Linear Algebra
C Term, Sections C01-C04
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Solutions – Linear Algebra Quiz 1

Suppose we have three matrices

$$A = \begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}, \qquad B = \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}, \qquad C = \begin{pmatrix} 3 \\ -1 \end{pmatrix}.$$

Compute each of the following two matrices, **if it exists**. If the matrix does not exist, briefly indicate why.

$C(A^2 - 5B)$

Solution: This matrix product is undefined since matrix C has one column and the matrix $A^2 - 5B$ has two rows.

$C^T(A^2 - 5B)$

Solution:

$$A^2 = \begin{pmatrix} 5 & 4 \\ 4 & 5 \end{pmatrix}$$

$$5B = \begin{pmatrix} 5 & -5 \\ 0 & 5 \end{pmatrix}$$

$$A^2 - 5B = \begin{pmatrix} 5 & 4 \\ 4 & 5 \end{pmatrix} - \begin{pmatrix} 5 & -5 \\ 0 & 5 \end{pmatrix} = \begin{pmatrix} 0 & 9 \\ 4 & 0 \end{pmatrix}$$

$$C^T(A^2 - 5B) = \begin{pmatrix} 3 & -1 \end{pmatrix} \begin{pmatrix} 0 & 9 \\ 4 & 0 \end{pmatrix} = \begin{pmatrix} -4 & 27 \end{pmatrix}.$$