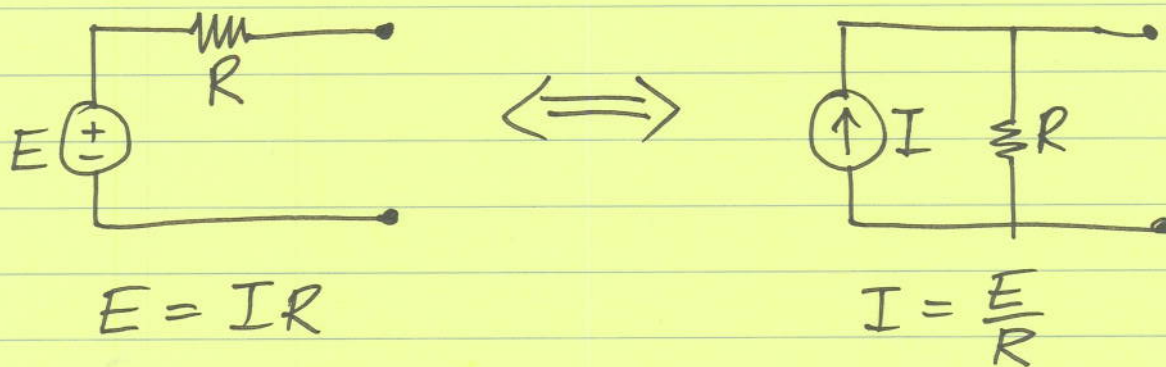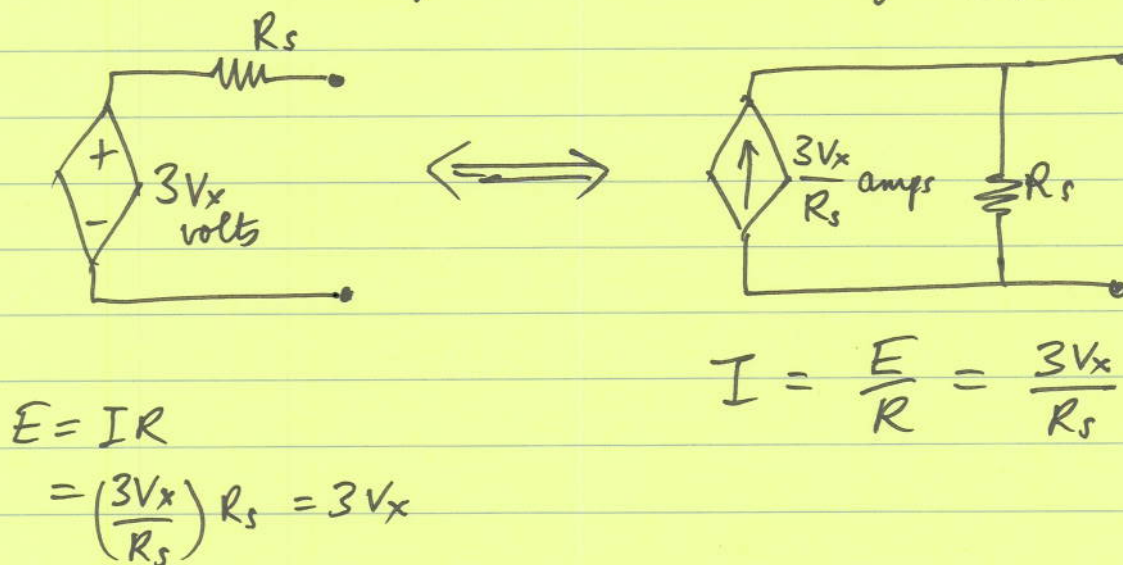# Source Transformations

Any voltage source that is connected in series with a resistor can be replaced by a current source in parallel with the same resistance.
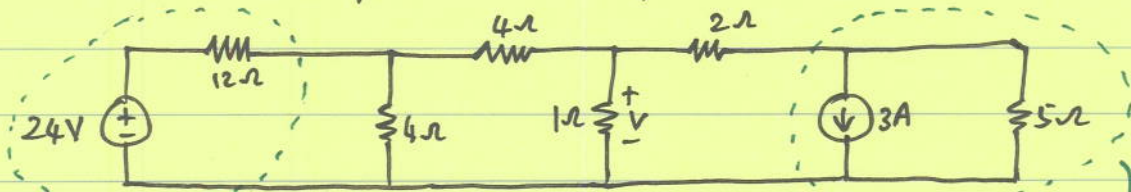
Any current source that is connected in parallel with a resistor can be replaced by a voltage source in series with the same resistance.

$$E = IR \qquad\qquad\qquad I = \frac{E}{R}$$

Note: Source transformations also work for <u>dependent sources</u>:

$$E = IR \qquad\qquad\qquad I = \frac{E}{R} = \frac{3V_x}{R_s}$$

$$= \left(\frac{3V_x}{R_s}\right) R_s = 3V_x$$

Ex   Use Source Transformations to find V:

$$12\,\Omega \quad 4\,\Omega \quad 2\,\Omega$$

24V $4\,\Omega$ $1\,\Omega \; V$ $\downarrow 3A$ $5\,\Omega$

$V = (3A)5\,\Omega$
$\quad = 15V$

Sln: $I = \dfrac{24V}{12\,\Omega} = 2A$

2A $\uparrow$ 12 4 $1 \; V$ $\mp 15V$ (2, 5, 4)

$12\,\Omega \| 4\,\Omega = 3\,\Omega$ $2\,\Omega + 5\,\Omega = 7\,\Omega$

2A $\uparrow$ 3 4 $1 \; V$ $\mp 15V$ (7)

$I = \dfrac{15V}{7\,\Omega} = 2.14286A$

$V = (2A)(3\,\Omega) = 6V$

6V 3 4 $1 \; V$ 7 $\downarrow 2.14286A$

$3 + 4 = 7\,\Omega$
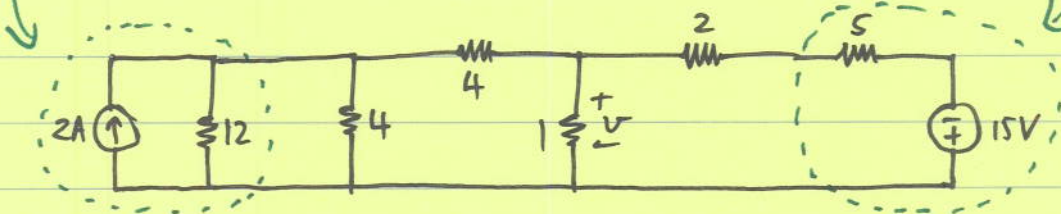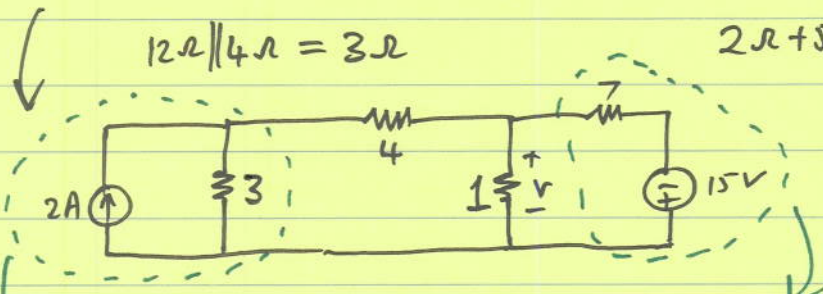
6V 7 $1 \; V$ 7 $\downarrow 2.14286A$
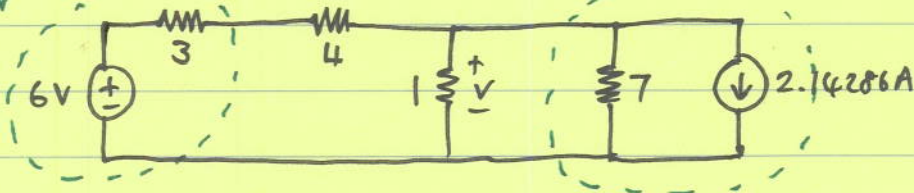
$I = \dfrac{6}{7} = 0.85714A$
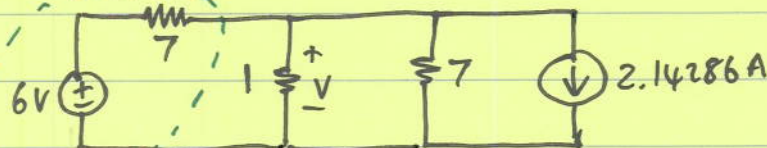
0.85714 $\uparrow$ A 7 $1 \; V$ 7 $\downarrow 2.14286A$
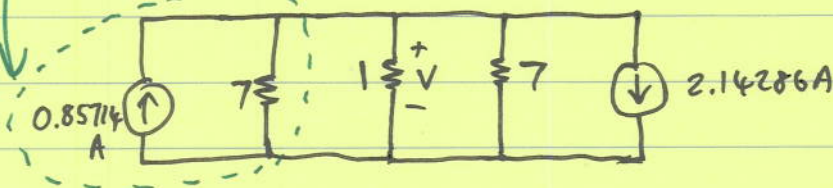
Now combine current sources: $0.85714A + (-2.14286A) = -1.28572A$

Combine the two $7\,\Omega$ resistors: $7\,\Omega \| 7\,\Omega = 3.5\,\Omega$.

So circuit reduces to :
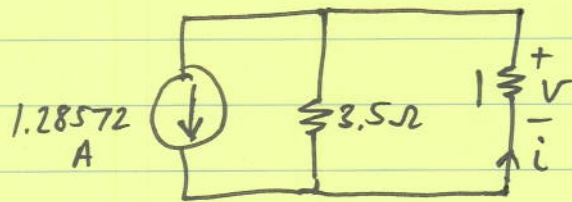
Get i using current divider: $i = 1.28572 \cdot \dfrac{3.5}{1+3.5}$

$$= -1A.$$

This should be +1A

So, $v = (-1A)(1\Omega) = -1V$

This is correct.