

Exercise 4

Math Bootcamp

Instructions

- Please show your work! You may lose points by simply writing in the answer. If the problem requires you to execute commands in **R**, please include the code you used to get your answers. Please also include the **.R** file that contains your code. If you are not sure if work needs to be shown for a particular problem, please ask.
- You should submit your work electronically on GitHub in **.pdf** form.

Question 1

Perform the following vector/matrix algebra:

1. $\begin{bmatrix} 3 & 1 & 2 \\ 6 & 3 & 4 \end{bmatrix} \begin{bmatrix} 4 & 7 \\ 3 & 0 \\ 1 & 2 \end{bmatrix} =$

2. $\begin{bmatrix} 3 & -3 \\ -3 & 3 \end{bmatrix} + \begin{bmatrix} 2 & 1 \\ 0 & 0 \end{bmatrix}$

3. $\begin{bmatrix} -1 & -9 \\ -1 & -4 \\ 1 & 2 \end{bmatrix} \begin{bmatrix} -4 & -4 \\ -1 & 0 \\ -3 & -8 \end{bmatrix}'$

Question 2

Calculate $|B|$ (the determinant), $tr(B)$, and B^{-1} (you can use R's **solve** function for the inverse) given $B = \begin{bmatrix} 1 & 0 & 4 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$.

Question 3

In their formal study of models of group interaction, Bonacich and Bailey (1971) looked at linear and nonlinear systems of equations (their interest was in models that include factors such as free time, psychological compatibility, friendliness, and common interests). One of their conditions for a stable system was that the determinant of the matrix must have a positive determinant for values of r and a .

$$\begin{pmatrix} -r & a & 0 \\ 0 & -r & a \\ 1 & 0 & -r \end{pmatrix}$$

Given the determinant is positive, what is the arithmetic relationship between r and a that must be true?