Lösungen

1

```
m1 = {{1, 2}, {2, 1}}; Eigensystem[m1]
```

```
{{3, -1}, {{1, 1}, {-1, 1}}}
```

```
m2 = {{1, 0, 0}, {1, 2, 0}, {1, 2, 3}}; Eigensystem[m2]
```

```
{{3, 2, 1}, {{0, 0, 1}, {0, -1, 2}, {2, -2, 1}}}
```

```
m3 = {{1, -2, 2}, {-1, 1, 1}, {-1, -2, 4}}; Eigensystem[m3]
```

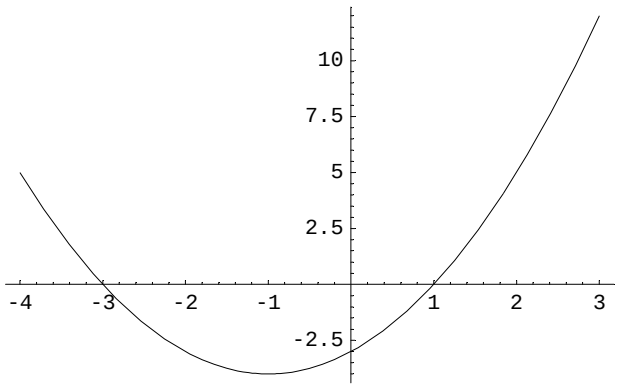
```
{{3, 2, 1}, {{1, 0, 1}, {0, 1, 1}, {1, 1, 1}}}
```

2

```
A = {{a, -1}, {1, -1}}; Eigensystem[A]
```

$$\left\{\left\{\frac{1}{2}\left(-1+a-\sqrt{-3+2a+a^2}\right),\ \frac{1}{2}\left(-1+a+\sqrt{-3+2a+a^2}\right)\right\},\ \left\{\left\{\frac{1}{2}\left(1+a-\sqrt{-3+2a+a^2}\right),\ 1\right\},\ \left\{\frac{1}{2}\left(1+a+\sqrt{-3+2a+a^2}\right),\ 1\right\}\right\}\right\}$$

```
Plot[-3 + 2 a + a^2, {a, -4, 3}];
```




```
Solve[-3 + 2 a + a^2 == 0, {a}]
```

```
{{a → -3}, {a → 1}}
```

```
Ab = {{-3, -1}, {1, -1}};
v = α {-1, 1} + β {1, -1};
Ab.v // Expand
```

```
{2 α - 2 β, -2 α + 2 β}
```

```
Ac = {{4, -1}, {1, -1}};
v = α {-1, 1} + β {1, -1};
Ac.v // Expand
```

```
{-5 α + 5 β, -2 α + 2 β}
```

3

```
v1 = {1, -1, 1}; v2 = {-1, -1, 2}; v3 = {1, 0, -1};
h = {1, 10, 100}; B = Transpose[{v1, v2, v3}]; B // MatrixForm
```

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

a

```
Det[B]
```

```
1
```

b

```
B1=Transpose[{2 v1,-4 v2,v3}]; B1//MatrixForm
```

$$\begin{pmatrix} 2 & 4 & 1 \\ -2 & 4 & 0 \\ 2 & -8 & -1 \end{pmatrix}$$

```
m4=B1.Inverse[B]; m4//MatrixForm
```

$$\begin{pmatrix} -3 & -9 & -4 \\ -6 & -10 & -6 \\ 11 & 21 & 12 \end{pmatrix}$$

```
m4.h
```

```
{-493, -706, 1421}
```

c

```
B2=Transpose[{2 v1,-4 v2,v2}]; B2//MatrixForm
```

$$\begin{pmatrix} 2 & 4 & -1 \\ -2 & 4 & -1 \\ 2 & -8 & 2 \end{pmatrix}$$

```
m5=B2.Inverse[B]; m5//MatrixForm
```

$$\begin{pmatrix} -1 & -3 & 0 \\ -5 & -7 & -4 \\ 8 & 12 & 6 \end{pmatrix}$$

m5.h

{−31, −475, 728}

4

```
u={2,-3,10}; a={1,-1,2}; b={1,0,-2}; n={0,0,0}; OQ={7,2,6};
matr1=Transpose[{u,a,b}];
matr2=Transpose[{n,a,b}];
Print[MatrixForm[matr1]];
Print[MatrixForm[matr2]];
```

$$\begin{pmatrix} 2 & 1 & 1 \\ -3 & -1 & 0 \\ 10 & 2 & -2 \end{pmatrix}$$

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

a

proj= matr2.Inverse[matr1]; MatrixForm[proj]

$$\begin{pmatrix} -1 & -4 & -1 \\ 3 & 7 & \frac{3}{2} \\ -10 & -20 & -4 \end{pmatrix}$$

b

OQ1=proj.OQ

{−21, 44, −134}

c

OQ2={OQ1[[1]],OQ1[[2]]}

{−21, 44}

α= Pi/6;
d={{Cos[α],-Sin[α]},{Sin[α],Cos[α]}};
d// MatrixForm

$$\begin{pmatrix} \frac{\sqrt{3}}{2} & -\frac{1}{2} \\ \frac{1}{2} & \frac{\sqrt{3}}{2} \end{pmatrix}$$

%//N

{{0.866025, −0.5}, {0.5, 0.866025}}

```
OQ3=d.OQ2
```

$$\left\{-22-\frac{21\sqrt{3}}{2},\ -\frac{21}{2}+22\sqrt{3}\right\}$$

```
%//N
```

```
{-40.1865, 27.6051}
```

5

```
X = Inverse[Transpose[B]].m3.Transpose[B].Inverse[m3];
X // MatrixForm
```

$$\begin{pmatrix} 2 & \frac{4}{3} & -\frac{1}{3} \\ -1 & \frac{4}{3} & \frac{17}{3} \\ 0 & 1 & 3 \end{pmatrix}$$

```
% // N // MatrixForm
```

$$\begin{pmatrix} 2. & 1.33333 & -0.333333 \\ -1. & 1.33333 & 5.66667 \\ 0. & 1. & 3. \end{pmatrix}$$