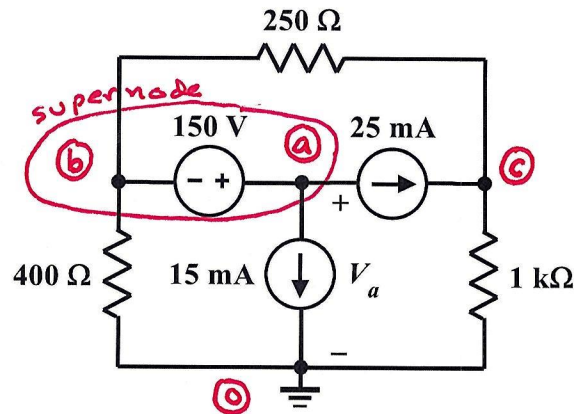# Homework Problem #024

Use the nodal analysis method to determine $V_a$.



$V_a - V_b = 150 V$      (constraint equation for supernode)

$\dfrac{V_b - V_c}{250\,\Omega} + 25mA + 15mA + \dfrac{V_b}{400\,\Omega}$      (KCL for supernode)

$\dfrac{V_c - V_b}{250\,\Omega} - 25mA + \dfrac{V_c}{1k\,\Omega} = 0$      (KCL for node c)

In matrix form:

$$\begin{bmatrix} 1 & -1 & 0 \\ 0 & \frac{1}{250} + \frac{1}{400} & -\frac{1}{250} \\ 0 & -\frac{1}{250} & \frac{1}{250} + \frac{1}{1000} \end{bmatrix} \begin{bmatrix} V_a \\ V_b \\ V_c \end{bmatrix} = \begin{bmatrix} 150 \\ -25 \times 10^{-3} - 15 \times 10^{-3} \\ 25 \times 10^{-3} \end{bmatrix}$$

Solving yields      $V_a = 143.9394 \ V$

(see next page for
MATLAB solution)

```
>> a=[1 -1 0; 0 1/250+1/400 -1/250; 0 -1/250 1/250+1/1000]

a =

    1.0000   -1.0000        0
         0    0.0065   -0.0040
         0   -0.0040    0.0050

>> c=[150 -25e-3-15e-3 25e-3]'

c =

  150.0000
   -0.0400
    0.0250

>> b=a\c

b =

  143.9394
   -6.0606
    0.1515
```