Wettl book 196/5.30: Calculate the invese, the square and 3rd power of the following matrixes.

$$A = \begin{pmatrix} 0 & 2 & 0 \\ 0 & 0 & 4 \\ 3 & 0 & 0 \end{pmatrix} \rightarrow A^{-1} = \begin{pmatrix} 0 & 0 & 1/3 \\ 1/2 & 0 & 0 \\ 0 & 1/4 & 0 \end{pmatrix}$$

$$A^2 = \begin{pmatrix} 0 & 0 & 8 \\ 12 & 0 & 0 \\ 0 & 6 & 0 \end{pmatrix}$$

$$A^3 = \begin{pmatrix} 24 & 0 & 0 \\ 0 & 24 & 0 \\ 0 & 0 & 24 \end{pmatrix}$$

Your matrix

	A_1	A_2	A_3
1	0	2	0
2	0	0	4
3	3	0	0

Determinant is not zero, therefore inverse matrix exists

☑ Very detailed solution   Calculate apart

Write the augmented matrix

	A_1	A_2	A_3	B_1	B_2	B_3
1	0	2	0	1	0	0
2	0	0	4	0	1	0
3	3	0	0	0	0	1

Make the pivot in the 1st column by dividing the 3rd row by 3 and swap the 3rd and the 3rd rows

	A_1	A_2	A_3	B_1	B_2	B_3
1	1	0	0	0	0	1/3
2	0	0	4	0	1	0
3	0	2	0	1	0	0

Make the pivot in the 2nd column by dividing the 3rd row by 2 and swap the 3rd and the 3rd rows

	A_1	A_2	A_3	B_1	B_2	B_3
1	1	0	0	0	0	1/3
2	0	1	0	1/2	0	0
3	0	0	4	0	1	0

Make the pivot in the 3rd column by dividing the 3rd row by 4

	A_1	A_2	A_3	B_1	B_2	B_3
1	1	0	0	0	0	1/3
2	0	1	0	1/2	0	0
3	0	0	1	0	1/4	0

There is the inverse matrix on the right

	A_1	A_2	A_3	B_1	B_2	B_3
1	1	0	0	0	0	1/3
2	0	1	0	1/2	0	0
3	0	0	1	0	1/4	0

Recalculate   Continue calculation

Result:

	B_1	B_2	B_3
1	0	0	1/3
2	1/2	0	0
3	0	1/4	0

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

$$A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & 1 & 2 \\ 3 & 2 & 3 \end{pmatrix} \quad A^T = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 2 \\ 1 & 2 & 3 \end{pmatrix}$$

$$\text{symmetric:} \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 3 \end{pmatrix} \qquad \text{skew symmetric:} \begin{pmatrix} 0 & 0 & -1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}$$

Wettl book 152/4.12

$$A = \left(\begin{array}{cc|c|c} 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 2 \\ \hline 0 & 0 & 3 & 0 \end{array}\right) \qquad B = \left(\begin{array}{cc} 2 & 4 \\ 1 & 5 \\ \hline 2 & 2 \\ \hline 0 & 1 \end{array}\right)$$

$$AB = \begin{pmatrix} 4 & 6 \\ 3 & 9 \\ 6 & 6 \end{pmatrix}$$

$$\left(\begin{array}{c} \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 2 & 4 \\ 1 & 5 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \end{pmatrix} \begin{pmatrix} 2 & 2 \end{pmatrix} + \begin{pmatrix} 0 \\ 2 \end{pmatrix} \begin{pmatrix} 0 & 1 \end{pmatrix} \\ \hline \begin{pmatrix} 0 & 0 \end{pmatrix} \begin{pmatrix} 2 & 4 \\ 1 & 5 \end{pmatrix} + 3 \begin{pmatrix} 2 & 2 \end{pmatrix} + 0 \begin{pmatrix} 0 & 1 \end{pmatrix} \end{array}\right) =$$

$$= \left(\begin{array}{c} \begin{pmatrix} 2 & 4 \\ 1 & 5 \end{pmatrix} + \begin{pmatrix} 2 & 2 \\ 2 & 2 \end{pmatrix} + \begin{pmatrix} 0 & 0 \\ 0 & 2 \end{pmatrix} \\ \hline 0 + \begin{pmatrix} 6 & 6 \end{pmatrix} + 0 \end{array}\right) = \begin{pmatrix} 4 & 6 \\ 3 & 9 \\ 6 & 6 \end{pmatrix}$$

Kronecker product

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

$$\underline{B} = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 1 & 1 \end{pmatrix}$$

$$\underline{A} \otimes \underline{B} = \begin{pmatrix} 0 & 0 & 0 & 1 & 2 & 3 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 2 & 4 & 6 & 0 & 0 & 0 \\ 2 & 2 & 2 & 0 & 0 & 0 \end{pmatrix}$$