QUIZ 24 SOLUTIONS: LESSON 32
NOVEMBER 19, 2018

Write legibly, clearly indicate the question you are answering, and put a box or circle around your final answer. If you do not clearly indicate the question numbers, I will take off points. Write as much work as you need to demonstrate to me that you understand the concepts involved. If you have any questions, raise your hand and I will come over to you.

Let

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

Evaluate the following if they exist. If they do not exist, write **does not exist**.

1. [3 pts] $AB - B$

Solution: Since A is a 2×2 matrix and B is a 2×3 matrix, AB **exists** and is a 2×3 matrix. So we write

$$\begin{aligned} AB - B &= \begin{bmatrix} -1 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 2 & 3 & -1 \\ 0 & 1 & -2 \end{bmatrix} - \begin{bmatrix} 2 & 3 & -1 \\ 0 & 1 & -2 \end{bmatrix} \\ &= \begin{bmatrix} -1(2)+1(0) & -1(3)+1(1) & -1(-1)+1(-2) \\ 0(2)+1(0) & 0(3)+1(1) & 0(-1)+1(-2) \end{bmatrix} - \begin{bmatrix} 2 & 3 & -1 \\ 0 & 1 & -2 \end{bmatrix} \\ &= \begin{bmatrix} -2 & -2 & -1 \\ 0 & 1 & -2 \end{bmatrix} - \begin{bmatrix} 2 & 3 & -1 \\ 0 & 1 & -2 \end{bmatrix} \\ &= \begin{bmatrix} -2-2 & -2-3 & -1-(-1) \\ 0-0 & 1-1 & -2-(-2) \end{bmatrix} \\ &= \begin{bmatrix} -4 & -5 & 0 \\ 0 & 0 & 0 \end{bmatrix} \end{aligned}$$

2. [3 pts] $3A - A^2$

Solution: We write

$$\begin{aligned} 3\begin{bmatrix} -1 & 1 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} -1 & 1 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} -1 & 1 \\ 0 & 1 \end{bmatrix} &= \begin{bmatrix} 3(-1) & 3(1) \\ 3(0) & 3(1) \end{bmatrix} - \begin{bmatrix} -1(-1)+0(1) & -1(1)+1(1) \\ 0(-1)+1(0) & 0(1)+1(1) \end{bmatrix} \\ &= \begin{bmatrix} -3 & 3 \\ 0 & 3 \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \\ &= \begin{bmatrix} -3-1 & 3-0 \\ 0-0 & 3-1 \end{bmatrix} \end{aligned}$$

$$= \begin{bmatrix} -4 & 3 \\ 0 & 2 \end{bmatrix}$$

3. [4 pts] $2B + BC$

Solution: Since B is a 2×3 matrix and C is a 3×3 matrix, BC exists and is a 2×3 matrix. Write

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

$$= \begin{bmatrix} 2(2) & 2(3) & 2(-1) \\ 2(0) & 2(1) & 2(-2) \end{bmatrix}$$

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

$$= \begin{bmatrix} 4 & 6 & -2 \\ 0 & 2 & -4 \end{bmatrix} + \begin{bmatrix} 0 & 5 & 7 \\ 4 & 5 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 4+0 & 6+5 & -2+7 \\ 0+4 & 2+5 & -4+5 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & 11 & 5 \\ 4 & 7 & 1 \end{bmatrix}$$