```
> with(linalg);
```

```
\QTR{_cstyle2}{Warning, the protected names norm and trace have been redefined and
unprotected}\QTR{_cstyle2}{
}
```

[*BlockDiagonal*, *GramSchmidt*, *JordanBlock*, *LUdecomp*, *QRdecomp*, *Wronskian*, *addcol*, *addrow*, *adj*, *adjoint*, *angle*, *augment*, *backsub*, *band*, *basis*, *bezout*, *blockmatrix*, *charmat*, *charpoly*, *cholesky*, *col*, *coldim*, *colspace*, *colspan*, *companion*, *concat*, *cond*, *copyinto*, *crossprod*, *curl*, *definite*, *delcols*, *delrows*, *det*, *diag*, *diverge*, *dotprod*, *eigenvals*, *eigenvalues*, *eigenvectors*, *eigenvects*, *entermatrix*, *equal*, *exponential*, *extend*, *ffgausselim*, *fibonacci*, *forwardsub*, *frobenius*, *gausselim*, *gaussjord*, *geneqns*, *genmatrix*, *grad*, *hadamard*, *hermite*, *hessian*, *hilbert*, *htranspose*, *ihermite*, *indexfunc*, *innerprod*, *intbasis*, *inverse*, *ismith*, *issimilar*, *iszero*, *jacobian*, *jordan*, *kernel*, *laplacian*, *leastsqrs*, *linsolve*, *matadd*, *matrix*, *minor*, *minpoly*, *mulcol*, *mulrow*, *multiply*, *norm*, *normalize*, *nullspace*, *orthog*, *permanent*, *pivot*, *potential*, *randmatrix*, *randvector*, *rank*, *ratform*, *row*, *rowdim*, *rowspace*, *rowspan*, *rref*, *scalarmul*, *singularvals*, *smith*, *stackmatrix*, *submatrix*, *subvector*, *sumbasis*, *swapcol*, *swaprow*, *sylvester*, *toeplitz*, *trace*, *transpose*, *vandermonde*, *vecpotent*, *vectdim*, *vector*, *wronskian*]

```
> A:=matrix(6,6,[23,76,23,-92,38,-3,-8,-32,-10,40,-17,1,-34,-124,-36,15
> 2,-64,6,-1,-7,-2,10,-4,0,23,86,26,-104,45,-4,3,14,4,-16,7,2]);
```

$$A := \begin{bmatrix} 23 & 76 & 23 & -92 & 38 & -3 \\ -8 & -32 & -10 & 40 & -17 & 1 \\ -34 & -124 & -36 & 152 & -64 & 6 \\ -1 & -7 & -2 & 10 & -4 & 0 \\ 23 & 86 & 26 & -104 & 45 & -4 \\ 3 & 14 & 4 & -16 & 7 & 2 \end{bmatrix}$$

```
> jordan(A);
```

$$\begin{bmatrix} 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 1 \\ 0 & 0 & 0 & 0 & 0 & 2 \end{bmatrix}$$

```
> p:=charpoly(A,lambda);
```

$$p := \lambda^6 - 12\,\lambda^5 + 60\,\lambda^4 - 160\,\lambda^3 + 240\,\lambda^2 - 192\,\lambda + 64$$

```
> factor(p);
```

$$(\lambda - 2)^6$$

```
> eigenvals(A);
```

$$2,\ 2,\ 2,\ 2,\ 2,\ 2$$

```
> eigenvects(A);
```

$$[2,\ 6,\ \{[0,\ 0,\ 4,\ 1,\ 0,\ 0],\ [-1,\ -1,\ 6,\ 0,\ -1,\ 1]\}]$$

```
> E6:=diag(1,1,1,1,1,1);
```

$$E6 := \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

```
> B:=evalm( A-2 * E6 );
```

$$B := \begin{bmatrix} 21 & 76 & 23 & -92 & 38 & -3 \\ -8 & -34 & -10 & 40 & -17 & 1 \\ -34 & -124 & -38 & 152 & -64 & 6 \\ -1 & -7 & -2 & 8 & -4 & 0 \\ 23 & 86 & 26 & -104 & 43 & -4 \\ 3 & 14 & 4 & -16 & 7 & 0 \end{bmatrix}$$

```
> B2:=evalm(B^2);
```

$$B2 := \begin{bmatrix} 8 & 30 & 9 & -36 & 15 & -1 \\ 16 & 60 & 18 & -72 & 30 & -2 \\ -36 & -140 & -42 & 168 & -70 & 6 \\ 3 & 10 & 3 & -12 & 5 & 0 \\ -8 & -30 & -9 & 36 & -15 & 1 \\ -8 & -30 & -9 & 36 & -15 & 1 \end{bmatrix}$$

```
> B3:=evalm(B^3);
```

$$B3 := \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 32 & 120 & 36 & -144 & 60 & -4 \\ 8 & 30 & 9 & -36 & 15 & -1 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

```
> B4:=evalm(B^4);
```

$$B4 := \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

```
> eigenvects(B);
```

$$[0,\ 6,\ \{[0,\ 0,\ 4,\ 1,\ 0,\ 0],\ [-1,\ -1,\ 6,\ 0,\ -1,\ 1]\}]$$

```
> eigenvects(B2);
```

$$[0,\ 6,\ \{\left[0,\ 1,\ \frac{-10}{3},\ 0,\ 0,\ 0\right],\ [0,\ 0,\ 4,\ 1,\ 0,\ 0],\ \left[0,\ 0,\ \frac{-5}{3},\ 0,\ 1,\ 0\right],\ [-1,\ 0,\ 1,\ 0,\ 0,\ 1]\}]$$

```
> eigenvects(B3);
```

$[0, 6, \{[0, 0, 0, 1, 0, -36], [0, 0, 1, 0, 0, 9], [0, 1, 0, 0, 0, 30], [1, 0, 0, 0, 0, 8], [0, 0, 0, 0, 1, 15]\}]$

```
> eigenvects(B4);
```

$[0, 6, \{[1, 0, 0, 0, 0, 0], [0, 0, 0, 1, 0, 0], [0, 0, 0, 0, 1, 0], [0, 0, 0, 0, 0, 1], [0, 1, 0, 0, 0, 0], [0, 0, 1, 0, 0, 0]\}]$

```
> X:=transpose(matrix(11,6,[0, 0, 0, 1, 0, -36,0, 0, 1, 0, 0, 9,0,
1,
> 0, 0, 0, 30,1, 0, 0, 0, 0, 8,0, 0, 0, 0, 1,
> 15,1,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0,0,0,0,0,1,0,0,0,0,0,1,0,0,0,0,0
> ,0,1]));
```

$$X := \begin{bmatrix} 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ -36 & 9 & 30 & 8 & 15 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

```
> Y:=gaussjord(X);
```

$$Y := \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & \frac{-15}{4} & \frac{-9}{8} & \frac{9}{2} & \frac{-15}{8} & \frac{1}{8} \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & \frac{15}{4} & \frac{9}{8} & \frac{-9}{2} & \frac{15}{8} & \frac{-1}{8} \end{bmatrix}$$

```
> v:=matrix(6,1,[1,0,0,0,0,0]);
```

$$v := \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

```
> Bv:=evalm( B &* v );
```

$$Bv := \begin{bmatrix} 21 \\ -8 \\ -34 \\ -1 \\ 23 \\ 3 \end{bmatrix}$$

```
> B2v:=evalm( B^2 &* v );
```

$$B2v := \begin{bmatrix} 8 \\ 16 \\ -36 \\ 3 \\ -8 \\ -8 \end{bmatrix}$$

```
> XX:=transpose(matrix(7,6,[0, 0, 4, 1, 0, 0,-1, -1, 6, 0, -1,
> 1,8,16,-36,3,-8,-8,0, 1, (-10)/3, 0, 0, 0,0, 0, 4, 1, 0, 0,0,
0,
> (-5)/3, 0, 1, 0,-1, 0, 1, 0, 0, 1]));
```

$$XX := \begin{bmatrix} 0 & -1 & 8 & 0 & 0 & 0 & -1 \\ 0 & -1 & 16 & 1 & 0 & 0 & 0 \\ 4 & 6 & -36 & \frac{-10}{3} & 4 & \frac{-5}{3} & 1 \\ 1 & 0 & 3 & 0 & 1 & 0 & 0 \\ 0 & -1 & -8 & 0 & 0 & 1 & 0 \\ 0 & 1 & -8 & 0 & 0 & 0 & 1 \end{bmatrix}$$

```
> YY:=gaussjord(XX);
```

$$YY := \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & \frac{3}{16} & \frac{3}{16} \\ 0 & 1 & 0 & 0 & 0 & \frac{-1}{2} & \frac{1}{2} \\ 0 & 0 & 1 & 0 & 0 & \frac{-1}{16} & \frac{-1}{16} \\ 0 & 0 & 0 & 1 & 0 & \frac{1}{2} & \frac{3}{2} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

```
> w:=matrix(6,1,[0,3,-10,0,0,0]);
```

$$w := \begin{bmatrix} 0 \\ 3 \\ -10 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

```
> Bw:=evalm( B &* w );
```

$$Bw := \begin{bmatrix} -2 \\ -2 \\ 8 \\ -1 \\ -2 \\ 2 \end{bmatrix}$$

```
> B3v:=evalm( B^3 &* v );
```

$$B3v := \begin{bmatrix} 0 \\ 0 \\ 32 \\ 8 \\ 0 \\ 0 \end{bmatrix}$$

```
> P:=Matrix([v,Bv,B2v,B3v,w,Bw]);
```

$$P := \begin{bmatrix} 1 & 21 & 8 & 0 & 0 & -2 \\ 0 & -8 & 16 & 0 & 3 & -2 \\ 0 & -34 & -36 & 32 & -10 & 8 \\ 0 & -1 & 3 & 8 & 0 & -1 \\ 0 & 23 & -8 & 0 & 0 & -2 \\ 0 & 3 & -8 & 0 & 0 & 2 \end{bmatrix}$$

```
> J:=evalm( inverse(P) &* A &* P );
```

$$J := \begin{bmatrix} 2 & 0 & 0 & 0 & 0 & 0 \\ 1 & 2 & 0 & 0 & 0 & 0 \\ 0 & 1 & 2 & 0 & 0 & 0 \\ 0 & 0 & 1 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 0 & 1 & 2 \end{bmatrix}$$