King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE205: Electric Circuits II
Quiz 3: State Equations

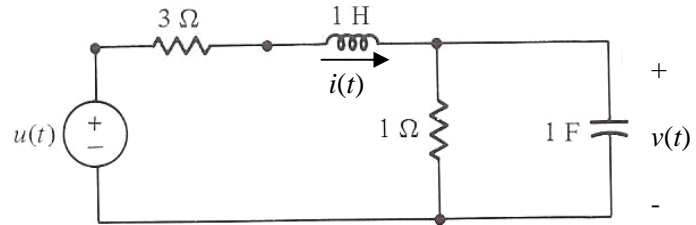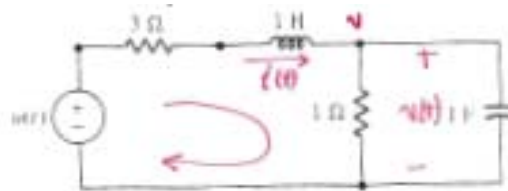Name: Key   ver.

For the circuit in the figure, write the matrix state equation.
Cleary state your steps (KVL on loop…., KCL at node….). *No or low grade will be given for not detailing the procedure.*

There are two State variables

By KCL @ node V:

$$i(t) = \frac{v(t)}{1} + 1\frac{d\,v(t)}{dt}$$

rewrite:

$$\frac{d\,v(t)}{dt} = -v(t) + i(t) = i(t) - v(t) \qquad \text{——①}$$

By KVL in the left hand loop.

$$-v_s(t) + 3\,i(t) + 1\frac{d\,i(t)}{dt} + v(t) = 0$$

$$\frac{d\,i(t)}{dt} = -3\,i(t) - v(t) + v_s(t) \qquad \text{——②}$$

$$\frac{d}{dt}\begin{bmatrix} i(t) \\ v(t) \end{bmatrix} = \begin{bmatrix} -3 & -1 \\ 1 & -1 \end{bmatrix}\begin{bmatrix} i(t) \\ v(t) \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(t)$$

$v_s(t) = u(t)$
given

↯ it is possible to start with the voltage & permute the rows.

Good Luck, **Dr. Ali Muqaibel**