I/1

$$(1,0,2)\begin{pmatrix}0\\2\\2\end{pmatrix} = \begin{pmatrix}0&0&0\\2&0&4\\2&0&4\end{pmatrix}$$

I/1

$$A \otimes I \quad \begin{pmatrix}2&0&0\\3&2&0\end{pmatrix} \otimes \begin{pmatrix}1&1&1\\0&2&0\end{pmatrix} =$$

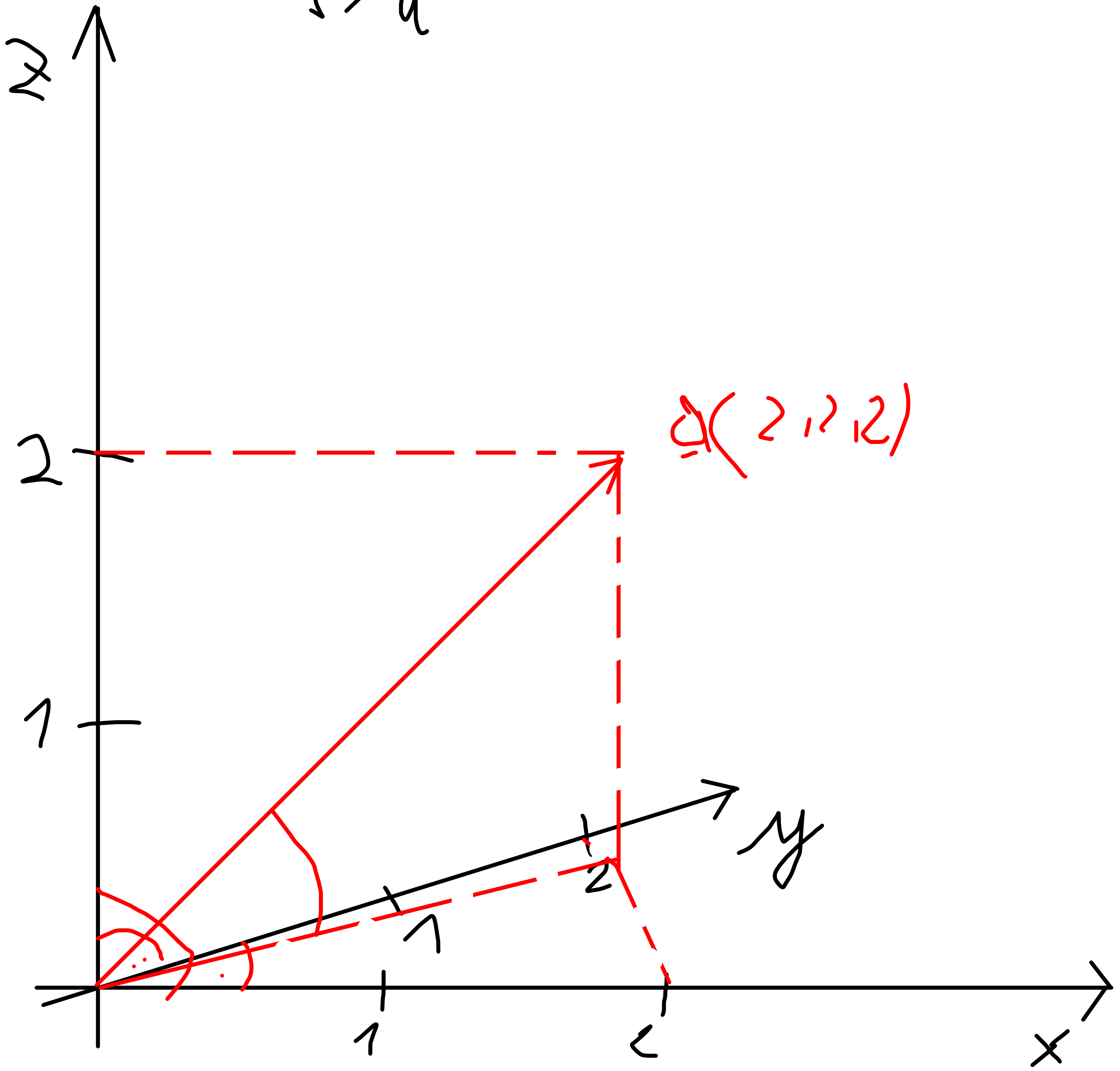
I/2

$$= \begin{pmatrix}2&2&2&0&0&0&0&0&0\\0&4&0&0&0&0&0&0&0\\3&3&3&2&2&2&0&0&0\\0&6&0&0&4&0&0&0&0\end{pmatrix}$$

$$\begin{pmatrix}4&2&2&2&0&0&0&0&0&0&0&0\\0&4&2&2&0&0&0&0&0&0&0&0\\0&0&4&2&0&0&0&0&0&0&0&0\\6&3&3&3&4&2&2&2&0&0&0&0\\0&6&3&3&0&4&2&2&0&0&0&0\\0&0&6&3&0&0&4&2&0&0&0&0\end{pmatrix} = A \otimes C$$

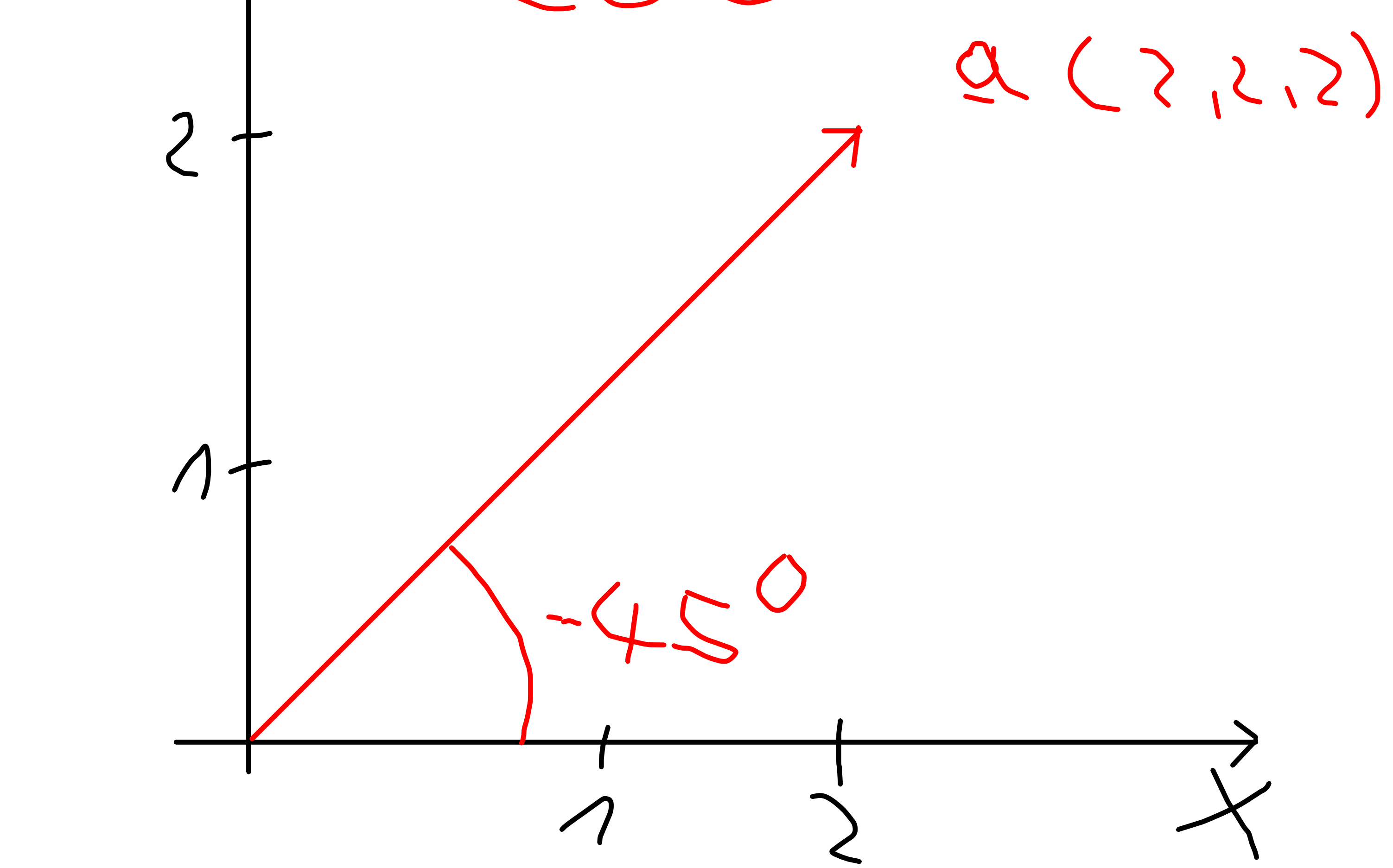
$$B \oplus C = \begin{pmatrix}2&1&1&1&2&1&1&1&2&1&1&1\\0&2&1&1&0&2&1&1&0&2&1&1\\0&0&2&1&0&0&2&1&0&0&2&1\\0&0&0&0&4&2&2&2&0&0&0&0\\0&0&0&0&0&4&2&2&0&0&0&0\\0&0&0&0&0&0&4&2&0&0&0&0\end{pmatrix}$$

II/3/a



$$\frac{\sqrt{2}}{2}\begin{pmatrix}1 & +1 & 0\\ -1 & 1 & 0\\ 0 & 0 & 0\end{pmatrix}$$

MEGOLDÁS I



cos (alpha) = (1,0)*(2,2)/(|(1,0)|*|(2,2)|)=2/(1*sqrt(8))=2/2/sqrt(2)=1/sqrt(2)=sqrt(2)/2

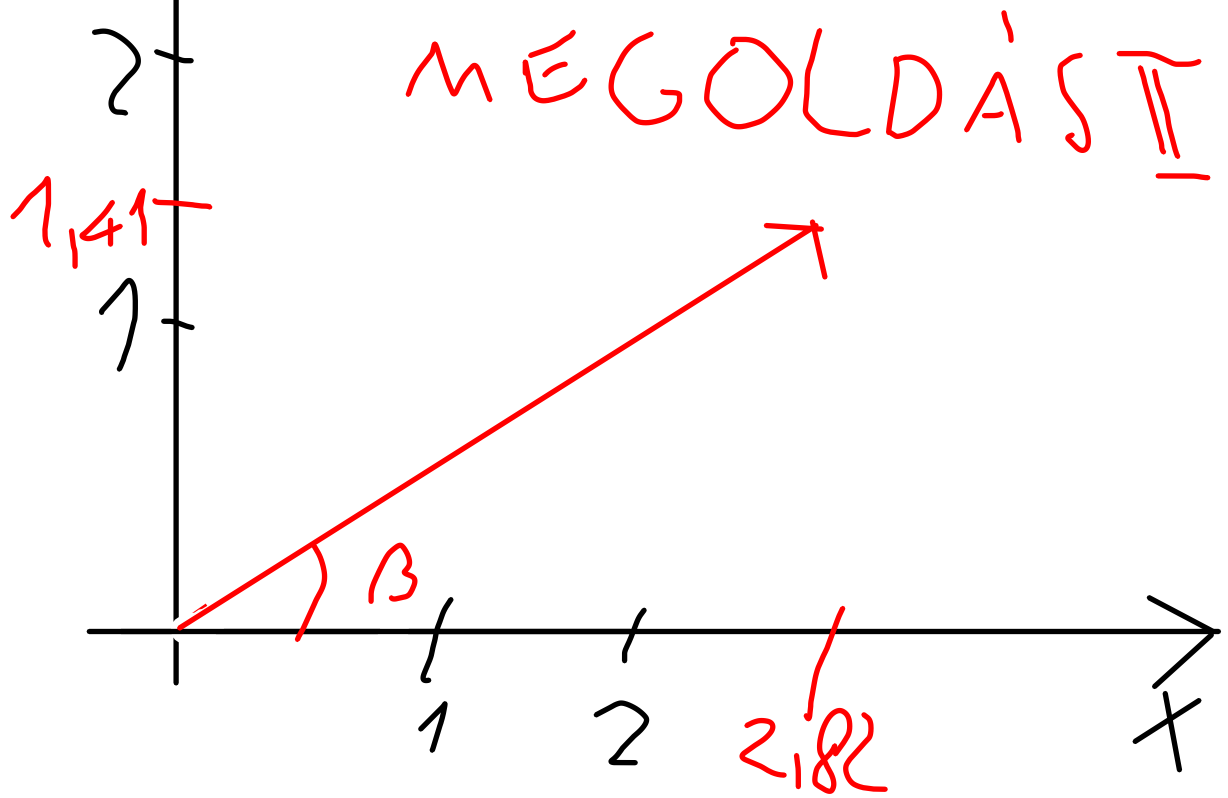
$$2\text{^}0.5/2\begin{pmatrix}1 & 1 & 0\\ -1 & 1 & 0\\ 0 & 0 & 1\end{pmatrix}\begin{pmatrix}2\\2\\2\end{pmatrix} = 2\text{^}0.5/2\begin{pmatrix}4\\0\\2\end{pmatrix}$$

cos(beta)=(1,0)*(2*sqrt(2),sqrt(2))/(1*(8+2))=2*sqrt(2)/10=sqrt(2)/5=
=73.57 → 26,43

$$\begin{pmatrix}0.89 & 0 & 0.45\\ 0 & 1 & 0\\ -0.45 & 0 & 0.89\end{pmatrix} \cdot \text{sqrt(2)} \begin{pmatrix}2\\0\\1\end{pmatrix} = \underline{\underline{\begin{pmatrix}3.1443\\0\\0\end{pmatrix}}}$$

$$\boxed{\begin{pmatrix}0{,}89 & 0 & 0{,}45\\ 0 & 1 & 0\\ -0{,}45 & 0 & 0{,}89\end{pmatrix}}$$

MEGOLDÁST



Determinant
Inverse Matrix
Matrix Power
Matrix Transpose
Matrix Multiplication
Matrix Addition/Subtraction

Back

Matrix A

	A_1	A_2	A_3
1	0.89	0	0.45
2	0	1	0
3	-0.45	0	0.89

Matrix B

	B_1
1	2.82
2	0
3	1.41

C_{11} = 0.89 x 2.82 + 0 x 0 + 0.45 x 1.41 = 3.1443

	C_1
1	3.1443
2	0
3	0

C_{21} = 0 x 2.82 + 1 x 0 + 0 x 1.41 = 0

	C_1
1	3.1443
2	0
3	0

C_{31} = -0.45 x 2.82 + 0 x 0 + 0.89 x 1.41 = -0.0141

	C_1
1	3.1443
2	0
3	-0.0141

Continue calculation

Result:

	C_1
1	3.1443
2	0
3	-0.0141

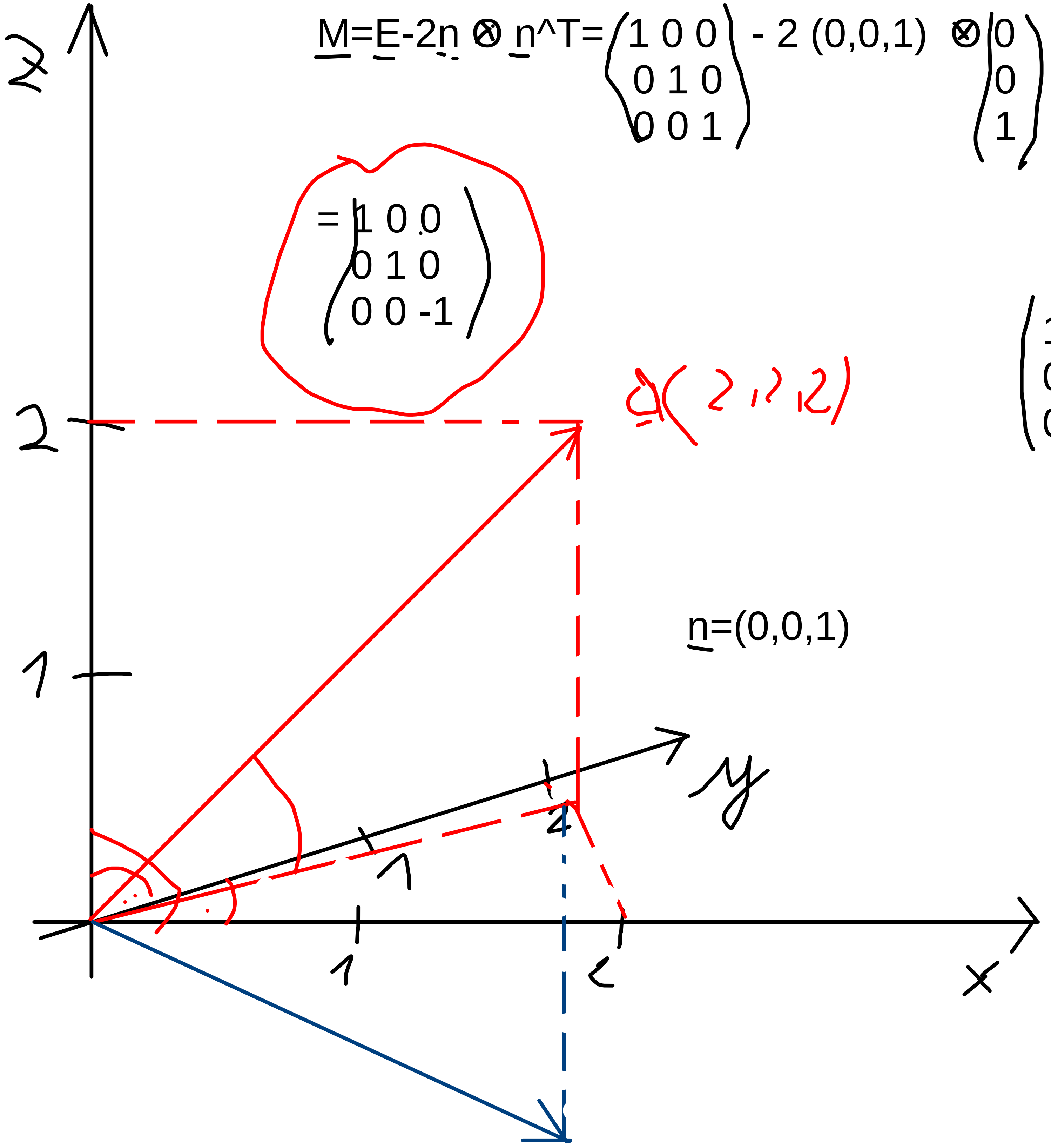
II / 3 b

$$\underline{M}=\underline{E}-2\underline{n}\otimes\underline{n}^T=\begin{pmatrix}1&0&0\\0&1&0\\0&0&1\end{pmatrix}-2\,(0,0,1)\otimes\begin{pmatrix}0\\0\\1\end{pmatrix}=\begin{pmatrix}1&0&0\\0&1&0\\0&0&1\end{pmatrix}-2\begin{pmatrix}0&0&0\\0&0&0\\0&0&1\end{pmatrix}=$$

$$=\begin{pmatrix}1&0&0\\0&1&0\\0&0&-1\end{pmatrix}$$

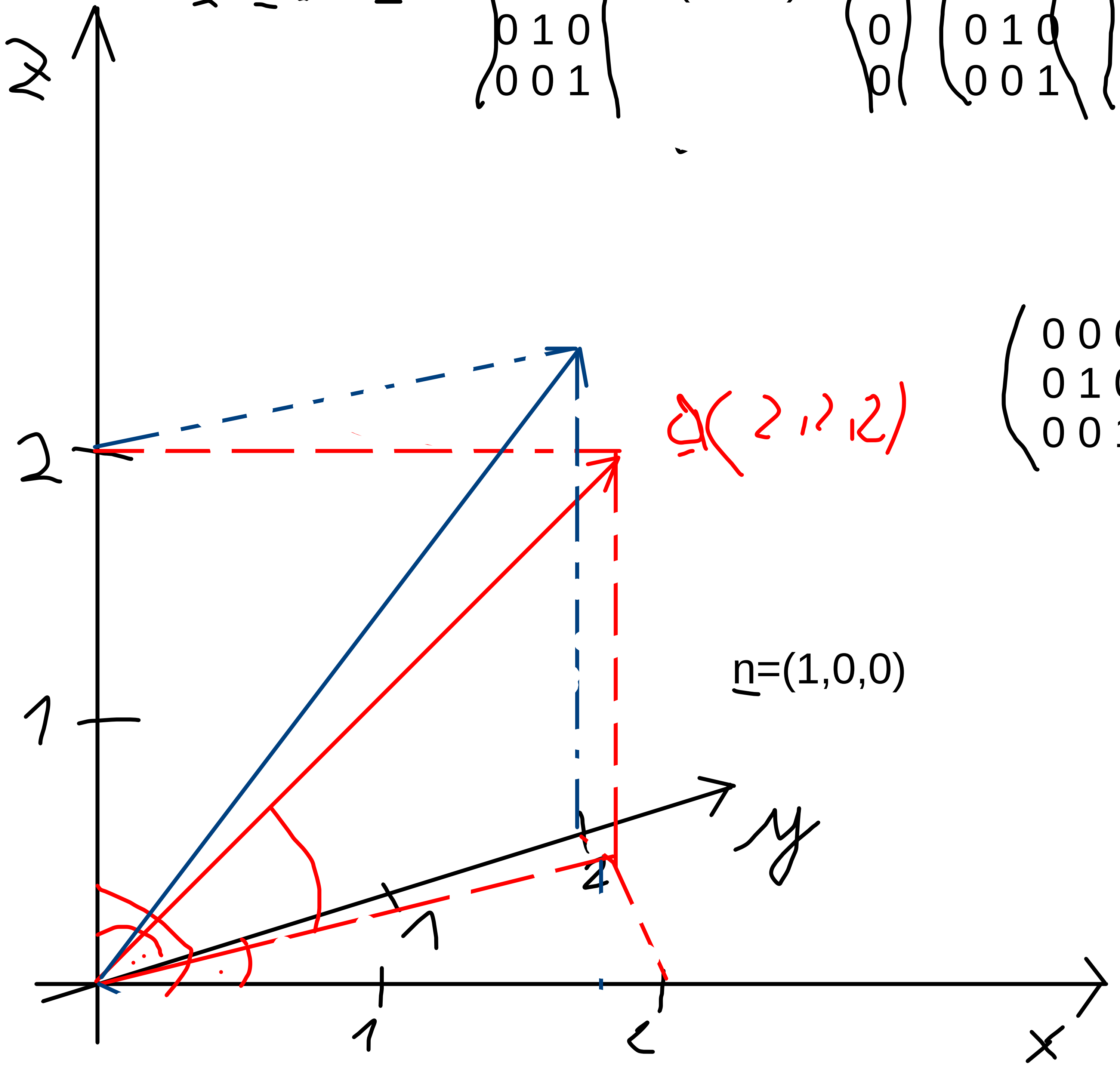
$$\begin{pmatrix}1&0&0\\0&1&0\\0&0&-1\end{pmatrix}\cdot\begin{pmatrix}2\\2\\2\end{pmatrix}=\begin{pmatrix}2\\2\\-2\end{pmatrix}$$

$\underline{n}=(0,0,1)$



Ü1/3c

$$\underline{P}=\underline{E}-\underline{n}\otimes\underline{n}^T=\begin{pmatrix}1&0&0\\0&1&0\\0&0&1\end{pmatrix}-(1,0,0)\otimes\begin{pmatrix}1\\0\\0\end{pmatrix}=\begin{pmatrix}1&0&0\\0&1&0\\0&0&1\end{pmatrix}-\begin{pmatrix}1&0&0\\0&0&0\\0&0&0\end{pmatrix}=\underline{\underline{\begin{pmatrix}0&0&0\\0&1&0\\0&0&1\end{pmatrix}}}$$



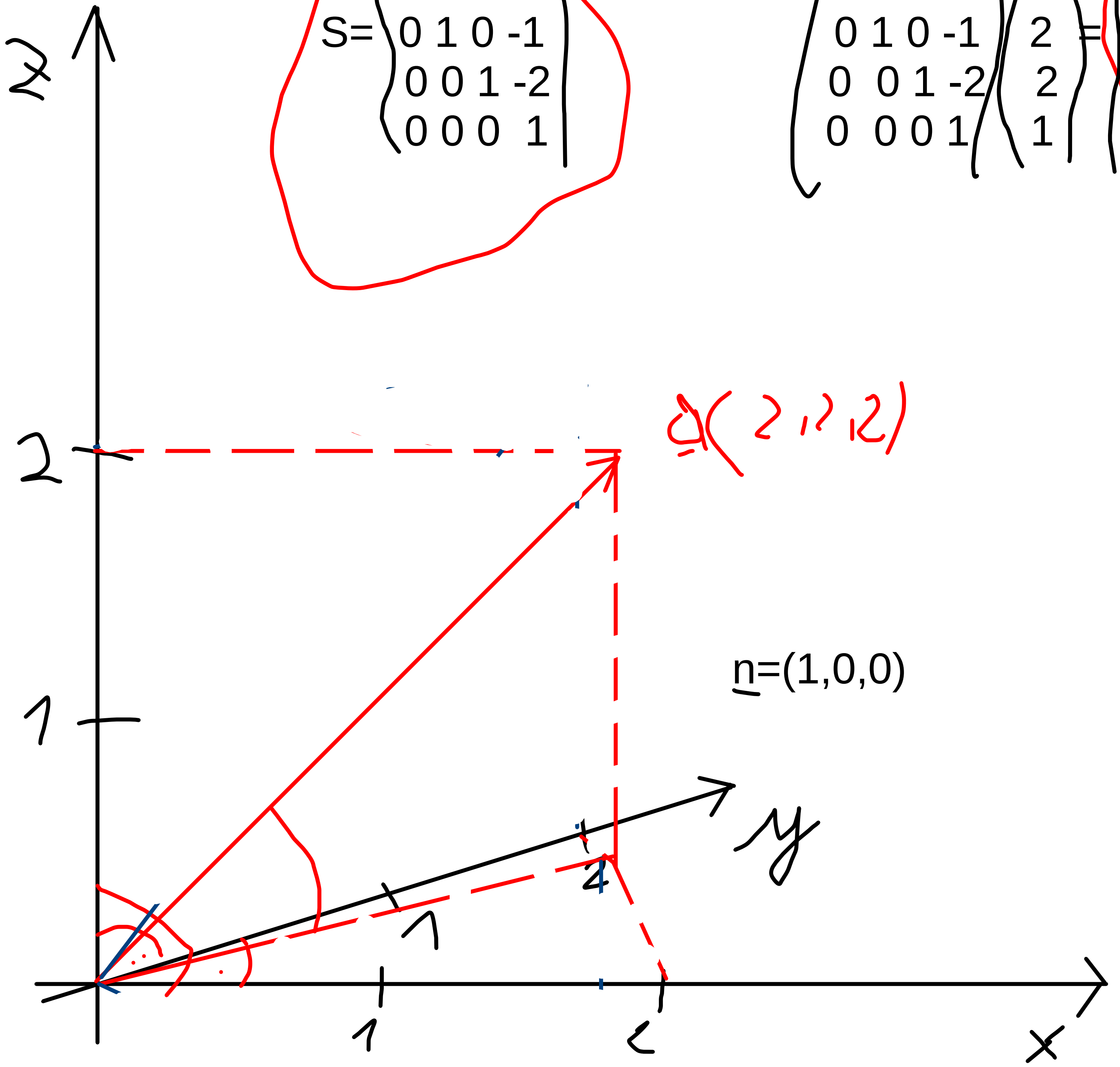
$$\begin{pmatrix}0&0&0\\0&1&0\\0&0&1\end{pmatrix}\begin{pmatrix}2\\2\\2\end{pmatrix}=\begin{pmatrix}0\\2\\2\end{pmatrix}$$

$\underline{n}=(1,0,0)$

II/3d

$$S=\begin{pmatrix}1&0&0&-1\\0&1&0&-1\\0&0&1&-2\\0&0&0&1\end{pmatrix}$$

$$\begin{pmatrix}1&0&0&-1\\0&1&0&-1\\0&0&1&-2\\0&0&0&1\end{pmatrix}\begin{pmatrix}2\\2\\2\\1\end{pmatrix}=\begin{pmatrix}1\\1\\0\\1\end{pmatrix} \checkmark$$



$\underline{n}=(1,0,0)$

II/4

a) $\begin{pmatrix} 9 & 0 & 0 \\ 0 & 14 & 0 \\ 0 & 0 & 18 \end{pmatrix}$ $\begin{pmatrix} 14 & 0 & 0 \\ 0 & 33 & 0 \\ 0 & 0 & 65 \end{pmatrix}$

b) $|D1|=30$ $|T|=8$ $|S|=-8$ $|P|=-1$

$D1^{-1}=\begin{pmatrix} 1/2 & 0 & 0 \\ 0 & 1/3 & 0 \\ 0 & 0 & 1/5 \end{pmatrix}$ $T=\begin{pmatrix} 1/2 & -1/4 & -1/8 \\ 0 & 1/2 & -1/4 \\ 0 & 0 & 1/2 \end{pmatrix}$ $S=\begin{pmatrix} 0 & 1/2 & 0 \\ 1/2 & 0 & 0 \\ 0 & 0 & 1/2 \end{pmatrix}$

c) $P=\begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

d) $D1^2=\begin{pmatrix} 4 & 0 & 0 \\ 0 & 9 & 0 \\ 0 & 0 & 25 \end{pmatrix}$ $T^2=\begin{pmatrix} 4 & 4 & 5 \\ 0 & 4 & 4 \\ 0 & 0 & 4 \end{pmatrix}$ $S^2=\begin{pmatrix} 4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 4 \end{pmatrix}$ $P^2=\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

e) $D1^3=\begin{pmatrix} 8 & 0 & 0 \\ 0 & 27 & 0 \\ 0 & 0 & 125 \end{pmatrix}$ $T^3=\begin{pmatrix} 8 & 12 & 18 \\ 0 & 8 & 12 \\ 0 & 0 & 8 \end{pmatrix}$ $S^3=\begin{pmatrix} 0 & 8 & 0 \\ 8 & 0 & 0 \\ 0 & 0 & 8 \end{pmatrix}$

$P^3=\begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

IV/5.

$$A=\begin{pmatrix} 2 & 3 & 2 \\ 3 & 2 & 3 \\ 3 & 2 & 3 \end{pmatrix} \quad A^T=\begin{pmatrix} 2 & 3 & 3 \\ 3 & 2 & 2 \\ 2 & 3 & 3 \end{pmatrix}$$

A=1/2*(A+A^T)+1/2*(A-A^T)=

$$=\begin{pmatrix} 2 & 3 & 5/2 \\ 3 & 2 & 5/2 \\ 5/2 & 5/2 & 3 \end{pmatrix} + \begin{pmatrix} 0 & 0 & -1/2 \\ 0 & 0 & 1/2 \\ 1/2 & -1/2 & 0 \end{pmatrix}$$

szimmetrikus ferdén szim.

$$B=\begin{pmatrix} 1 & 1 & 1 \\ 0 & 2 & 0 \\ 2 & 2 & 2 \end{pmatrix} \quad B^T=\begin{pmatrix} 1 & 0 & 2 \\ 1 & 2 & 2 \\ 1 & 0 & 2 \end{pmatrix}$$

B=1/2*(B+B^T)+1/2*(B-B^T)=

$$=\begin{pmatrix} 1 & 1/2 & 3/2 \\ 1/2 & 2 & 1 \\ 3/2 & 1 & 2 \end{pmatrix} + \begin{pmatrix} 0 & 1/2 & -1/2 \\ -1/2 & 0 & -1 \\ 1/2 & 1 & 0 \end{pmatrix}$$

szimmetrkus ferdén szimmetrikus

$$C=\begin{pmatrix} 2 & 3 & 3 \\ 0 & 3 & 3 \\ 0 & 0 & 2 \end{pmatrix} \quad C^T=\begin{pmatrix} 2 & 0 & 0 \\ 3 & 3 & 0 \\ 3 & 3 & 2 \end{pmatrix}$$

C=1/2*(C+C^T)+1/2*(C-C^T)=

$$=\begin{pmatrix} 2 & 3/2 & 3/2 \\ 3/2 & 3 & 3/2 \\ 3/2 & 3/2 & 2 \end{pmatrix} + \begin{pmatrix} 0 & 3/2 & 3/2 \\ -3/2 & 0 & 3/2 \\ -3/2 & -3/2 & 0 \end{pmatrix}$$

szimmetrikus ferdén szim.

V/6.

a) $$A+B=\left(\begin{array}{ccc|cc} 0&1&0&2&0\\ 1&0&1&1&2\\ \hline 2&1&2&2&3\\ 0&3&0&3&2 \end{array}\right)+\left(\begin{array}{ccc|cc} 1&0&1&0&1\\ 1&2&1&1&2\\ \hline 2&1&2&2&0\\ 0&3&0&0&2 \end{array}\right)=\left(\begin{array}{c|c} \begin{pmatrix}0&1&0\\1&0&1\end{pmatrix}+\begin{pmatrix}1&0&1\\1&2&1\end{pmatrix} & \begin{pmatrix}2&0\\1&2\end{pmatrix}+\begin{pmatrix}0&1\\1&2\end{pmatrix}\\ \hline \begin{pmatrix}2&1&2\\0&3&0\end{pmatrix}+\begin{pmatrix}2&1&2\\0&3&0\end{pmatrix} & \begin{pmatrix}2&3\\3&2\end{pmatrix}+\begin{pmatrix}2&0\\0&2\end{pmatrix} \end{array}\right)=\left(\begin{array}{c|c} \begin{pmatrix}1&1&1\\2&2&2\end{pmatrix} & \begin{pmatrix}2&1\\2&4\end{pmatrix}\\ \hline \begin{pmatrix}4&2&4\\0&6&0\end{pmatrix} & \begin{pmatrix}4&3\\3&4\end{pmatrix} \end{array}\right)=\left(\begin{array}{ccc|cc} 1&1&1&2&1\\ 2&2&2&2&4\\ \hline 4&2&4&4&3\\ 0&6&0&3&4 \end{array}\right)$$

A+C: Nem lehetséges / It is not possible.

B+C: Nem lehetséges / It is not possible.

b) $$2*A=2*\left(\begin{array}{ccc|cc} 0&1&0&2&0\\ 1&0&1&1&2\\ \hline 2&1&2&2&3\\ 0&3&0&3&2 \end{array}\right)=\left(\begin{array}{c|c} 2*\begin{pmatrix}0&1&0\\1&0&1\end{pmatrix} & 2*\begin{pmatrix}2&0\\1&2\end{pmatrix}\\ \hline 2*\begin{pmatrix}2&1&2\\0&3&0\end{pmatrix} & 2*\begin{pmatrix}2&3\\3&2\end{pmatrix} \end{array}\right)=\left(\begin{array}{c|c} \begin{pmatrix}0&2&0\\2&0&2\end{pmatrix} & \begin{pmatrix}4&0\\2&4\end{pmatrix}\\ \hline \begin{pmatrix}4&2&4\\0&6&0\end{pmatrix} & \begin{pmatrix}4&6\\6&4\end{pmatrix} \end{array}\right)=\left(\begin{array}{ccc|cc} 0&2&0&4&0\\ 2&0&2&2&4\\ \hline 4&2&4&4&6\\ 0&6&0&6&4 \end{array}\right)$$

$$3*B=3*\left(\begin{array}{ccc|cc} 1&0&1&0&1\\ 1&2&1&1&2\\ \hline 2&1&2&2&0\\ 0&3&0&0&2 \end{array}\right)=\left(\begin{array}{c|c} 3*\begin{pmatrix}1&0&1\\1&2&1\end{pmatrix} & 3*\begin{pmatrix}0&1\\1&2\end{pmatrix}\\ \hline 3*\begin{pmatrix}2&1&2\\0&3&0\end{pmatrix} & 3*\begin{pmatrix}2&0\\0&2\end{pmatrix} \end{array}\right)=\left(\begin{array}{c|c} \begin{pmatrix}3&0&3\\3&6&3\end{pmatrix} & \begin{pmatrix}0&3\\3&6\end{pmatrix}\\ \hline \begin{pmatrix}6&3&6\\0&9&0\end{pmatrix} & \begin{pmatrix}6&0\\0&6\end{pmatrix} \end{array}\right)=\left(\begin{array}{ccc|cc} 3&0&3&0&3\\ 3&6&3&3&6\\ \hline 6&3&6&6&0\\ 0&9&0&0&6 \end{array}\right)$$

$$5*C=\left(\begin{array}{cc|cc} 1 & 0 & 1 & 0 \\ 0 & 2 & 0 & 2 \\ 2 & 1 & 2 & 1 \\ \hline 0 & 1 & 3 & 1 \\ 1 & 0 & 1 & 3 \end{array}\right)=\left(\begin{array}{c|c} 5*\begin{pmatrix} 1 & 0 \\ 0 & 2 \\ 2 & 1 \end{pmatrix} & 5*\begin{pmatrix} 1 & 0 \\ 0 & 2 \\ 2 & 1 \end{pmatrix} \\ \hline 5*\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} & 5*\begin{pmatrix} 3 & 1 \\ 1 & 3 \end{pmatrix} \end{array}\right)=\left(\begin{array}{c|c} \begin{pmatrix} 5 & 0 \\ 0 & 10 \\ 10 & 5 \end{pmatrix} & \begin{pmatrix} 5 & 0 \\ 0 & 10 \\ 10 & 5 \end{pmatrix} \\ \hline \begin{pmatrix} 0 & 5 \\ 5 & 0 \end{pmatrix} & \begin{pmatrix} 15 & 5 \\ 5 & 15 \end{pmatrix} \end{array}\right)=$$

$$=\left(\begin{array}{cc|cc} 5 & 0 & 5 & 0 \\ 0 & 10 & 0 & 10 \\ 10 & 5 & 10 & 5 \\ \hline 0 & 5 & 15 & 5 \\ 5 & 0 & 5 & 15 \end{array}\right)$$

c) A*B: Nem lehetséges / It is not possible.

$$A*C=\left(\begin{array}{c|c} \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ 0 & 2 \\ 2 & 1 \end{pmatrix}+\begin{pmatrix} 2 & 0 \\ 1 & 2 \end{pmatrix}\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} & \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ 0 & 2 \\ 2 & 1 \end{pmatrix}+\begin{pmatrix} 2 & 0 \\ 1 & 2 \end{pmatrix}\begin{pmatrix} 3 & 1 \\ 1 & 3 \end{pmatrix} \\ \hline \begin{pmatrix} 2 & 1 & 2 \\ 0 & 3 & 0 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ 0 & 2 \\ 2 & 1 \end{pmatrix}+\begin{pmatrix} 2 & 3 \\ 3 & 2 \end{pmatrix}\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} & \begin{pmatrix} 2 & 1 & 2 \\ 0 & 3 & 0 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ 0 & 2 \\ 2 & 1 \end{pmatrix}+\begin{pmatrix} 2 & 3 \\ 3 & 2 \end{pmatrix}\begin{pmatrix} 3 & 1 \\ 1 & 3 \end{pmatrix} \end{array}\right)=\left(\begin{array}{c|c} \begin{pmatrix} 0 & 2 \\ 3 & 1 \end{pmatrix}+\begin{pmatrix} 0 & 2 \\ 2 & 1 \end{pmatrix} & \begin{pmatrix} 0 & 2 \\ 3 & 1 \end{pmatrix}+\begin{pmatrix} 6 & 2 \\ 5 & 7 \end{pmatrix} \\ \hline \begin{pmatrix} 6 & 4 \\ 0 & 6 \end{pmatrix}+\begin{pmatrix} 3 & 2 \\ 2 & 3 \end{pmatrix} & \begin{pmatrix} 6 & 4 \\ 0 & 6 \end{pmatrix}+\begin{pmatrix} 9 & 11 \\ 11 & 9 \end{pmatrix} \end{array}\right)=\left(\begin{array}{cc|cc} 0 & 4 & 6 & 4 \\ 5 & 2 & 8 & 8 \\ \hline 9 & 6 & 15 & 15 \\ 2 & 9 & 11 & 15 \end{array}\right)$$

$$B*C=\left(\begin{array}{c|c}
\begin{pmatrix}1&0&1\\1&2&1\end{pmatrix}\begin{pmatrix}1&0\\0&2\\2&1\end{pmatrix}+\begin{pmatrix}0&1\\1&2\end{pmatrix}\begin{pmatrix}0&1\\1&0\end{pmatrix} & \begin{pmatrix}1&0&1\\1&2&1\end{pmatrix}\begin{pmatrix}1&0\\0&2\\2&1\end{pmatrix}+\begin{pmatrix}0&1\\1&2\end{pmatrix}\begin{pmatrix}3&1\\1&3\end{pmatrix}\\
\hline
\begin{pmatrix}2&1&2\\0&3&0\end{pmatrix}\begin{pmatrix}1&0\\0&2\\2&1\end{pmatrix}+\begin{pmatrix}2&0\\0&2\end{pmatrix}\begin{pmatrix}0&1\\1&0\end{pmatrix} & \begin{pmatrix}2&1&2\\0&3&0\end{pmatrix}\begin{pmatrix}1&0\\0&2\\2&1\end{pmatrix}+\begin{pmatrix}2&0\\0&2\end{pmatrix}\begin{pmatrix}3&1\\1&3\end{pmatrix}
\end{array}\right)=\left(\begin{array}{c|c}
\begin{pmatrix}3&0\\3&5\end{pmatrix}+\begin{pmatrix}1&1\\2&1\end{pmatrix} & \begin{pmatrix}3&1\\3&5\end{pmatrix}+\begin{pmatrix}1&3\\5&7\end{pmatrix}\\
\hline
\begin{pmatrix}6&4\\0&6\end{pmatrix}+\begin{pmatrix}0&2\\2&0\end{pmatrix} & \begin{pmatrix}6&4\\0&6\end{pmatrix}+\begin{pmatrix}6&2\\2&6\end{pmatrix}
\end{array}\right)=\left(\begin{array}{cc|cc}
4&1&4&4\\
5&6&8&12\\
\hline
6&6&12&6\\
2&6&2&12
\end{array}\right)$$