Lösungen

```
Remove["Global`*"]
```

0. Materialbereitstellung

```
A2 = {{1,2},{1,-1}};
B2 = {{3,5},{4,7}};
C2 = {{4,1},{5,6}};
Map[MatrixForm,{A2,B2,C2}]
```

$$\left\{\begin{pmatrix}1 & 2\\ 1 & -1\end{pmatrix}, \begin{pmatrix}3 & 5\\ 4 & 7\end{pmatrix}, \begin{pmatrix}4 & 1\\ 5 & 6\end{pmatrix}\right\}$$

```
A3 = {{1,2,3},{1,-1,0},{-2,1,5}};
B3 = {{3,5,1},{4,7,9},{3,2,6}};
C3 = {{4,1,3},{5,6,5},{5,8,8}};
Map[MatrixForm,{A3,B3,C3}]
```

$$\left\{\begin{pmatrix}1 & 2 & 3\\ 1 & -1 & 0\\ -2 & 1 & 5\end{pmatrix}, \begin{pmatrix}3 & 5 & 1\\ 4 & 7 & 9\\ 3 & 2 & 6\end{pmatrix}, \begin{pmatrix}4 & 1 & 3\\ 5 & 6 & 5\\ 5 & 8 & 8\end{pmatrix}\right\}$$

```
A4 = {{1,2,3,4},{1,-1,0,1},{-2,1,5,2},{-2,2,1,5}};
B4 = {{3,5,1,1},{4,7,9,5},{3,2,6,8},{5,6,5,1}};
Map[MatrixForm,{A4,B4}]
```

$$\left\{\begin{pmatrix}1 & 2 & 3 & 4\\ 1 & -1 & 0 & 1\\ -2 & 1 & 5 & 2\\ -2 & 2 & 1 & 5\end{pmatrix}, \begin{pmatrix}3 & 5 & 1 & 1\\ 4 & 7 & 9 & 5\\ 3 & 2 & 6 & 8\\ 5 & 6 & 5 & 1\end{pmatrix}\right\}$$

```
A24 = {{3,5,1,1},{4,7,9,5}};
B42 = {{1,2},{1,-1},{-2,1},{-2,2}};
Map[MatrixForm,{A42,B24}]
```

```
{A42, B24}
```

```
X13 = {{x11,x12,x13}};
X31 = {{x11},{x21},{x31}};
X24 = {{x11,x12,x13,x14},{x21,x22,x23,x24}};
X42 = {{x11,x12},{x21,x22},{x31,x32},{x41,x42}};
Map[MatrixForm,{X13,X31,X24,X42}]
```

$$\left\{\begin{pmatrix}x11 & x12 & x13\end{pmatrix}, \begin{pmatrix}x11\\ x21\\ x31\end{pmatrix}, \begin{pmatrix}x11 & x12 & x13 & x14\\ x21 & x22 & x23 & x24\end{pmatrix}, \begin{pmatrix}x11 & x12\\ x21 & x22\\ x31 & x32\\ x41 & x42\end{pmatrix}\right\}$$

```
b31 = {{50},{-100},{1000}};
b32 = {{50,203},{-100,105},{1000,-50}}; ;
Map[MatrixForm,{b31,b32}]
```

$$\left\{\begin{pmatrix} 50 \\ -100 \\ 1000 \end{pmatrix}, \begin{pmatrix} 50 & 203 \\ -100 & 105 \\ 1000 & -50 \end{pmatrix}\right\}$$

```
Em2 = IdentityMatrix[2];
Em3 = IdentityMatrix[3];
Em4 = IdentityMatrix[4];
Map[MatrixForm,{Em2,Em3,Em4}]
```

$$\left\{\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}\right\}$$

```
NullMatrix[m_]:= Table[ Table[0,{k,1,m}],{k,1,m}];
NullMatrix[4]//MatrixForm
```

$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

1. Matrixaddition, Multiplikation mit Skalar

a

```
(A2+B2) // MatrixForm
```

$$\begin{pmatrix} 4 & 7 \\ 5 & 6 \end{pmatrix}$$

```
(B2+C2) // MatrixForm
```

$$\begin{pmatrix} 7 & 6 \\ 9 & 13 \end{pmatrix}$$

```
(A2+B2)+C2 // MatrixForm
```

$$\begin{pmatrix} 8 & 8 \\ 10 & 12 \end{pmatrix}$$

```
A2+(B2+C2) // MatrixForm
```

$$\begin{pmatrix} 8 & 8 \\ 10 & 12 \end{pmatrix}$$

```
(A3+B3)+C3 // MatrixForm
```

$$\begin{pmatrix} 8 & 8 & 7 \\ 10 & 12 & 14 \\ 6 & 11 & 19 \end{pmatrix}$$

```
A3+(B3+C3) // MatrixForm
```

$$\begin{pmatrix} 8 & 8 & 7 \\ 10 & 12 & 14 \\ 6 & 11 & 19 \end{pmatrix}$$

b

```
(A2+B2)+C2 == A2+(B2+C2)
```

```
True
```

```
(A3+B3)+C3
```

```
{{8, 8, 7}, {10, 12, 14}, {6, 11, 19}}
```

```
(A3+B3)+C3 == A3+(B3+C3)
```

```
True
```

c

```
4 A3+(-5) B3+ 6 C3 // MatrixForm
```

$$\begin{pmatrix} 13 & -11 & 25 \\ 14 & -3 & -15 \\ 7 & 42 & 38 \end{pmatrix}$$

```
4 A3 -5 B3 - 6 C3 // MatrixForm
```

$$\begin{pmatrix} -35 & -23 & -11 \\ -46 & -75 & -75 \\ -53 & -54 & -58 \end{pmatrix}$$

d

```
A4 + Em4 // MatrixForm
```

$$\begin{pmatrix} 2 & 2 & 3 & 4 \\ 1 & 0 & 0 & 1 \\ -2 & 1 & 6 & 2 \\ -2 & 2 & 1 & 6 \end{pmatrix}$$

```
A4 + Em4 + NullMatrix[4]   // MatrixForm
```

$$\begin{pmatrix} 2 & 2 & 3 & 4 \\ 1 & 0 & 0 & 1 \\ -2 & 1 & 6 & 2 \\ -2 & 2 & 1 & 6 \end{pmatrix}$$

e

Die Koeffizentenmatrizen werden addiert.

2. Matrixmultiplikation

a

```
A3.X31   // MatrixForm
```

$$\begin{pmatrix} x11 + 2\,x21 + 3\,x31 \\ x11 - x21 \\ -2\,x11 + x21 + 5\,x31 \end{pmatrix}$$

b

```
A3.X13   // MatrixForm
```

```
Dot::dotsh :
 Tensors {{1, 2, 3}, {1, -1, 0}, {-2, 1, 5}} and {{x11, x12, x13}} have incompatible shapes. Mehr…
```

```
{{1, 2, 3}, {1, -1, 0}, {-2, 1, 5}}.{{x11, x12, x13}}
```

Funktioniert nicht!!!

c

```
A4.X42   // MatrixForm
```

$$\begin{pmatrix} x11 + 2\,x21 + 3\,x31 + 4\,x41 & x12 + 2\,x22 + 3\,x32 + 4\,x42 \\ x11 - x21 + x41 & x12 - x22 + x42 \\ -2\,x11 + x21 + 5\,x31 + 2\,x41 & -2\,x12 + x22 + 5\,x32 + 2\,x42 \\ -2\,x11 + 2\,x21 + x31 + 5\,x41 & -2\,x12 + 2\,x22 + x32 + 5\,x42 \end{pmatrix}$$

d

```
A24.X42   // MatrixForm
```

$$\begin{pmatrix} 3\,x11 + 5\,x21 + x31 + x41 & 3\,x12 + 5\,x22 + x32 + x42 \\ 4\,x11 + 7\,x21 + 9\,x31 + 5\,x41 & 4\,x12 + 7\,x22 + 9\,x32 + 5\,x42 \end{pmatrix}$$

e

```
B42.X24   // MatrixForm
```

$$\begin{pmatrix} x11 + 2\,x21 & x12 + 2\,x22 & x13 + 2\,x23 & x14 + 2\,x24 \\ x11 - x21 & x12 - x22 & x13 - x23 & x14 - x24 \\ -2\,x11 + x21 & -2\,x12 + x22 & -2\,x13 + x23 & -2\,x14 + x24 \\ -2\,x11 + 2\,x21 & -2\,x12 + 2\,x22 & -2\,x13 + 2\,x23 & -2\,x14 + 2\,x24 \end{pmatrix}$$

f

```
A3.b31   // MatrixForm
```

$$\begin{pmatrix} 2850 \\ 150 \\ 4800 \end{pmatrix}$$

g

```
A3.b32   // MatrixForm
```

$$\begin{pmatrix} 2850 & 263 \\ 150 & 98 \\ 4800 & -551 \end{pmatrix}$$

h

```
(A2.B2).C2   // MatrixForm
```

$$\begin{pmatrix} 139 & 125 \\ -14 & -13 \end{pmatrix}$$

```
A2.(B2.C2)   // MatrixForm
```

$$\begin{pmatrix} 139 & 125 \\ -14 & -13 \end{pmatrix}$$

h

```
(A3.B3).C3   // MatrixForm
```

$$\begin{pmatrix} 390 & 466 & 481 \\ -54 & -77 & -77 \\ 272 & 351 & 370 \end{pmatrix}$$

```
A3.(B3.C3)   // MatrixForm
```

$$\begin{pmatrix} 390 & 466 & 481 \\ -54 & -77 & -77 \\ 272 & 351 & 370 \end{pmatrix}$$

i

```
A3.B3   // MatrixForm
```

$$\begin{pmatrix} 20 & 25 & 37 \\ -1 & -2 & -8 \\ 13 & 7 & 37 \end{pmatrix}$$

B3.A3 // MatrixForm

$$\begin{pmatrix} 6 & 2 & 14 \\ -7 & 10 & 57 \\ -7 & 10 & 39 \end{pmatrix}$$

A3.B3 == B3.A3

```
False
```

k

A4.B4 // MatrixForm

$$\begin{pmatrix} 40 & 49 & 57 & 39 \\ 4 & 4 & -3 & -3 \\ 23 & 19 & 47 & 45 \\ 30 & 36 & 47 & 21 \end{pmatrix}$$

B4.A4 // MatrixForm

$$\begin{pmatrix} 4 & 4 & 15 & 24 \\ -17 & 20 & 62 & 66 \\ -23 & 26 & 47 & 66 \\ -1 & 11 & 41 & 41 \end{pmatrix}$$

A4.B4 == B4.A4

```
False
```

l

A3.Em3 // MatrixForm

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

Em3.A3 // MatrixForm

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

A4.Em4 // MatrixForm

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & -1 & 0 & 1 \\ -2 & 1 & 5 & 2 \\ -2 & 2 & 1 & 5 \end{pmatrix}$$

Em4.A4 // MatrixForm

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & -1 & 0 & 1 \\ -2 & 1 & 5 & 2 \\ -2 & 2 & 1 & 5 \end{pmatrix}$$

A4.Em4 == A4

True

Em4.A4 == A4

True

m

Det[A4]

-111

Inverse[A4] // MatrixForm

$$\begin{pmatrix} \frac{32}{111} & \frac{7}{111} & -\frac{5}{37} & -\frac{7}{37} \\ \frac{31}{111} & -\frac{73}{111} & -\frac{6}{37} & -\frac{1}{37} \\ \frac{7}{111} & \frac{5}{111} & \frac{7}{37} & -\frac{5}{37} \\ -\frac{1}{111} & \frac{31}{111} & -\frac{1}{37} & \frac{6}{37} \end{pmatrix}$$

Inverse[A4].A4 // MatrixForm

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

A4.Inverse[A4] // MatrixForm

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