1. Answer the following questions about the matrices below:

$$A = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -4 & 0 & 0 & 1 \end{pmatrix}, \quad B = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \quad C = \begin{pmatrix} 0 & 11 & -5 & 3 \\ 1 & 3 & -1 & 2 \\ 2 & -5 & 3 & 1 \\ 4 & 1 & 1 & 5 \end{pmatrix}.$$

   (a) Compute BC. What effect does B have on the rows of C? *[1 point]*

   (b) Compute ABC. What effect does A have on the rows of BC? *[1 point]*

   (c) Write the inverse matrix, A^{-1}, which reverses the effect of A on matrix rows. *[1 point]*

2. Write down the augmented matrix $[\ A \mid \vec{b}\ ]$ for the following system of equations. Use elimination to reduce the system to upper triangular form, and then back substitute for z, y, x. Show all your steps and write down the elimination (row exchange) matrix used in each step. *[4 points]*

$$\begin{aligned} x + 2y + z &= 1 \\ 3x + 7y + 3z &= 1 \\ -2x - 3y - 4z &= -1 \end{aligned}$$

3. Choose the numbers p, q, r, s in this augmented matrix so that there is (a) no solution (b) infinitely many solutions.

$$\left(A \mid \vec{b}\right) = \left(\begin{array}{ccc|c} 3 & 12 & -6 & p \\ 0 & 1 & 3 & q \\ 0 & 0 & s & r \end{array}\right)$$

Which of the numbers p, q, r or s have no effect on the solvability? *[3 points]*