Diagonalizing Transformation

In[47]:
```
mat = {{-2, 1, 0, 0}, {1, -2, 1, 0}, {0, 1, -2, 1}, {0, 0, 1, -2}};
MatrixForm[mat]
```

Out[48]//MatrixForm=

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

In[49]:
```
eout = Eigensystem[mat];
```

In[50]:
```
evals = eout[[1]]
```

Out[50]=

$$\left\{\frac{1}{2}\left(-5-\sqrt{5}\right), \frac{1}{2}\left(-3-\sqrt{5}\right), \frac{1}{2}\left(-5+\sqrt{5}\right), \frac{1}{2}\left(-3+\sqrt{5}\right)\right\}$$

In[51]:
```
evecs = eout[[2]];
```

In[52]:
```
bmat = Transpose[evecs];
bmatInv = Simplify[Inverse[bmat]];
```

In[54]:
```
MatrixForm[bmat]
```

Out[54]//MatrixForm=

$$\begin{pmatrix} -1 & 1 & -1 & 1 \\ \frac{1}{2}\left(1+\sqrt{5}\right) & \frac{1}{2}\left(1-\sqrt{5}\right) & \frac{1}{2}\left(1-\sqrt{5}\right) & \frac{1}{2}\left(1+\sqrt{5}\right) \\ \frac{1}{2}\left(-1-\sqrt{5}\right) & \frac{1}{2}\left(1-\sqrt{5}\right) & \frac{1}{2}\left(-1+\sqrt{5}\right) & \frac{1}{2}\left(1+\sqrt{5}\right) \\ 1 & 1 & 1 & 1 \end{pmatrix}$$

In[55]:
```
MatrixForm[bmatInv]
```

Out[55]//MatrixForm=

$$\begin{pmatrix} \frac{1}{20}\left(-5+\sqrt{5}\right) & \frac{1}{2\sqrt{5}} & -\frac{1}{2\sqrt{5}} & \frac{1}{20}\left(5-\sqrt{5}\right) \\ \frac{1}{20}\left(5+\sqrt{5}\right) & -\frac{1}{2\sqrt{5}} & -\frac{1}{2\sqrt{5}} & \frac{1}{20}\left(5+\sqrt{5}\right) \\ \frac{1}{20}\left(-5-\sqrt{5}\right) & -\frac{1}{2\sqrt{5}} & \frac{1}{2\sqrt{5}} & \frac{1}{20}\left(5+\sqrt{5}\right) \\ \frac{1}{20}\left(5-\sqrt{5}\right) & \frac{1}{2\sqrt{5}} & \frac{1}{2\sqrt{5}} & \frac{1}{20}\left(5-\sqrt{5}\right) \end{pmatrix}$$

In[56]:
```
bmatInv.mat.bmat // Simplify // MatrixForm
```

Out[56]//MatrixForm=

$$\begin{pmatrix} \frac{1}{2}\left(-5-\sqrt{5}\right) & 0 & 0 & 0 \\ 0 & \frac{1}{2}\left(-3-\sqrt{5}\right) & 0 & 0 \\ 0 & 0 & \frac{1}{2}\left(-5+\sqrt{5}\right) & 0 \\ 0 & 0 & 0 & \frac{1}{2}\left(-3+\sqrt{5}\right) \end{pmatrix}$$