3. In the figure below, \( E = 100 \) volts, \( R_1 = 10 \) ohms, \( R_2 = 20 \) ohms, \( R_3 = 30 \) ohms, and \( L = 2 \) henry. Find the value of \( i_1 \) and \( i_2 \).

(a) immediately after \( S \) is closed,
(b) a long time later,
(c) immediately after \( S \) is opened again, and
(d) a long time later.

\[ A_V = 17.6 \]

**Solution for Final Exam 173

#3**

\[ \frac{V}{R_1 + R_{eq}} = \frac{100}{2} = 4.54 \text{ amps.} \]

\[ V_{18} = \frac{R_2}{R_2 + R_3} = \frac{1}{2} \text{ of } V_{18} \]

\[ i_2 = \frac{4.54 \times 12}{2 \times 2} = 2.72 \text{ A} \]
c. With \( L \) open, \( i_1 = 0 \). The inductor will start losing stored energy through \( R_2 \) and \( R_3 \). At \( t = 0 \) it must still be sending the same current out as before the switch was open.

The current is \( i, R_{eq} = \frac{3}{R_3} \)

\[
\frac{V_3}{3} = \frac{4.54 \times 12}{30} = 1.82 \text{ amp.}
\]

Then \( i_2 = -1.82 \text{ amp} \), since current i sin diode operates to oppose definition of \( i_2 \) in diagram.

d. \( i_1 = 0 \) still.

\( i_2 \) gets to zero at \( t = \infty \) because all energy stored in inductors has been dissipated in resistors.

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