1
```
restart;maple_mode(0);cas_setup(0,0,0,1,0,1e-10,10,[1,50,0,25],0,0,0); #radians,pas de cmplx, pas de  Sqrt
```

Syntax compatibility mode xcas
Parse error line 1 at pas
Warning: some commands like subs might change arguments order

2
```
------------------Polynome caracteristique et mineurs diagonaux----------------------------------------------------------------------
```

3
```
n:=5; In:=%{seq(j,j=1..n)%}; In minus %{2,4%};
```

$$(5, [1, 2, 3, 4, 5], [1, 3, 5])$$

4
```
In:=set[seq(j,j=1..n)]; In minus set[2,4];
```

$$([1, 2, 3, 4, 5], [1, 3, 5])$$

5
```
extr:=proc(A,II,JJ)
matrix([seq([seq(A[i0-1,j0-1],j0=JJ)],i0=II)]);
end_proc;
```

// Warning: i0,j0, declared as global variable(s)
// End defining extr

```
(A,II,JJ)->
{ local NULL;
  matrix(seq([seq(A[i0-1,j0-1],j0=JJ)],i0=II));
}
```

6
Attention, diff(f,x,y) derive en x puis y, alors que diff(f,[x,y])
donne la liste des derive en x et en y.

7
```
diff(x*y,x,y);diff(x*y,[x,y]);
```

$$(1, [y, x])$$

8
```
purge(a,x);
```

(No such variable a , No such variable x)

9
```
n:=5;A:=matrix(n,n,(i0,j0)->a[i0,j0]);
```

$$\left(5, \begin{bmatrix} a[0,0], & a[0,1], & a[0,2], & a[0,3], & a[0,4] \\ a[1,0], & a[1,1], & a[1,2], & a[1,3], & a[1,4] \\ a[2,0], & a[2,1], & a[2,2], & a[2,3], & a[2,4] \\ a[3,0], & a[3,1], & a[3,2], & a[3,3], & a[3,4] \\ a[4,0], & a[4,1], & a[4,2], & a[4,3], & a[4,4] \end{bmatrix}\right)$$

10
```
d:=diag(seq(x[i0],i0=1..n));
```

$$\begin{bmatrix} x[1], & 0, & 0, & 0, & 0 \\ 0, & x[2], & 0, & 0, & 0 \\ 0, & 0, & x[3], & 0, & 0 \\ 0, & 0, & 0, & x[4], & 0 \\ 0, & 0, & 0, & 0, & x[5] \end{bmatrix}$$

11
```
II:=In minus %{1,3%};// on essaye (i,j)=(1,3)
```

Syntax compatibility mode xcas
Parse error line 1 at /

$$([2, 4, 5], (\text{undef}(i, j), 1, 3) = \text{NULL})$$

12
```
extr(A,II,II);
```

$$\begin{bmatrix} a[1,1], & a[1,3], & a[1,4] \\ a[3,1], & a[3,3], & a[3,4] \\ a[4,1], & a[4,3], & a[4,4] \end{bmatrix}$$

13
```
dij:=diff(det(A-d),x[1],x[3]);
```

```
(a[1, 1]) · (a[3, 3]) · (a[4, 4]) -(a[1, 1]) · (a[3, 3]) · (x[5]) -(a[1, 1]) · (a[3, 4]) · (a[4, 3]) -(a
(a[1, 1]) · (x[4]) · (x[5]) -(a[1, 3]) · (a[3, 1]) · (a[4, 4]) + (a[1, 3]) · (a[3, 1]) · (x[5]) + (a[1, 3]) ·
(a[1, 4]) · (a[3, 1]) · (a[4, 3]) -(a[1, 4]) · (a[3, 3]) · (a[4, 1]) + (a[1, 4]) · (a[4, 1]) · (x[4]) -(a
(a[3, 3]) · (x[2]) · (x[5]) + (a[3, 4]) · (a[4, 3]) · (x[2]) + (a[4, 4]) · (x[2]) · (x[4]) -(x[2]) · (x[4]) · (x[5])
```

14
Pour remplacer rapidement les x[1]..x[5] par des zeros, on affecte au
vecteur x le vecteur nul. Attention en mode xcas les indices
commence a 0, donc on annulle x[0]..x[5] en faisant x:=[0$6];

15
```
normal(det( extr(A,II,II)) - subst(dij,x=[0,0,0,0,0,0]));
```

0

16 II:=In minus %{2,3%};// on essaye (i,j)=(2,3)

Syntax compatibility mode xcas
Parse error line 1 at /

```
( [1, 4, 5 ], ( undef ( i, j ) , 2, 3 )= NULL )
```

17 extr(A,II,II);

```
[ a[( 0, 0 )], a[( 0, 3 )], a[( 0, 4 )]
  a[( 3, 0 )], a[( 3, 3 )], a[( 3, 4 )]
  a[( 4, 0 )], a[( 4, 3 )], a[( 4, 4 )] ]
```

18 dij:=diff(det(A-d),x[2],x[3]);

```
(a[( 0, 0 )])*(a[( 3, 3 )])*(a[( 4, 4 )]) -(a[( 0, 0 )])*(a[( 3, 3 )])*(x[5]) -(a[( 0, 0 )])*(a[( 3, 4 )])*(a[( 4, 3 )]) -(a
(a[( 0, 0 )])*(x[4])*(x[5]) -(a[( 0, 3 )])*(a[( 3, 0 )])*(a[( 4, 4 )])+ (a[( 0, 3 )])*(a[( 3, 0 )])*(x[5])+ (a[( 0, 3 )])*
(a[( 0, 4 )])*(a[( 3, 0 )])*(a[( 4, 3 )]) -(a[( 0, 4 )])*(a[( 3, 3 )])*(a[( 4, 0 )])+ (a[( 0, 4 )])*(a[( 4, 0 )])*(x[4]) -(a
(a[( 3, 3 )])*(x[1])*(x[5])+ (a[( 3, 4 )])*(a[( 4, 3 )])*(x[1])+ (a[( 4, 4 )])*(x[1])*(x[4]) -(x[1])*(x[4])*(x[5])
```

19 normal(det(extr(A,II,II)) - subst(dij,x=[0,0,0,0,0,0]));

```
0
```

20 II:=In minus %{4,5%};// on essaye (i,j)=(4,5)

Syntax compatibility mode xcas
Parse error line 1 at /

```
( [1, 2, 3 ], ( undef ( i, j ) , 4, 5 )= NULL )
```

21 extr(A,II,II);

```
[ a[( 0, 0 )], a[( 0, 1 )], a[( 0, 2 )]
  a[( 1, 0 )], a[( 1, 1 )], a[( 1, 2 )]
  a[( 2, 0 )], a[( 2, 1 )], a[( 2, 2 )] ]
```

22 dij:=diff(det(A-d),x[4],x[5]);

```
(a[( 0, 0 )])*(a[( 1, 1 )])*(a[( 2, 2 )]) -(a[( 0, 0 )])*(a[( 1, 1 )])*(x[3]) -(a[( 0, 0 )])*(a[( 1, 2 )])*(a[( 2, 1 )]) -(a
(a[( 0, 0 )])*(x[2])*(x[3]) -(a[( 0, 1 )])*(a[( 1, 0 )])*(a[( 2, 2 )])+ (a[( 0, 1 )])*(a[( 1, 0 )])*(x[3])+ (a[( 0, 1 )])*
(a[( 0, 2 )])*(a[( 1, 0 )])*(a[( 2, 1 )]) -(a[( 0, 2 )])*(a[( 1, 1 )])*(a[( 2, 0 )])+ (a[( 0, 2 )])*(a[( 2, 0 )])*(x[2]) -(a
(a[( 1, 1 )])*(x[1])*(x[3])+ (a[( 1, 2 )])*(a[( 2, 1 )])*(x[1])+ (a[( 2, 2 )])*(x[1])*(x[2]) -(x[1])*(x[2])*(x[3])
```

23 normal(det(extr(A,II,II)) - subst(dij,x=[0,0,0,0,0,0]));

```
0
```

24 B:=A-x*identity(n);

```
[ a[( 0, 0 )] -x, a[( 0, 1 )],    a[( 0, 2 )],    a[( 0, 3 )],    a[( 0, 4 )]
  a[( 1, 0 )],    a[( 1, 1 )] -x, a[( 1, 2 )],    a[( 1, 3 )],    a[( 1, 4 )]
  a[( 2, 0 )],    a[( 2, 1 )],    a[( 2, 2 )] -x, a[( 2, 3 )],    a[( 2, 4 )]
  a[( 3, 0 )],    a[( 3, 1 )],    a[( 3, 2 )],    a[( 3, 3 )] -x, a[( 3, 4 )]
  a[( 4, 0 )],    a[( 4, 1 )],    a[( 4, 2 )],    a[( 4, 3 )],    a[( 4, 4 )] -x ]
```

25 d:=seq(normal(subst(diff(det(B),x,i0),x=0)/i0!),i0=n..1);

Evaluation time: 0.44

```
                                                                                -(a[( 0, 0 )])*(a[( 1, 1 )]) -(a[( 0, 0 )])*(a[( 2, 2
                                                                                -(a[( 0, 0 )])*(a[( 3, 3 )]) -(a[( 0, 0 )])*(a[( 4, 4
                                                                                (a[( 0, 1 )])*(a[( 1, 0 )])+ (a[( 0, 2 )])*(a[( 2, 0
                                                                                (a[( 0, 3 )])*(a[( 3, 0 )])+ (a[( 0, 4 )])*(a[( 4, 0
                                                                                -(a[( 1, 1 )])*(a[( 2, 2 )]) -(a[( 1, 1 )])*(a[( 3, 3
                                                                                -(a[( 1, 1 )])*(a[( 4, 4 )])+ (a[( 1, 2 )])*(a[( 2,
                                                                                (a[( 1, 3 )])*(a[( 3, 1 )])+ (a[( 1, 4 )])*(a[( 4, 1
                                                                                -(a[( 2, 2 )])*(a[( 3, 3 )]) -(a[( 2, 2 )])*(a[( 4, 4
                                                                                (a[( 2, 3 )])*(a[( 3, 2 )])+ (a[( 2, 4 )])*(a[( 4, 2
-1, a[( 0, 0 )]+ a[( 1, 1 )]+ a[( 2, 2 )]+ a[( 3, 3 )]+ a[( 4, 4 )], -(a[( 3, 3 )])*(a[( 4, 4 )])+ (a[( 3, 4 )])*(a[( 4,
```

26 P:=charpoly(A);

Done

28 Prog Edit Add | 1 | nxt | OK (F9) | Save

```
monpolyfaddeev:=proc(A)
local a,n,B,P;
n:=dim(A)[0];a:=1;B:=identity(n);P:=[a];
for i0 from n-1 to 0 by -1 do
B:=normal(B*A);
a:=trace(B)/(i0-n);
P:=[op(P),a];B:=B+a*identity(n) od;
P;
end proc:;
```

Done

29 n:=30;A:=matrix(n,n,(i0,j0)->rand(21)-10):;

// Success

(30 , Done)

30 normal(poly2symb(monpolyfaddeev(A),x));

Evaluation time: 0.45

$x^{30} + 41 \cdot x^{29} + 604 \cdot x^{28} + 11674 \cdot x^{27} -294068 \cdot x^{26} + 7577545 \cdot x^{25} + 85497973 \cdot x^{24} -1137279443 \cdot x^{23} + 87587749624$
$93182091975199 \cdot x^{20} -16411254578329631 \cdot x^{19} -449644781388068038 \cdot x^{18} + 701878459589301436 \cdot x^{17} -941224$
$8466926813192360011017 \cdot x^{15} -1247220451114475425140 93 \cdot x^{14} + 1801069956929244656719062 \cdot x^{13} -1141353$
$-2282152825251248805725682 93 \cdot x^{11} -1749003759568606729636899402 \cdot x^{10} -1063605760846142542108835380674$
$4796176554516264590540074693 0129 \cdot x^{8} -698449364181603549840052819069305 \cdot x^{7} + 576840950711376563056$
$-4442737779004016866243731546819 3487 \cdot x^{5} -674264771373644569827005641217964503 \cdot x^{4} +$
$1570852616603596930572260838353491 1556 \cdot x^{3} -543385371772773372867631473859098964 72 \cdot x^{2}$
$-1653052755528647941387024088881159713 91 \cdot x + 878007343079412806828327830415166755075$

31 charpoly(A)-monpolyfaddeev(A);

Evaluation time: 0.45

0

32 time(monpolyfaddeev(A));

Evaluation time: 0.43

[0.43 , 0.408301343]

33 time(charpoly(A));

[0.018 , 0.0172106616]

34 coeff(3*x^4+2*x^3+y^3,x,3);

2

35 A:=matrix(3,4,2);matrix(op(dim(A)));

$$\left(\begin{bmatrix} 2, & 2, & 2, & 2 \\ 2, & 2, & 2, & 2 \\ 2, & 2, & 2, & 2 \end{bmatrix}, \begin{bmatrix} 0, & 0, & 0, & 0 \\ 0, & 0, & 0, & 0 \\ 0, & 0, & 0, & 0 \end{bmatrix} \right)$$

36

37 Prog Edit Add | 1 | nxt | OK (F9) | Save

```
cf:=proc(P,k)
local i0,j0;
matrix(op(dim(P)),(i0,j0)->coeff(P[i0,j0],x,k));
end_proc;
```

// End defining cf

```
(P,k)->
{ local i0,j0;
  matrix(op(dim(P)), (i0,j0)->coeff(P[i0,j0],x,k));
}
```

38 P:=matrix(3,3,(i0,j0)->add(rand(7)*x^l,l=0..4));

// Warning: x,l, declared as global variable(s)

$$\begin{bmatrix} 1 + 4 \cdot x + x^3 + 6 \cdot x^4, & 1 + x + 4 \cdot x^2 + 3 \cdot x^3 + 6 \cdot x^4, & 3 + 5 \cdot x + 5 \cdot x^2 + 2 \cdot x^3 + 2 \cdot x^4 \\ 6 + 3 \cdot x + x^2 + x^3 + 4 \cdot x^4, & 1 + 2 \cdot x^2 + 3 \cdot x^3 + 4 \cdot x^4, & 2 + 5 \cdot x + 5 \cdot x^2 + 5 \cdot x^3 + x^4 \\ 2 \quad 3 \quad 4 & 2 \quad 3 & 2 \quad 3 \quad 4 \end{bmatrix}$$

39 A:=matrix(3,3,(i0,j0)->a[i0,j0]);

// Warning: a, declared as global variable(s)

$$\begin{bmatrix} a[0,0], & a[0,1], & a[0,2] \\ a[1,0], & a[1,1], & a[1,2] \\ a[2,0], & a[2,1], & a[2,2] \end{bmatrix}$$

40 cf(P,4);

$$\begin{bmatrix} 6, & 6, & 2 \\ 4, & 4, & 1 \\ 4, & 0, & 3 \end{bmatrix}$$

41 R:=P;k:=4;Q:=0;

$$\left(\begin{bmatrix} 1+4\cdot x+x^3+6\cdot x^4, & 1+x+4\cdot x^2+3\cdot x^3+6\cdot x^4, & 3+5\cdot x+5\cdot x^2+2\cdot x^3+2\cdot x^4 \\ 6+3\cdot x+x^2+x^3+4\cdot x^4, & 1+2\cdot x^2+3\cdot x^3+4\cdot x^4, & 2+5\cdot x+5\cdot x^2+5\cdot x^3+x^4 \\ 4+x+4\cdot x^2+x^3+4\cdot x^4, & 5+6\cdot x+6\cdot x^2+5\cdot x^3, & 2+x+3\cdot x^2+2\cdot x^3+3\cdot x^4 \end{bmatrix}, 4, 0 \right)$$

42 R:=normal(R-cf(R,k)*x^(k-1)*(x*identity(3)-A));Q:=cf(R,k)*x^(k-1)+Q:;k:=k-1;

$$\begin{matrix} 6\cdot x^3\cdot(a[0,0])+ & 6\cdot x^3\cdot(a[0,1])+ & 6\cdot x \\ 6\cdot x^3\cdot(a[1,0])+ & 6\cdot x^3\cdot(a[1,1])+ & 6\cdot x \\ 2\cdot x^3\cdot(a[2,0])+x^3+4\cdot x+1, & 2\cdot x^3\cdot(a[2,1])+3\cdot x^3+4\cdot x^2+x+1, & 2\cdot x \\ & & 4\cdot x \\ 4\cdot x^3\cdot(a[0,0])+ & 4\cdot x^3\cdot(a[0,1])+ & 4\cdot x \\ 4\cdot x^3\cdot(a[1,0])+x^3\cdot(a[2,0])+x^3+x^2+3\cdot x+6, & 4\cdot x^3\cdot(a[1,1])+x^3\cdot(a[2,1])+3\cdot x^3+2\cdot x^2+1, & 5\cdot x \\ 4\cdot x^3\cdot(a[0,0])+ & 4\cdot x^3\cdot(a[0,1])+ & 4\cdot x \\ 3\cdot x^3\cdot(a[2,0])+x^3+4\cdot x^2+x+4, & 3\cdot x^3\cdot(a[2,1])+5\cdot x^3+6\cdot x^2+6\cdot x+5, & 3\cdot x \end{matrix}$$

43 R:=normal(R-cf(R,k)*x^(k-1)*(x*identity(3)-A));Q:=cf(R,k)*x^(k-1)+Q:;k:=k-1;

$$\begin{matrix} 6\cdot x^2\cdot(a[0,0])^2+ & 6\cdot x^2\cdot(a[0,0])\cdot(a[0,1])+ & 6\cdot x^2\cdot(\\ 6\cdot x^2\cdot(a[0,0])\cdot(a[1,0])+ & 6\cdot x^2\cdot(a[0,1])\cdot(a[1,0])+ & 6\cdot x^2\cdot(\\ 2\cdot x^2\cdot(a[0,0])\cdot(a[2,0])+ & 6\cdot x^2\cdot(a[0,1])\cdot(a[1,1])+ & 6\cdot x^2\cdot(\\ x^2\cdot(a[0,0])+6\cdot x^2\cdot(a[0,1])\cdot(a[1,0])+ & 2\cdot x^2\cdot(a[0,1])\cdot(a[2,0])+ & 2\cdot x^2\cdot(\\ 6\cdot x^2\cdot(a[0,2])\cdot(a[2,0])+ & x^2\cdot(a[0,1])+6\cdot x^2\cdot(a[0,2])\cdot(a[2,1])+ & 6\cdot x^2\cdot(\\ 6\cdot x^2\cdot(a[1,0])\cdot(a[1,1])+ & 6\cdot x^2\cdot(a[1,1])^2+ & x^2\cdot(a[\\ 2\cdot x^2\cdot(a[1,0])\cdot(a[2,1])+ & 2\cdot x^2\cdot(a[1,1])\cdot(a[2,1])+ & 2\cdot x^2\cdot(\\ 3\cdot x^2\cdot(a[1,0])+ & 3\cdot x^2\cdot(a[1,1])+ & 6\cdot x^2\cdot(\\ 6\cdot x^2\cdot(a[1,2])\cdot(a[2,0])+ & 6\cdot x^2\cdot(a[1,2])\cdot(a[2,1])+ & 3\cdot x^2\cdot(\\ 2\cdot x^2\cdot(a[2,0])\cdot(a[2,2])+ & 2\cdot x^2\cdot(a[2,1])\cdot(a[2,2])+ & 2\cdot x^2\cdot(\\ 2\cdot x^2\cdot(a[2,0])+4\cdot x+1, & 2\cdot x^2\cdot(a[2,1])+4\cdot x^2+x+1, & 2\cdot x^2\cdot(\\ & & \\ 4\cdot x^2\cdot(a[0,0])^2+ & 4\cdot x^2\cdot(a[0,0])\cdot(a[0,1])+ & \\ 4\cdot x^2\cdot(a[0,0])\cdot(a[1,0])+ & 4\cdot x^2\cdot(a[0,1])\cdot(a[1,0])+ & 4\cdot x^2\cdot(\\ x^2\cdot(a[0,0])\cdot(a[2,0])+ & 4\cdot x^2\cdot(a[0,1])\cdot(a[1,1])+ & 4\cdot x^2\cdot(\\ x^2\cdot(a[0,0])+4\cdot x^2\cdot(a[0,1])\cdot(a[1,0])+ & x^2\cdot(a[0,1])\cdot(a[2,0])+ & 4\cdot x^2\cdot(\\ 4\cdot x^2\cdot(a[0,2])\cdot(a[2,0])+ & x^2\cdot(a[0,1])+4\cdot x^2\cdot(a[0,2])\cdot(a[2,1])+ & x^2\cdot(a[\\ 4\cdot x^2\cdot(a[1,0])\cdot(a[1,1])+ & 4\cdot x^2\cdot(a[1,1])^2+ & 4\cdot x^2\cdot(\\ x^2\cdot(a[1,0])\cdot(a[2,1])+ & x^2\cdot(a[1,1])\cdot(a[2,1])+ & x^2\cdot(a[\\ 3\cdot x^2\cdot(a[1,0])+ & 3\cdot x^2\cdot(a[1,1])+ & x^2\cdot(a[\\ 4\cdot x^2\cdot(a[1,2])\cdot(a[2,0])+ & 4\cdot x^2\cdot(a[1,2])\cdot(a[2,1])+ & 4\cdot x^2\cdot(\\ x^2\cdot(a[2,0])\cdot(a[2,2])+ & x^2\cdot(a[2,1])\cdot(a[2,2])+ & 3\cdot x^2\cdot(\\ 5\cdot x^2\cdot(a[2,0])+x^2+3\cdot x+6, & 5\cdot x^2\cdot(a[2,1])+2\cdot x^2+1, & 5\cdot x^2\cdot(\\ & & \\ 4\cdot x^2\cdot(a[0,0])^2+ & 4\cdot x^2\cdot(a[0,0])\cdot(a[0,1])+ & 4\cdot x^2\cdot(\end{matrix}$$

44 R:=normal(R-cf(R,k)*x^(k-1)*(x*identity(3)-A));Q:=cf(R,k)*x^(k-1)+Q:;k:=k-1;

```
x*(a[(0, 1 ])*(a[(1, 0 ])+
6*x*(a[(0, 1 ])*(a[(1, 2 ])*(a[(2, 0 ])+
6*x*(a[(0, 2 ])*(a[(1, 0 ])*(a[(2, 0 ])+
6*x*(a[(0, 2 ])*(a[(1, 0 ])*(a[(2, 1 ])+
                                        2
2*x*(a[(0, 2 ])*(a[(2, 0 ])  +
6*x*(a[(0, 2 ])*(a[(2, 0 ])*(a[(2, 2 ])+
x*(a[(0, 2 ])*(a[(2, 0 ])+
                                        2
6*x*(a[(1, 0 ])*(a[(1, 1 ])  +
2*x*(a[(1, 0 ])*(a[(1, 1 ])*(a[(2, 1 ])+
3*x*(a[(1, 0 ])*(a[(1, 1 ])+
6*x*(a[(1, 0 ])*(a[(1, 2 ])*(a[(2, 1 ])+
2*x*(a[(1, 0 ])*(a[(2, 1 ])*(a[(2, 2 ])+
2*x*(a[(1, 0 ])*(a[(2, 1 ])+
4*x*(a[(1, 0 ])+
6*x*(a[(1, 1 ])*(a[(1, 2 ])*(a[(2, 0 ])+
2*x*(a[(1, 2 ])*(a[(2, 0 ])*(a[(2, 1 ])+
6*x*(a[(1, 2 ])*(a[(2, 0 ])*(a[(2, 2 ])+
3*x*(a[(1, 2 ])*(a[(2, 0 ])+
                                        2
 *x*(a[(2, 0 ])*(a[(2, 2 ])  +
 x*(a[(2, 0 ])*(a[(2, 2 ])+
*x*(a[(2, 0 ])+ 4*x+ 1
```

```
                                        2
2*x*(a[(0, 1 ])*(a[(2, 0 ])*(a[(2, 2 ])+
2*x*(a[(0, 1 ])*(a[(2, 0 ])+
6*x*(a[(0, 2 ])*(a[(1, 0 ])*(a[(2, 1 ])+
6*x*(a[(0, 2 ])*(a[(1, 1 ])*(a[(2, 1 ])+
2*x*(a[(0, 2 ])*(a[(2, 0 ])*(a[(2, 1 ])+
6*x*(a[(0, 2 ])*(a[(2, 1 ])*(a[(2, 2 ])+
x*(a[(0, 2 ])*(a[(2, 1 ])+
                                        3
6*x*(a[(1, 1 ])  +
                                        2
2*x*(a[(1, 1 ])  *(a[(2, 1 ])+
                                        2
3*x*(a[(1, 1 ])  +
12*x*(a[(1, 1 ])*(a[(1, 2 ])*(a[(2, 1 ])+
2*x*(a[(1, 1 ])*(a[(2, 1 ])*(a[(2, 2 ])+
2*x*(a[(1, 1 ])*(a[(2, 1 ])+
4*x*(a[(1, 1 ])+
                                        2
2*x*(a[(1, 2 ])*(a[(2, 1 ])  +
6*x*(a[(1, 2 ])*(a[(2, 1 ])*(a[(2, 2 ])+
3*x*(a[(1, 2 ])*(a[(2, 1 ])+
                                        2
2*x*(a[(2, 1 ])*(a[(2, 2 ])  +
2*x*(a[(2, 1 ])*(a[(2, 2 ])+
, 5*x*(a[(2, 1 ])+ x+ 1
```

```
                                        2
4*x*(a[(0, 0 ])  *(a[(0, 1 ])+
4*x*(a[(0, 0 ])*(a[(0, 1 ])*(a[(1, 0 ])+
4*x*(a[(0, 0 ])*(a[(0, 1 ])*(a[(1, 1 ])+
x*(a[(0, 0 ])*(a[(0, 1 ])*(a[(2, 0 ])+
x*(a[(0, 0 ])*(a[(0, 1 ])+
4*x*(a[(0, 0 ])*(a[(0, 2 ])*(a[(2, 1 ])+
                                        2
4*x*(a[(0, 1 ])  *(a[(1, 0 ])+
4*x*(a[(0, 1 ])*(a[(0, 2 ])*(a[(2, 0 ])+
8*x*(a[(0, 1 ])*(a[(1, 0 ])*(a[(1, 1 ])+
x*(a[(0, 1 ])*(a[(1, 0 ])*(a[(2, 1 ])+
3*x*(a[(0, 1 ])*(a[(1, 0 ])+
                                        2
4*x*(a[(0, 1 ])*(a[(1, 1 ])  +
x*(a[(0, 1 ])*(a[(1, 1 ])*(a[(2, 0 ])+
x*(a[(0, 1 ])*(a[(1, 1 ])+
```

```
                                        3
x*(a[(0, 0 ])  +
                                        2
4*x*(a[(0, 0 ])  *(a[(1, 0 ])+
                                        2
x*(a[(0, 0 ])  *(a[(2, 0 ])+
                                        2
x*(a[(0, 0 ])  + 8*x*(a[(0, 0 ])*(a[(0, 1 ])*(a[(1, 0 ])+
8*x*(a[(0, 0 ])*(a[(0, 2 ])*(a[(2, 0 ])+
4*x*(a[(0, 0 ])*(a[(1, 0 ])*(a[(1, 1 ])+
x*(a[(0, 0 ])*(a[(1, 0 ])*(a[(2, 1 ])+
3*x*(a[(0, 0 ])*(a[(1, 0 ])+
4*x*(a[(0, 0 ])*(a[(1, 2 ])*(a[(2, 0 ])+
x*(a[(0, 0 ])*(a[(2, 0 ])*(a[(2, 2 ])+
5*x*(a[(0, 0 ])*(a[(2, 0 ])+
                                        2
x*(a[(0, 0 ])+ 4*x*(a[(0, 1 ])*(a[(1, 0 ])  +
```

45 R:=normal(R-cf(R,k)*x^(k-1)*(x*identity(3)-A));Q:=cf(R,k)*x^(k-1)+Q:;k:=k-1;

Evaluation time: 0.7

Done

46 R2:=add(cf(P,i0)*A^i0,i0=0..4);

Done

47 normal(R2-R);

$$\begin{bmatrix} 0, & 0, & 0 \\ 0, & 0, & 0 \\ 0, & 0, & 0 \end{bmatrix}$$