```
> # verticalshear
> k:=2;A:=<1,k|0,1>;
```

$$k := 2$$

$$A := \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix} \quad (1)$$

```
> with(LinearAlgebra):
> Eigenvectors(A); # Only one eigenpair
```

$$\begin{bmatrix} 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix} \quad (2)$$

```
> ?svd
> U,S,Vt:=SingularValues(A,output=['U','S','Vt']);
```

$$U, S, Vt := \begin{bmatrix} -0.382683432365090 & -0.923879532511287 \\ -0.923879532511287 & 0.382683432365090 \end{bmatrix}, \begin{bmatrix} 2.41421356237310 \\ 0.414213562373095 \end{bmatrix}, \begin{bmatrix} -0.923879532511287 & -0.382683432365090 \\ -0.382683432365090 & 0.923879532511287 \end{bmatrix} \quad (3)$$

```
> Sigma:=DiagonalMatrix(S);
```

$$\Sigma := \begin{bmatrix} 2.41421356237310 & 0. \\ 0. & 0.414213562373095 \end{bmatrix} \quad (4)$$

```
> v1:=<1,0>;
```

$$v1 := \begin{bmatrix} 1 \\ 0 \end{bmatrix} \quad (5)$$

```
> Vt.v1;
```

$$\begin{bmatrix} -0.923879532511287 \\ -0.382683432365090 \end{bmatrix} \quad (6)$$

```
> ?plottools
> with(plottools):with(plots): RED:=polygon([[0,0],[1,0],[1,1],[0,
  1]],color = red, linestyle = dash, thickness = 2);
```

$$RED := POLYGONS\left(\begin{bmatrix} 0. & 0. \\ 1. & 0. \\ 1. & 1. \\ 0. & 1. \end{bmatrix}, COLOUR(RGB, 1.00000000, 0., 0.), LINESTYLE(3), THICKNESS(2) \right) \quad (7)$$

```
> s1:=convert(A.<1,0>,list);s2:=convert(A.<1,1>,list);s3:=convert
```

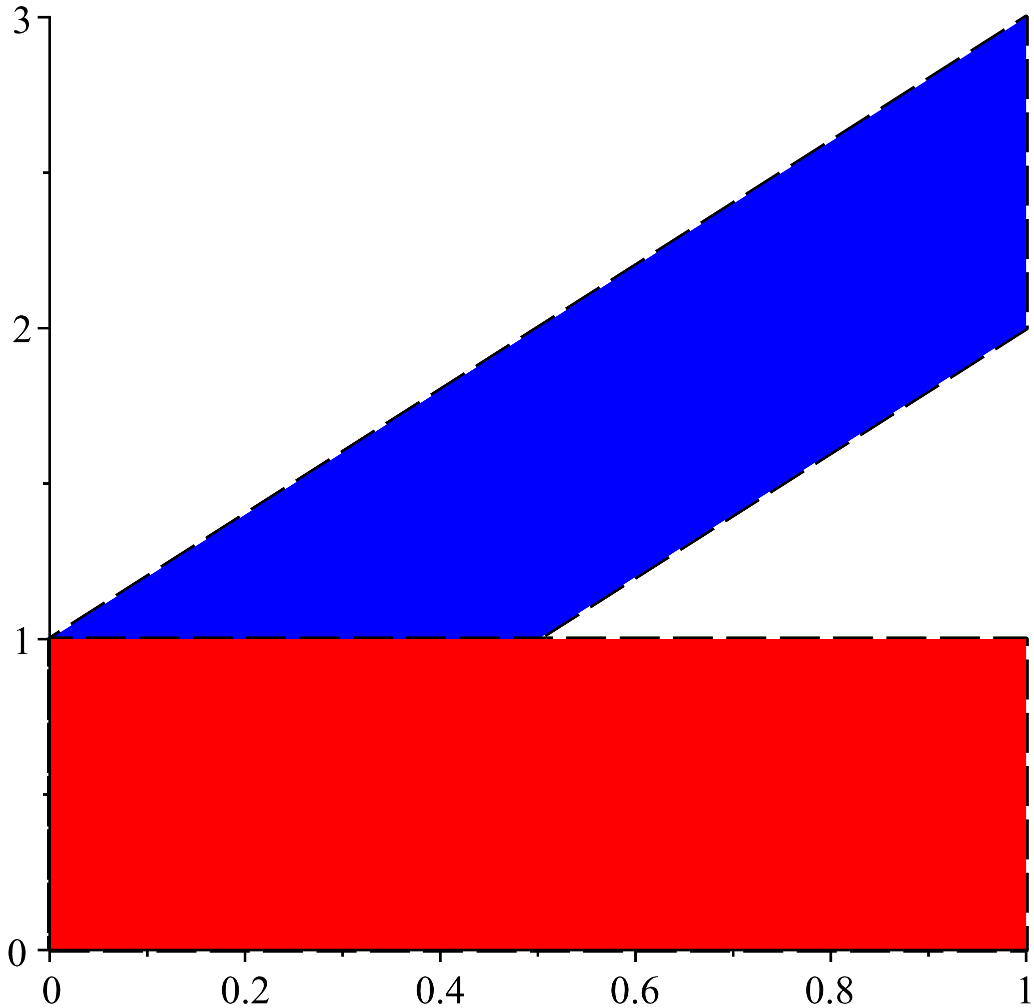
```
(A.<0,1>,list);
```

$$s1 := [1, 2]$$
$$s2 := [1, 3]$$
$$s3 := [0, 1] \quad \textbf{(8)}$$

```
> BLUE:=polygon([[0,0],s1,s2,s3],color = blue, linestyle = dash,
  thickness = 2);
```

$$BLUE := POLYGONS\left(\left[\begin{array}{cc} 0. & 0. \\ 1. & 2. \\ 1. & 3. \\ 0. & 1. \end{array}\right], COLOUR(RGB, 0., 0., 1.00000000), LINESTYLE(3), THICKNESS(2)\right) \quad \textbf{(9)}$$

```
> display(RED,BLUE);
```

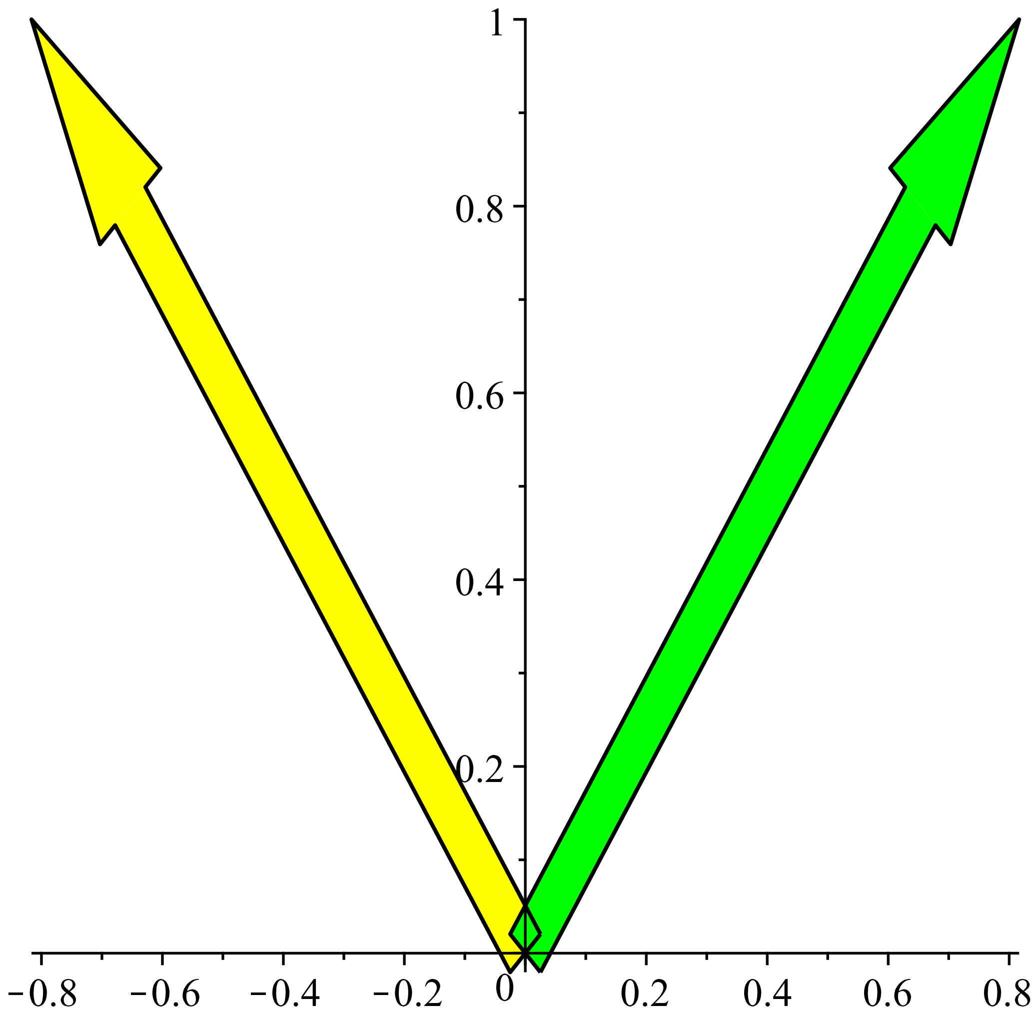



```
> # Plot eigenvectors of A
```

```
A:=<1,3|2,1>;S,V:=Eigenvectors(A);
display(arrow(V.<1,0>,color=green),arrow(V.<0,1>,color=yellow));
# plot eigenvectors
```

$$A := \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}$$

$$S, V := \begin{bmatrix} 1+\sqrt{6} \\ 1-\sqrt{6} \end{bmatrix}, \begin{bmatrix} \frac{\sqrt{6}}{3} & -\frac{\sqrt{6}}{3} \\ 1 & 1 \end{bmatrix}$$




```
> # Singular value decomposition of A
> k:=2;A:=<1,k|0,1>:
> U,S,Vt:=SingularValues(A,output=['U','S','Vt']);
```

$$U, S, Vt := \begin{bmatrix} -0.382683432365090 & -0.923879532511287 \\ -0.923879532511287 & 0.382683432365090 \end{bmatrix}, \begin{bmatrix} 2.41421356237310 \\ 0.414213562373095 \end{bmatrix}, \begin{bmatrix} -0.923879532511287 & -0.382683432365090 \\ -0.382683432365090 & 0.923879532511287 \end{bmatrix} \quad (10)$$

```
> Sigma:=DiagonalMatrix(S);
```

$$\Sigma := \begin{bmatrix} 2.41421356237310 & 0. \\ 0. & 0.414213562373095 \end{bmatrix} \quad (11)$$

```
> U.Sigma.Vt; # Should be A
```

$$\begin{bmatrix} 1.00000000000000 & -1.66533453693773\ 10^{-16} \\ 2.00000000000000 & 1.00000000000000 \end{bmatrix} \quad (12)$$