

Answers: Matrix multiplication with special matrices

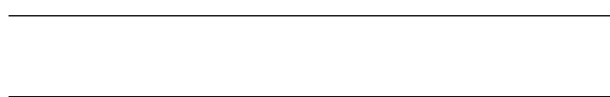
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Summary

Answers to questions for the study guide on matrix multiplication with special matrices.

These are the answers to [Questions: Matrix multiplication with special matrices](#).

Please attempt the questions before reading these answers!



Q1

1.1.

$$3x + 3y = 4$$

$$x - y = 5$$

1.2.

$$3x + 3y = 4$$

$$x - y = 5$$

$$-4x + 3y = 0$$

1.3.

$$3x + 3y + 3z = 4$$

$$y - z = 5$$

$$-4x + 3y + z = 0$$

1.4.

$$3x + 3y + 3z = 4$$

1.5.

$$3x + 3y + 3z + 3t = 4$$

$$x - y + t = 5$$



Q2

$$2.1. \begin{bmatrix} 9 & -1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -4 \\ 1 \end{bmatrix}$$

$$2.2. \begin{bmatrix} 1 & 3 & 1 \\ -1 & -1 & 9 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 8 \\ -1 \end{bmatrix}$$

$$2.3. \begin{bmatrix} 3 & 1 \\ 1 & -1 \\ 8 & -9 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \\ 1 \end{bmatrix}$$

$$2.4. \begin{bmatrix} 3 & 3 & 3 \\ 0 & 0 & 1 \\ -4 & -4 & 8 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 1 \\ 1 \end{bmatrix}$$

$$2.5. \begin{bmatrix} 2 & 2 & 2 & 9 \\ -1 & -1 & -1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ t \end{bmatrix} = \begin{bmatrix} 4 \\ -10 \end{bmatrix}$$

Q3

$$3.1. S_{0_{3 \times 9}} = 0_{2 \times 9}$$

$$3.2. 0_{9 \times 3}T = 0_{9 \times 2}$$

$$3.3. SI_3 = S$$

$$3.4. I_2S = S$$

$$3.5. I_2T \text{ is undefined as } I_2 \text{ has two columns and } T \text{ has three rows.}$$

Q4

For 4.1 to 4.4, pick $A = B = I_2$, the 2×2 identity matrix. In this case, $AB = I_2$ which is both upper triangular and lower triangular, a diagonal matrix, and the 2×2 identity matrix.

For 4.5, pick

$$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$$

where A is upper triangular and B is lower triangular. But

$$AB = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$$

which is neither upper nor lower triangular.

Version history

v1.0: initial version created 05/26 by tdhc.

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