

3 Matrizenrechnung

Englische Aufgaben

- 3.1** At the beginning of the school year Mrs Steward has to buy exercise books for her three children Laura, Sue and Tim.

	Laura	Sue	Tim
A4 squared	6	10	5
A4 ruled	4	3	8
A5 blank	2	1	0
A5 squared	1	2	6
A5 ruled	4	1	2

- How many squared A5 exercise books does Tim need for school?
- Calculate how many ruled A4 exercise books Mrs Steward has to buy.
- Mrs Steward also wants to buy exercise book covers. How many does she have to buy of each format?
[ruled ... liniert; blank ... leer]

- 3.2** Summarize the ingredients for the following mixed spices in a suitable matrix.

Curry	Grill Spice	Garam Masala
20 g coriander 15 g turmeric 20 g cumin 5 g red pepper 10 g ginger 5 g garlic powder 2 g cinnamon 5 g green cardamom 10 g black pepper	35g red pepper 15 g oregano 20 g black pepper 25 g salt 40 g garlic powder 30 g coriander 20 g cumin	25 g black pepper 10 g cloves 5 g cinnamon 15 g cumin 5 g green cardamom

[turmeric ... Kurkuma; cumin ... Kreuzkümmel; red pepper ... Cayennepfeffer; ginger ... Ingwer; cinnamon ... Zimt; clove ... Gewürznelke]

- 3.3** A sewing store sells five different sewing kits. The amount of accessories is shown in the following table.

	Set 1	Set 2	Set 3	Set 4	Set 5
foam pin cushion	0	0	1	1	0
tape measure	0	1	0	1	1
scissors	1	1	1	1	1
needles	5	5	10	12	15
polyester thread	4	5	8	10	15
safety pin	2	5	5	5	10

- How many safety pins are in Set 4?
- How many accessories does Set 2 contain?
- Which set has the most needles?
- Calculate how many polyester threads you get if you buy one of each of the five sets.
[sewing ... Näh-; accessory ... Zubehör; thread ... Garn; to contain ... enthalten]

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- 3.4** A book publishing house decides to market a science fiction trilogy in four different bookstores. The sales figures of November, December and January in these stores are shown in the following 3×4 matrices.

$$N = \begin{pmatrix} 127 & 201 & 145 & 166 \\ 89 & 56 & 45 & 77 \\ 25 & 33 & 5 & 35 \end{pmatrix} \quad J = \begin{pmatrix} 31 & 46 & 4 & 86 \\ 140 & 56 & 45 & 57 \\ 123 & 133 & 167 & 178 \end{pmatrix} \quad D = \begin{pmatrix} 253 & 156 & 47 & 66 \\ 104 & 67 & 34 & 177 \\ 85 & 43 & 55 & 75 \end{pmatrix}$$

- How many second parts of the trilogy were sold at the third store in January?
- How many first parts of the trilogy were sold in total in November?
- Give the value of D_{31} and explain its meaning.
- Calculate the sum of all the entries in the fourth column of N . Express in words the meaning of this sum.
- Calculate the sum of all the entries in the second row of D . Express in words the meaning of this sum.
- Work out $N + D + J$. What kind of information do you get from this matrix?

[book publishing house ... Buchverlag]

- 3.5** A carrier company owns ten lorries ($l_1 - l_{10}$) with different load capacities. The following table (T) is a summary of how many days the truck drivers ($d_1 - d_{10}$) used the various trucks in October. This table can be interpreted as a 10×10 matrix.

	l_1	l_2	l_3	l_4	l_5	l_6	l_7	l_8	l_9	l_{10}
d_1	2	3	1	4	2	0	6	1	1	3
d_2	6	2	2	1	0	1	3	4	0	4
d_3	1	4	1	6	0	2	1	3	5	0
d_4	2	1	5	3	1	4	0	2	1	4
d_5	0	5	2	2	3	1	4	1	3	2
d_6	3	2	0	1	6	1	1	0	5	4
d_7	4	1	4	0	5	3	2	0	1	3
d_8	0	1	3	1	2	4	4	5	1	2
d_9	2	3	2	1	3	3	0	7	1	1
d_{10}	3	1	3	4	1	4	2	0	5	0

- Express in words the meaning of the entry T_{49} .
- Calculate the sum of all entries in the third column and calculate the sum of all the entries in the tenth column. Express in words the meaning of these sums.
- Calculate the sum of all entries in the first row as well as the sum of all the entries in the seventh row. Express in words the meaning of these sums.
- Actually the entries in each column and the entries in each row add up to 23. Try to find an explanation for that.

[carrier company ... Transportunternehmen; load capacity ... Ladekapazität; entry ... Eintrag; column ... Spalte; row ... Zeile; explanation ... Erklärung]

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- 3.6** A party service has three different sandwiches on offer which are used for different varieties of party trays. The ingredients are summarized in the following table. The entries in this table make up the matrix P.

	vegetarian sandwich	meat sandwich	seafood sandwich
toast (slices)	2	2	2
tomatoes (slices)	4	2	0
cucumber (slices)	4	1	4
egg (slices)	3	0	2
pickle (slices)	1	3	2
grilled chicken (g)	0	50	0
mayonnaise dressing (g)	5	5	10
shrimps (g)	0	0	50

The next table shows how many sandwiches of each type are used to compose one of the four party trays. The entries in this table make up the matrix T.

	House Party	Garden Party	Simply the Best	Surf & Turf
vegetarian sandwich	10	45	25	0
meat sandwich	35	20	25	35
seafood sandwich	20	35	25	35

- Multiply matrix P by the third column of matrix T. Express in words the meaning of the result.
- Calculate $S = P \times T$. Explain the meaning of the entries in matrix S.

[tray ... Tablett; cucumber ... (Salat)gurke]

- 3.7** A retailer for sporting goods keeps the accounts of the sold goods. An extract of four weeks of his book-keeping is partially given in the table below. Choose suitable matrices and compute by matrix multiplication:

- the amount of the weekly turnovers.
- for each product: the total number of sold articles.
- the amount of the retailers' total turnover.

	prize in €	number of sold articles			
		week 1	week 2	week 3	week 4
snowboard	360	4	7	18	11
football	17	12	13	4	27
racket	170	7	4	3	9
tennis balls	3	25	18	7	14

[retailer ... Einzelhändler; sporting goods ... Sportartikel; to keep the accounts of ... Buch führen; amount ... Höhe; weekly turnover ... Wochenumsatz]

- 3.8** Decide whether the matrices A and B can be multiplied. If so, compute the product $A \cdot B$.

$$\text{a. } \begin{pmatrix} 4 & -7 & -9 \\ 8 & 8 & -5 \\ -4 & 4 & 9 \end{pmatrix} \cdot \begin{pmatrix} 1 & 1 \\ 2 & -1 \end{pmatrix} \quad \text{b. } \begin{pmatrix} 4 & -7 & -9 \\ 8 & 8 & -5 \\ -4 & 4 & 9 \end{pmatrix} \cdot \begin{pmatrix} -6 & 9 \\ -8 & -4 \\ 3 & 9 \end{pmatrix} \quad \text{c. } \begin{pmatrix} 1 & 0 \\ 3 & -1 \end{pmatrix} \cdot \begin{pmatrix} 2 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix}$$

- 3.9** Write down the linear system of equations in matrix form and solve it.

$$\begin{aligned} -3x + 2y - 4z &= 1 & -6a + 2b + 6c - 9d &= -30 \\ \text{a. } 2x + 2y - 3z &= -1 & 9a - 4b - c - 9d &= -8 \\ 4x - 6y + 2z &= 2 & 4a - 9b - 7c - 4d &= 3 \\ & & -4a + 9b + 7c + d &= -9 \end{aligned}$$

[linear system of equations ... lineares Gleichungssystem]

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3.10 Compute the inverse of the matrix.

a. $A = \begin{pmatrix} 1 & 2 \\ 0 & 9 \end{pmatrix}$

b. $B = \begin{pmatrix} -3 & 2 \\ -1 & -2 \end{pmatrix}$

c. $C = \begin{pmatrix} 3 & 2 & 0 \\ 1 & 2 & -3 \\ 4 & -1 & 2 \end{pmatrix}$ (use a CAS)

[inverse of a matrix ... die Inverse einer Matrix]