Matrix Algebra
Matrix Operations
Extra Homework 3

1. For the following matrices A and B, find $7A$, $A - B$, AB and BA (or explain why they don't exist).

a)

$$A = \begin{pmatrix} 3 & 1 & 1 \\ 1 & 2 & 1 \\ 2 & 2 & 0 \end{pmatrix}$$

$$B = \begin{pmatrix} 0 & 2 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$$

b)

$$A = \begin{pmatrix} 2 & 2 & 0 \\ -2 & 3 & 1 \end{pmatrix}$$

$$B = \begin{pmatrix} 7 & 0 & 3 \\ 0 & 1 & 7 \\ 3 & 8 & 1 \end{pmatrix}$$

c)

$$A = \begin{pmatrix} 3 & 1 & 2 \\ 2 & -1 & 1 \\ 2 & -2 & 1 \end{pmatrix}$$

$$B = \begin{pmatrix} 1 & 1 & 4 \\ 2 & 0 & 3 \\ 3 & 1 & 2 \\ 4 & 0 & 1 \end{pmatrix}$$

d)

$$A = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 1 & 1 & 4 \\ -2 & 3 & 1 & 2 \end{pmatrix}$$

$$B = \begin{pmatrix} 1 & 5 & 1 & 5 \\ 3 & 1 & 2 & 2 \\ 2 & 2 & 1 & 0 \end{pmatrix}$$

2. Write the following systems in the form $A\boldsymbol{x} = \boldsymbol{b}$.
   a)

$$\begin{aligned} 2x \;+y &= -4 \\ x \;\;\;\;\;\; &= 5 \\ x \;+y \;\;\;\; &= 7 \end{aligned}$$

   b)

$$\begin{aligned} \;\;\;\;\;\; -x_2 \;+4x_3 \;+x_4 \;\;\;\; &= 0 \\ x_1 \;-2x_2 \;\;\;\; -x_3 \;+2x_4 \;\;\;\; &= 2 \\ 9x_1 \;+8x_2 \;+2x_3 \;-7x_4 \;\;\;\; &= 1 \end{aligned}$$

3. Given A and $\boldsymbol{b}$, write a system of equations equivalent to $A\boldsymbol{x} = \boldsymbol{b}$.
   a)

$$A = \begin{pmatrix} 2 & 1 & 0 & 0 \\ 1 & 2 & -3 & -4 \\ 0 & 1 & 1 & 3 \end{pmatrix}, \quad \boldsymbol{b} = \begin{pmatrix} 4 \\ 2 \\ -1 \end{pmatrix}$$

   b)

$$A = \begin{pmatrix} 2 & 0 & 1 \\ 0 & 1 & -1 \\ 2 & 3 & 0 \end{pmatrix}, \quad \boldsymbol{b} = \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix}$$

   c)

$$A = \begin{pmatrix} 2 & 3 & 1 \end{pmatrix}, \quad \boldsymbol{b} = \begin{pmatrix} -8 \end{pmatrix}$$