29. (II) Determine the magnitudes and directions of the currents in each resistor shown in Fig. 19–48. The batteries have emfs of $\mathscr{E}_1 = 9.0$ V and $\mathscr{E}_2 = 12.0$ V and the resistors have values of $R_1 = 25\,\Omega$, $R_2 = 18\,\Omega$, and $R_3 = 35\,\Omega$.
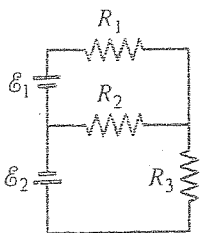
FIGURE 19–48
Problems 29 and 30.

30. (II) Repeat Problem 29, assuming each battery has internal resistance $r = 1.0\,\Omega$.

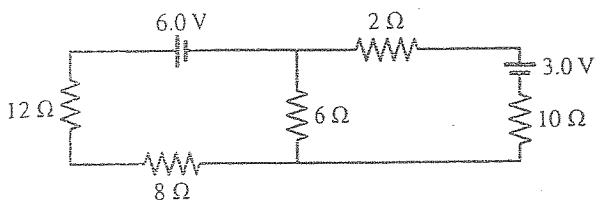31. (II) Calculate the currents in each resistor of Fig. 19–49.

FIGURE 19–49   Problem 31.

32. (III) (a) Determine the currents I_1, I_2, and I_3 in Fig. 19–50. Assume the internal resistance of each battery is $r = 1.0\,\Omega$. (b) What is the terminal voltage of the 6.0-V battery?
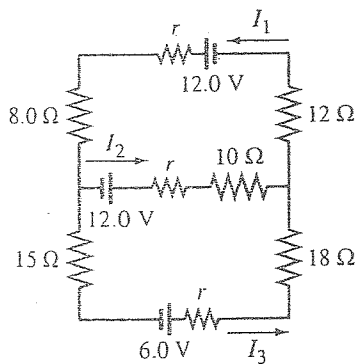
FIGURE 19–50
Problems 32 and 33.

33. (III) What would the current I_1 be in Fig. 19–50 if the 12-Ω resistor is shorted out? Let $r = 1.0\,\Omega$.

19–4 Emfs Combined, Battery Charging

34. (II) Suppose two batteries, with unequal emfs of 2.00 V and 3.00 V, are connected as shown in Fig. 19–51. If each internal resistance is $r = 0.100\,\Omega$, and $R = 4.00\,\Omega$, what is the voltage across the resistor R?
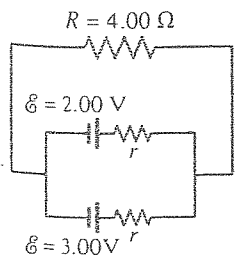
FIGURE 19–51
Problem 34.

24. (II) Determine the terminal voltage of each battery in Fig. 19–44.
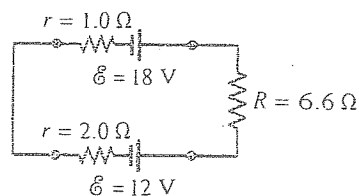
FIGURE 19–44   Problem 24.

25. (II) (a) What is the potential difference between points a and d in Fig. 19–45 (same circuit as Fig. 19–13, Example 19–8), and (b) what is the terminal voltage of each battery?
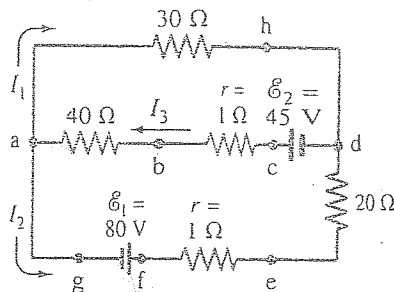
FIGURE 19–45   Problem 25.

26. (II) For the circuit shown in Fig. 19–46, find the potential difference between points a and b. Each resistor has $R = 75\,\Omega$ and each battery is 1.5 V.
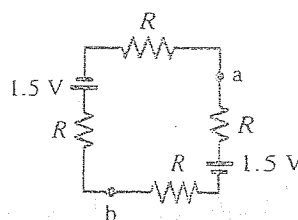
FIGURE 19–46   Problem 26.

27. (II) Determine the magnitudes and directions of the currents through R_1 and R_2 in Fig. 19–47.
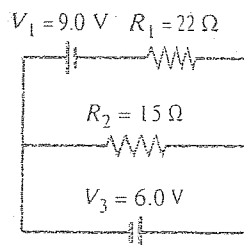
FIGURE 19–47   Problems 27 and 28.

28. (II) Repeat Problem 27, now assuming that each battery has an internal resistance $r = 1.2\,\Omega$.

MATRIX operations w/ TI calculator

1) set up matrix.

2) perform operations on matrix

) -set up. [2nd] [matrix / x^{-1}] $\Rightarrow$ $\Rightarrow$ [EDIT] $\Rightarrow$ [Enter]
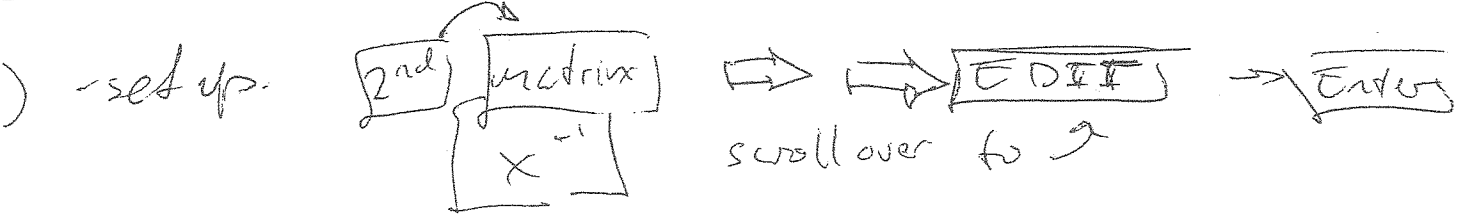
scroll over to 2

) enter in size of matrix 3×4 in this case

and enter in <u>values</u>
for each term*

$3 \begin{cases} I_1 & + I_2 & + I_3 & = \underline{\quad} \\ I_1 & I_2 & I_3 & = \underline{\quad} \\ I_1 & I_2 & I_3 & = \underline{\quad} \end{cases}$

4

(* requires rewriting
all equations into
proper format

[Clear] [2nd / guit] [MODE] to exit] becomes

i.e. $I_1 + I_2 = I_3$

becomes $1 I_1 + 1 I_2 = 1 I_3 = 0$
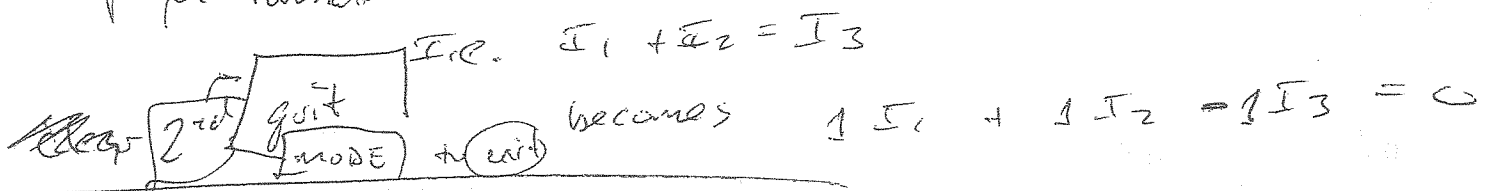
2 perform mathematical operations

[2nd] [MATRIX / x^{-1}]) $\Rightarrow$ [MATH]

↓scroll down to

[rref] $\rightarrow$ [Enter]

(reduced row echelon form)
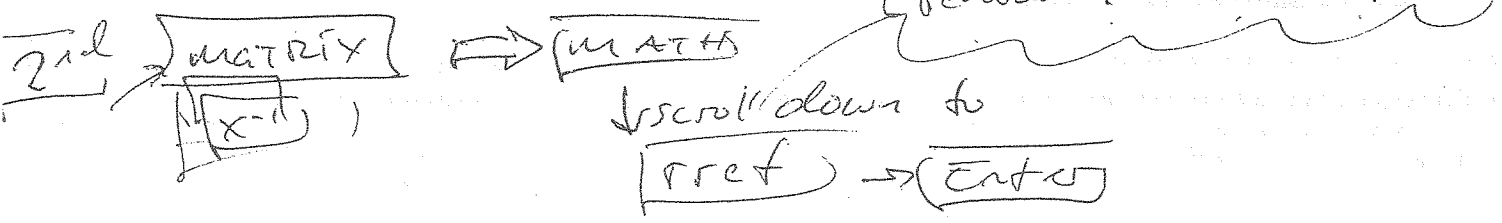
now the TI wants you to select the matrix to
do math on...

[2nd] [MATRIX / x^{-1}]

= should have the list of matrices
top of list = your matrix
- close parenthesis [ )] → [enter]