3}{40}$$

$$V_3 = 69.474$$

(b) When A is a 9V source, the voltage at A is V_3, also use KVL and KCL

$$V_2 = V_3 + 9 \ldots (1)$$

$$V_3 = V_1 + 30 \ldots (2)$$

$$\frac{80 - V_1}{10} = \frac{V_2}{30} + \frac{V_3}{40} \ldots (3)$$

Combine (1), (2) and (3) we get

$$\frac{110 - V_3}{10} = \frac{V_3 + 9}{30} + \frac{V_3}{40}$$

So,

$$V_3 = 67.579$$