For Questions 1, 2, and 3, let

\[ u = \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix}, \quad v = \begin{bmatrix} -2 \\ 3 \\ 0 \end{bmatrix}, \quad A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 6 & 7 \\ 0 & 0 & -1 \end{bmatrix} \]

1. Calculate \( u^T v \).

2. Calculate \( uv^T \).

3. Is the following operation on \( u \), \( v \), and \( A \) valid? Explain why or why not. (If it is valid you do not need to perform the calculation.)

\[ (u^T v)^T - 4A \]

4. Given matrices \( A_{m \times n} \), \( B_{n \times p} \), and \( C_{p \times q} \), what is the size of the matrix
   a.) determined by the product \( AB \)?
   
   b.) determined by \( (ABC)^T \)?