**Topic:** Matrix math; Solving linear systems of equations
**Read:** Intro to Part 3; Chapter 8; Chapter 9 intro & 9.1.1

## Handwork problems:

### HW4_1

$$A=\begin{bmatrix}-6\\9\\9\end{bmatrix} \quad B=\begin{bmatrix}0&8\\6&6\\-6&9\\-1&3\end{bmatrix} \quad C=[-8 \quad 7 \quad 9] \quad D=\begin{bmatrix}4&3&-4&4\\5&-6&-8&-3\\5&4&-7&9\\-2&-8&7&-8\end{bmatrix}$$

The following matrix operations are shown in MATLAB. Perform the same operation by hand and show your work for just the single element shown in green.
For example, if asked `x=D*B %x(1,1)` write:
x(1,1)=(d11)(b11)+(d12)(b21)+(d13)(b31) =0 + 18 + 24 + -4 = 38

(1) `e=C*A-10` `%e(1,1)`

(2) `f=D^2` `%f(4,2)`

(3) `g=D.*D` `%g(4,2)`

(4) `h=D(2:3,:)*B` `%h(2,2)`

### HW4_2

Solve the following system of linear equations, using Gaussian-Naïve elimination

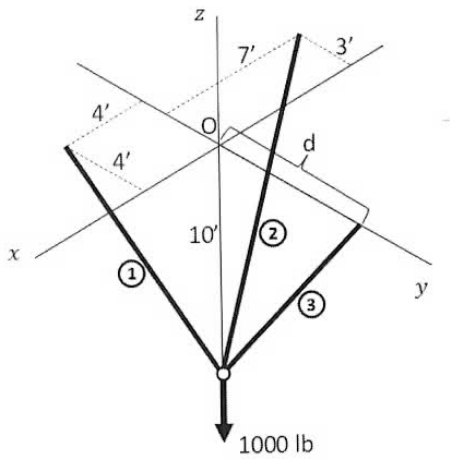
$$\begin{bmatrix}3&1&5&5\\4&-4&5&0\\-4&-2&-4&3\\5&1&-5&-4\end{bmatrix}\begin{Bmatrix}x_1\\x_2\\x_3\\x_4\end{Bmatrix}=\begin{Bmatrix}42\\-9\\-3\\-5\end{Bmatrix}$$

**Show all your work, explaining each step with words so that your work is easy to follow.**

## Coding problems:

### HW4_3

A 1000-lb weight is supported by 3 cables as shown in the figure. Note that cable #3 is attached along the y-axis, at a distance of *d* feet from the origin, O. The static equilibrium equations for this structure are

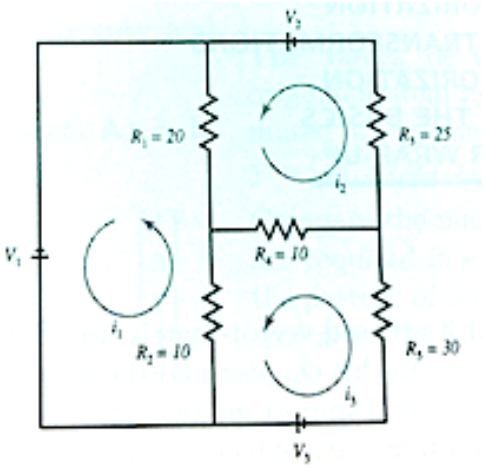



$$\frac{2}{\sqrt{33}}T_1-\frac{7}{\sqrt{158}}T_2=0$$
$$-\frac{2}{\sqrt{33}}T_1-\frac{3}{\sqrt{158}}T_2+\frac{d}{L}T_3=0$$
$$\frac{5}{\sqrt{33}}T_1+\frac{10}{\sqrt{158}}T_2+\frac{10}{L}T_3-1000=0$$
$$where\ L=\sqrt{10^2+d^2}\,,length\ of\ cable\ 3$$

Write a script to solve for the three tensions simultaneously using backslash with *d*= 5 ft. Use an `fprintf` statement to write your answer to the screen.

**HW4_4** Given the circuit shown at right. Equations for the three loops are written as follows

$$\begin{aligned} loop\ 1 \quad & R_1(i_1 - i_2) + R_2(i_1 - i_3) = V_1 \\ loop\ 2 \quad & R_3 i_2 + R_4(i_2 - i_3) + R_1(i_2 - i_1) = V_2 \\ loop\ 3 \quad & R_5 i_3 + R_4(i_3 - i_2) + R_2(i_3 - i_1) = V_3 \end{aligned}$$




Let $V_1$=10, $V_2$=20 and $V_3$=100 in Volts. Also, $R_1$=20, $R_2$=10, $R_3$=25, $R_4$=10, $R_5$=30 in Ohms. Find the three currents in the circuit using MATLAB. Your code should place the equations in matrix form and use backslash to solve. Print the answers for $i_1$, $i_2$, $i_3$, to the screen using `fprintf`.

**HW4_5 (for practice only, not for grade)**
One of the two nearly identical systems of equations below does not have a solution. Which one is it? Demonstrate how you determine your answer in a script M-file. Print the solution for other system, using `fprintf`

`Sys1:`

$$\begin{aligned} -4x_2 - 2x_3 + 2x_4 &= 4 \\ 3x_1 - 2x_2 - 4x_3 &= 3 \\ 4x_1 - 5x_2 - 3x_3 + 5x_4 &= 22 \\ -4x_1 + 4x_3 - 4x_4 &= -28 \end{aligned}$$

`Sys2:`

$$\begin{aligned} -4x_2 - 2x_3 + 2x_4 &= 4 \\ 3x_1 - 2x_2 - 4x_3 &= 3 \\ 4x_1 + 2x_2 - 3x_3 + 5x_4 &= 22 \\ -4x_1 + 4x_3 - 4x_4 &= -28 \end{aligned}$$