# 4th lesson

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## Theory

**Definition 1.** We say that the matrix $\boldsymbol{B} \in M(n \times n)$ is an *inverse* of a matrix $\boldsymbol{A} \in M(n \times n)$ if $\boldsymbol{AB} = \boldsymbol{BA} = \boldsymbol{I}$.

## Exercises

1. Find the inverse matrix

   (a) $A = \begin{pmatrix} 1 & 2 \\ 3 & 7 \end{pmatrix}$ (c) $A = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$ (e) $A = \begin{pmatrix} 2 & 7 & 1 \\ -3 & -9 & 2 \end{pmatrix}$

   (b) $A = \begin{pmatrix} 1 & -2 \\ 2 & -3 \end{pmatrix}$ (d) $A = \begin{pmatrix} 2 & 4 \\ 4 & 8 \end{pmatrix}$

2. Find the inverse matrix

   (a) $A = \begin{pmatrix} 1 & 1 & 1 \\ 3 & 5 & 4 \\ 3 & 6 & 5 \end{pmatrix}$ (c) $A = \begin{pmatrix} 1 & 1 & 2 \\ -2 & 0 & 4 \\ 3 & 1 & -2 \end{pmatrix}$ (e) $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 5 & 3 \\ 1 & 0 & 8 \end{pmatrix}$

   (b) $A = \begin{pmatrix} 1 & 2 & 2 \\ 3 & 7 & 9 \\ -1 & -4 & -7 \end{pmatrix}$ (d) $A = \begin{pmatrix} 2 & 1 & 1 \\ 3 & 2 & 1 \\ 2 & 1 & 2 \end{pmatrix}$

3. Let $A = \begin{pmatrix} 1 & 2 \\ 1 & 3 \end{pmatrix}$ $B = \begin{pmatrix} 3 & 2 \\ 2 & 2 \end{pmatrix}$

   Compute

   (a) $AB$ (b) $(AB)^{-1}$ (c) $A^{-1}$ (d) $B^{-1}$ (e) $B^{-1}A^{-1}$

   Then confirm that $(AB)^{-1} = B^{-1}A^{-1}$.

4. Let $A = \begin{pmatrix} 1 & 0 \\ 9 & 3 \end{pmatrix}$ Compute

   (a) $A^{-1}$ (b) $A^T$ (c) $(A^{-1})^T$ (d) $(A^T)^{-1}$

   Then confirm that $(A^T)^{-1} = (A^{-1})^T$.

5. True or false? (Assume that all operations are defined.)

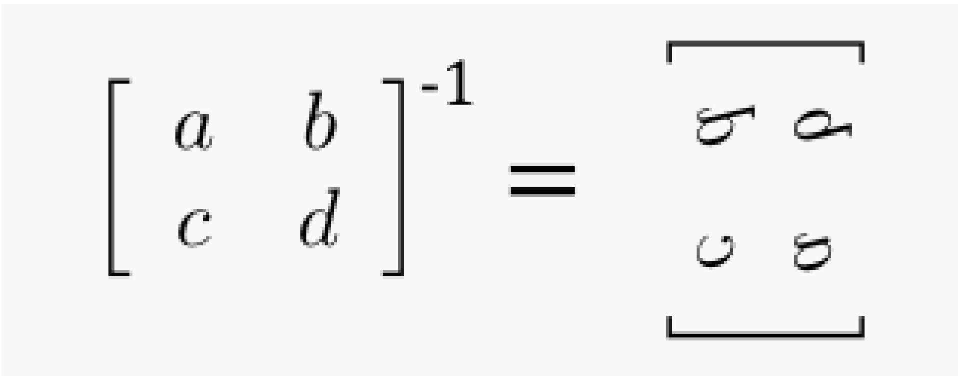
(TRUE – FALSE) $A + B = B + A$

(TRUE – FALSE) $AB = BA$

(TRUE – FALSE) $(AB)^T = A^T B^T$

(TRUE – FALSE) $(AB)^T = B^T A^T$

(TRUE – FALSE) $IA = AI = A$



Source 1: http://mathfail.com/movabletype/mt/mt-search.cgi?blog_id=4&tag=matrices&limit=20