

$$\square A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix}$$

$$\text{Легко заметить } 0 \cdot A = \begin{pmatrix} 0 \cdot a_{11} & 0 \cdot a_{12} & \dots & 0 \cdot a_{1n} \\ 0 \cdot a_{21} & 0 \cdot a_{22} & \dots & 0 \cdot a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 0 \cdot a_{m1} & 0 \cdot a_{m2} & \dots & 0 \cdot a_{mn} \end{pmatrix} =$$

$$= \begin{pmatrix} 0 & 0 & \dots & 0 \\ 0 & 0 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & 0 \end{pmatrix} = 0: \text{ нулевой элемент}$$

Чтобы умножить транспонированную матрицу!

$$1) (A^T)^T = A$$

$$\square A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix} \quad A^T = \begin{pmatrix} a_{11} & a_{21} & \dots & a_{m1} \\ a_{12} & a_{22} & \dots & a_{m2} \\ \vdots & \vdots & \ddots & \vdots \\ a_{1n} & a_{2n} & \dots & a_{mn} \end{pmatrix}$$

$$\text{Легко заметить } (A^T)^T = \begin{pmatrix} a_{11} & a_{21} & \dots & a_{m1} \\ a_{12} & a_{22} & \dots & a_{m2} \\ \vdots & \vdots & \ddots & \vdots \\ a_{1n} & a_{2n} & \dots & a_{mn} \end{pmatrix}^T = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix} = A$$

= нулевой элемент

$$2) (2 \cdot A)^T = 2 \cdot A^T$$

$$\square A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix} \quad A^T = \begin{pmatrix} a_{11} & \dots & a_{m1} \\ a_{12} & \dots & a_{m2} \\ \vdots & \ddots & \vdots \\ a_{1n} & \dots & a_{mn} \end{pmatrix}$$

$$\text{Легко заметить } (2 \cdot A)^T = \begin{pmatrix} 2 \cdot a_{11} & \dots & 2 \cdot a_{m1} \\ 2 \cdot a_{12} & \dots & 2 \cdot a_{m2} \\ \vdots & \ddots & \vdots \\ 2 \cdot a_{1n} & \dots & 2 \cdot a_{mn} \end{pmatrix} =$$

$$= 2 \cdot \begin{pmatrix} a_{11} & \dots & a_{m1} \\ a_{12} & \dots & a_{m2} \\ \vdots & \ddots & \vdots \\ a_{1n} & \dots & a_{mn} \end{pmatrix} = 2 \cdot A^T = \text{нулевой элемент}$$

$$3) D: (A+B)^T = A^T + B^T$$

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix} \quad A^T = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix}$$

$$B = \begin{pmatrix} b_{11} & b_{12} & \dots & b_{1n} \\ \vdots & \vdots & \ddots & \vdots \\ b_{m1} & b_{m2} & \dots & b_{mn} \end{pmatrix} \quad B^T = \begin{pmatrix} b_{11} & \dots & b_{1n} \\ b_{21} & \dots & b_{2n} \\ \vdots & \ddots & \vdots \\ b_{m1} & \dots & b_{mn} \end{pmatrix}$$

$$\text{Naherungsansatz} = (A+B)^T = \begin{pmatrix} a_{11}+b_{11} & a_{12}+b_{12} & \dots & a_{1n}+b_{1n} \\ a_{21}+b_{21} & a_{22}+b_{22} & \dots & a_{2n}+b_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1}+b_{m1} & a_{m2}+b_{m2} & \dots & a_{mn}+b_{mn} \end{pmatrix} =$$

$$= \begin{pmatrix} a_{11}+b_{11} & \dots & a_{1n}+b_1 \\ a_{12}+b_{12} & \dots & a_{m2}+b_{m2} \\ \vdots & \ddots & \vdots \\ a_{1n}+b_{1n} & \dots & a_{mn}+b_{mn} \end{pmatrix} = \begin{pmatrix} a_{11} & \dots & a_{1n} \\ a_{12} & \dots & a_{m2} \\ \vdots & \ddots & \vdots \\ a_{1n} & \dots & a_{mn} \end{pmatrix} + \begin{pmatrix} b_{11} & \dots & b_{1n} \\ b_{12} & \dots & b_{m2} \\ \vdots & \ddots & \vdots \\ b_{1n} & \dots & b_{mn} \end{pmatrix}$$

$$= A^T + B^T = \text{naherungsansatz}$$

$$4) (A \cdot B)^T = B^T \cdot A^T$$

$$D: A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix}$$

$$A^T = \begin{pmatrix} a_{11} & \dots & a_{1n} \\ a_{21} & \dots & a_{2n} \\ \vdots & \ddots & \vdots \\ a_{m1} & \dots & a_{mn} \end{pmatrix}$$

$$B = \begin{pmatrix} b_{11} & b_{12} & \dots & b_{1n} \\ \vdots & \vdots & \ddots & \vdots \\ b_{m1} & b_{m2} & \dots & b_{mn} \end{pmatrix}$$

$$B^T = \begin{pmatrix} b_{11} & \dots & b_{1n} \\ b_{21} & \dots & b_{2n} \\ \vdots & \ddots & \vdots \\ b_{m1} & \dots & b_{mn} \end{pmatrix}$$

$$\text{Naherungsansatz} = (A \cdot B)^T =$$

$$= \begin{pmatrix} a_{11} \cdot b_{11} & \dots & a_{1n} \cdot b_{1n} \\ a_{11} \cdot b_{11} & \dots & a_{1n} \cdot b_{1n} \\ \vdots & \ddots & \vdots \\ a_{1n} \cdot b_{1n} & \dots & a_{mn} \cdot b_{mn} \end{pmatrix} = \begin{pmatrix} b_{11} & \dots & b_{1n} \\ b_{12} & \dots & b_{mn} \\ \vdots & \ddots & \vdots \\ b_{1n} & \dots & b_{mn} \end{pmatrix} \cdot \begin{pmatrix} a_{11} & \dots & a_{1n} \\ a_{21} & \dots & a_{2n} \\ \vdots & \ddots & \vdots \\ a_{m1} & \dots & a_{mn} \end{pmatrix}^T =$$

$$B^T \cdot A^T = \text{natürliche Zahlen}$$



$$\begin{vmatrix} 1 & 0 & -1 & -1 \\ 3 & -2 & -1 & 0 \end{vmatrix} \vdash -3I \quad \begin{pmatrix} 1 & 0 & -1 & -1 \\ 0 & -2 & 2 & 3 \end{pmatrix}$$