```
Maxima 5.9.1 http://maxima.sourceforge.net
Using Lisp CMU Common Lisp 19a
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Dedicated to the memory of William Schelter.
This is a development version of Maxima. The function bug_report()
provides bug reporting information.
```

```
(%i1) load("kihon.mac");
```

(%o1) kihon.mac

```
(%i2) A : matrix([1,2,3,1,0,0],[4,5,6,0,1,0],[7,8,0,0,0,1]);
```

$$(\%o2)\quad \begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 4 & 5 & 6 & 0 & 1 & 0 \\ 7 & 8 & 0 & 0 & 0 & 1 \end{pmatrix}$$

```
(%i3) col_ad(A, -4, 2, 1);
```

$$(\%o3)\quad \begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & -3 & -6 & -4 & 1 & 0 \\ 7 & 8 & 0 & 0 & 0 & 1 \end{pmatrix}$$

```
(%i4) col_ad(A, -7, 3, 1);
```

$$(\%o4)\quad \begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & -3 & -6 & -4 & 1 & 0 \\ 0 & -6 & -21 & -7 & 0 & 1 \end{pmatrix}$$

```
(%i5) col_ad(A, -2, 3, 2);
```

$$(\%o5)\quad \begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & -3 & -6 & -4 & 1 & 0 \\ 0 & 0 & -9 & 1 & -2 & 1 \end{pmatrix}$$

```
(%i6) col_sp(A, -1/3, 2);
```

$$(\%o6)\quad \begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & 0 & -9 & 1 & -2 & 1 \end{pmatrix}$$

```
(%i7) col_sp(A, -1/9, 3);
```

$$(\%o7)\quad \begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix}$$

```
(%i8) col_ad(A, -2, 1, 2);
```

$$(\%o8)\quad \begin{pmatrix} 1 & 0 & -1 & -\frac{5}{3} & \frac{2}{3} & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix}$$

```
(%i9) col_ad(A, 1, 1, 3);
```

$$(\%o9)\quad \begin{pmatrix} 1 & 0 & 0 & -\frac{16}{9} & \frac{8}{9} & -\frac{1}{9} \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix}$$

```
(%i10) col_ad(A, -2, 2, 3);
```

$$(\%o10)\quad \begin{pmatrix} 1 & 0 & 0 & -\frac{16}{9} & \frac{8}{9} & -\frac{1}{9} \\ 0 & 1 & 0 & \frac{14}{9} & -\frac{7}{9} & \frac{2}{9} \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix}$$

```
(%i11) kill(A);
```

(%o11) DONE

```
(%i12) A : matrix([1,2,3,1,0,0],[4,5,6,0,1,0],[7,8,0,0,0,1]);
```

$$(\%o12)\quad \begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 4 & 5 & 6 & 0 & 1 & 0 \\ 7 & 8 & 0 & 0 & 0 & 1 \end{pmatrix}$$

```
(%i13) kaidan(A);
```

$$\begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 4 & 5 & 6 & 0 & 1 & 0 \\ 7 & 8 & 0 & 0 & 0 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & -3 & -6 & -4 & 1 & 0 \\ 7 & 8 & 0 & 0 & 0 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & -3 & -6 & -4 & 1 & 0 \\ 0 & -6 & -21 & -7 & 0 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & -6 & -21 & -7 & 0 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & -1 & -\frac{5}{3} & \frac{2}{3} & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & -6 & -21 & -7 & 0 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & -1 & -\frac{5}{3} & \frac{2}{3} & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & 0 & -9 & 1 & -2 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & -1 & -\frac{5}{3} & \frac{2}{3} & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & 0 & -\frac{16}{9} & \frac{8}{9} & -\frac{1}{9} \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & 0 & -\frac{16}{9} & \frac{8}{9} & -\frac{1}{9} \\ 0 & 1 & 0 & \frac{14}{9} & -\frac{7}{9} & \frac{2}{9} \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix} \textbf{false}$$

(%o13)
$$\begin{pmatrix} 1 & 0 & 0 & -\frac{16}{9} & \frac{8}{9} & -\frac{1}{9} \\ 0 & 1 & 0 & \frac{14}{9} & -\frac{7}{9} & \frac{2}{9} \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix}$$

```
(%i14) kill(A);
```

(%o14) DONE

```
(%i15) A : matrix([1,2,3],[4,5,6],[7,8,9]);
```

(%o15)
$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

```
(%i16) kaidan(A);
```

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 2 & 3 \\ 0 & -3 & -6 \\ 7 & 8 & 9 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 2 & 3 \\ 0 & -3 & -6 \\ 0 & -6 & -12 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 0 & -6 & -12 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 2 \\ 0 & -6 & -12 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{pmatrix} \textbf{false}$$
(%o16) $$\begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{pmatrix}$$

```
(%i17) B : matrix([1,2],[0,0],[3,4],[0,0],[5,6]);
```

(%o17) $$\begin{pmatrix} 1 & 2 \\ 0 & 0 \\ 3 & 4 \\ 0 & 0 \\ 5 & 6 \end{pmatrix}$$

```
(%i18) kaidan(B);
```

$$\begin{pmatrix} 1 & 2 \\ 0 & 0 \\ 3 & 4 \\ 0 & 0 \\ 5 & 6 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 2 \\ 0 & 0 \\ 0 & -2 \\ 0 & 0 \\ 5 & 6 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 2 \\ 0 & 0 \\ 0 & -2 \\ 0 & 0 \\ 0 & -4 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 2 \\ 0 & -2 \\ 0 & 0 \\ 0 & 0 \\ 0 & -4 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 2 \\ 0 & 1 \\ 0 & 0 \\ 0 & 0 \\ 0 & -4 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \\ 0 & 0 \\ 0 & -4 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{pmatrix}$$ **false**

(%o18) $$\begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{pmatrix}$$

```
(%i19) C : matrix([3,0,2],[0,0,4]);
```

(%o19) $$\begin{pmatrix} 3 & 0 & 2 \\ 0 & 0 & 4 \end{pmatrix}$$

```
(%i20) kaidan(C);
```

$$\begin{pmatrix} 1 & 0 & \frac{2}{3} \\ 0 & 0 & 4 \end{pmatrix}$$ **false**

$$\begin{pmatrix} 1 & 0 & \frac{2}{3} \\ 0 & 0 & 1 \end{pmatrix}$$ **false**

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$ **false**

(%o20) $$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

```
(%i21) kill(A,B,C);
```

(%o21) DONE

```
(%i22) F : matrix([a,b,c],[d,e,f],[g,h,i]);
```

(%o22) $$\begin{pmatrix} a & b & c \\ d & e & f \\ g & h & i \end{pmatrix}$$

```
(%i23) kaidan(F);
```

$$\begin{pmatrix} 1 & \frac{b}{a} & \frac{c}{a} \\ d & e & f \\ g & h & i \end{pmatrix}$$ **false**

$$\begin{pmatrix} 1 & \frac{b}{a} & \frac{c}{a} \\ 0 & e-\frac{b\,d}{a} & f-\frac{c\,d}{a} \\ g & h & i \end{pmatrix}$$ **false**

$$\begin{pmatrix} 1 & \frac{b}{a} & \frac{c}{a} \\ 0 & e-\frac{b\,d}{a} & f-\frac{c\,d}{a} \\ 0 & h-\frac{b\,g}{a} & i-\frac{c\,g}{a} \end{pmatrix}$$ **false**

$$\begin{pmatrix} 1 & \frac{b}{a} & \frac{c}{a} \\ 0 & 1 & \frac{f-\frac{c\,d}{a}}{e-\frac{b\,d}{a}} \\ 0 & h-\frac{b\,g}{a} & i-\frac{c\,g}{a} \end{pmatrix}\ \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & \frac{c}{a}-\frac{b\left(f-\frac{c\,d}{a}\right)}{a\left(e-\frac{b\,d}{a}\right)} \\ 0 & 1 & \frac{f-\frac{c\,d}{a}}{e-\frac{b\,d}{a}} \\ 0 & h-\frac{b\,g}{a} & i-\frac{c\,g}{a} \end{pmatrix}\ \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & \frac{c}{a}-\frac{b\left(f-\frac{c\,d}{a}\right)}{a\left(e-\frac{b\,d}{a}\right)} \\ 0 & 1 & \frac{f-\frac{c\,d}{a}}{e-\frac{b\,d}{a}} \\ 0 & 0 & i+\frac{\left(f-\frac{c\,d}{a}\right)\left(\frac{b\,g}{a}-h\right)}{e-\frac{b\,d}{a}}-\frac{c\,g}{a} \end{pmatrix}\ \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & \frac{c}{a}-\frac{b\left(f-\frac{c\,d}{a}\right)}{a\left(e-\frac{b\,d}{a}\right)} \\ 0 & 1 & \frac{f-\frac{c\,d}{a}}{e-\frac{b\,d}{a}} \\ 0 & 0 & 1 \end{pmatrix}\ \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & \frac{f-\frac{c\,d}{a}}{e-\frac{b\,d}{a}} \\ 0 & 0 & 1 \end{pmatrix}\ \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}\ \textbf{false}$$

(%o23) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

```
(%i24) kill(F);
```

(%o24) DONE

```
(%i25) A : matrix([1,0,2,0,3],[4,0,5,0,6],[7,0,8,0,9]);
```

(%o25) $\begin{pmatrix} 1 & 0 & 2 & 0 & 3 \\ 4 & 0 & 5 & 0 & 6 \\ 7 & 0 & 8 & 0 & 9 \end{pmatrix}$

```
(%i26) B : kaidan(A);
```

$$\begin{pmatrix} 1 & 0 & 2 & 0 & 3 \\ 4 & 0 & 5 & 0 & 6 \\ 7 & 0 & 8 & 0 & 9 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 0 & 2 & 0 & 3 \\ 0 & 0 & -3 & 0 & -6 \\ 7 & 0 & 8 & 0 & 9 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 0 & 2 & 0 & 3 \\ 0 & 0 & -3 & 0 & -6 \\ 0 & 0 & -6 & 0 & -12 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 0 & 2 & 0 & 3 \\ 0 & 0 & 1 & 0 & 2 \\ 0 & 0 & -6 & 0 & -12 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & 2 \\ 0 & 0 & -6 & 0 & -12 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & 2 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix} \textbf{false}$$
(%o26) $$\begin{pmatrix} 1 & 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & 2 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

```
(%i27) kai2hyo(B);
```

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 2 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 2 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix} \textbf{false}$$
(%o27) $$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

```
(%i28) kill(A,B);
```

(%o28) DONE

```
(%i29) A : matrix([1,2,3],[4,5,6],[7,8,0]);
```

(%o29) $$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 0 \end{pmatrix}$$

```
(%i30) myinv(A);
```

$$\begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 4 & 5 & 6 & 0 & 1 & 0 \\ 7 & 8 & 0 & 0 & 0 & 1 \end{pmatrix} \textbf{false}$$
$$\begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & -3 & -6 & -4 & 1 & 0 \\ 7 & 8 & 0 & 0 & 0 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & -3 & -6 & -4 & 1 & 0 \\ 0 & -6 & -21 & -7 & 0 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 2 & 3 & 1 & 0 & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & -6 & -21 & -7 & 0 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & -1 & -\frac{5}{3} & \frac{2}{3} & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & -6 & -21 & -7 & 0 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & -1 & -\frac{5}{3} & \frac{2}{3} & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & 0 & -9 & 1 & -2 & 1 \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & -1 & -\frac{5}{3} & \frac{2}{3} & 0 \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & 0 & -\frac{16}{9} & \frac{8}{9} & -\frac{1}{9} \\ 0 & 1 & 2 & \frac{4}{3} & -\frac{1}{3} & 0 \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix} \textbf{false}$$

$$\begin{pmatrix} 1 & 0 & 0 & -\frac{16}{9} & \frac{8}{9} & -\frac{1}{9} \\ 0 & 1 & 0 & \frac{14}{9} & -\frac{7}{9} & \frac{2}{9} \\ 0 & 0 & 1 & -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix} \textbf{false}$$

(%o30)
$$\begin{pmatrix} -\frac{16}{9} & \frac{8}{9} & -\frac{1}{9} \\ \frac{14}{9} & -\frac{7}{9} & \frac{2}{9} \\ -\frac{1}{9} & \frac{2}{9} & -\frac{1}{9} \end{pmatrix}$$

```
(%i31) kill(A);
```

(%o31) DONE

```
(%i32) F : matrix([a,b,c],[d,e,f],[g,h,i]);
```

(%o32)
$$\begin{pmatrix} a & b & 0 \\ d & e & f \\ g & h & i \end{pmatrix}$$

```
(%i33) P : queryp(F);
```

$$\begin{pmatrix} 1 & \frac{b}{a} & 0 \\ d & e & f \\ g & h & i \end{pmatrix} \begin{pmatrix} \frac{1}{a} & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & \frac{b}{a} & 0 \\ 0 & e-\frac{b\,d}{a} & f \\ g & h & i \end{pmatrix}\begin{pmatrix} \frac{1}{a} & 0 & 0 \\ -\frac{d}{a} & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & \frac{b}{a} & 0 \\ 0 & e-\frac{b\,d}{a} & f \\ 0 & h-\frac{b\,g}{a} & i \end{pmatrix}\begin{pmatrix} \frac{1}{a} & 0 & 0 \\ -\frac{d}{a} & 1 & 0 \\ -\frac{g}{a} & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & \frac{b}{a} & 0 \\ 0 & 1 & \frac{f}{e-\frac{b\,d}{a}} \\ 0 & h-\frac{b\,g}{a} & i \end{pmatrix}\begin{pmatrix} \frac{1}{a} & 0 & 0 \\ -\frac{d}{a\left(e-\frac{b\,d}{a}\right)} & \frac{1}{e-\frac{b\,d}{a}} & 0 \\ -\frac{g}{a} & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & -\frac{b\,f}{a\left(e-\frac{b\,d}{a}\right)} \\ 0 & 1 & \frac{f}{e-\frac{b\,d}{a}} \\ 0 & h-\frac{b\,g}{a} & i \end{pmatrix}\begin{pmatrix} \frac{b\,d}{a^2\left(e-\frac{b\,d}{a}\right)}+\frac{1}{a} & -\frac{b}{a\left(e-\frac{b\,d}{a}\right)} & 0 \\ -\frac{d}{a\left(e-\frac{b\,d}{a}\right)} & \frac{1}{e-\frac{b\,d}{a}} & 0 \\ -\frac{g}{a} & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & -\frac{b\,f}{a\left(e-\frac{b\,d}{a}\right)} \\ 0 & 1 & \frac{f}{e-\frac{b\,d}{a}} \\ 0 & 0 & i-\frac{f\left(h-\frac{b\,g}{a}\right)}{e-\frac{b\,d}{a}} \end{pmatrix}\begin{pmatrix} \frac{b\,d}{a^2\left(e-\frac{b\,d}{a}\right)}+\frac{1}{a} & -\frac{b}{a\left(e-\frac{b\,d}{a}\right)} & 0 \\ -\frac{d}{a\left(e-\frac{b\,d}{a}\right)} & \frac{1}{e-\frac{b\,d}{a}} & 0 \\ \frac{d\left(h-\frac{b\,g}{a}\right)}{a\left(e-\frac{b\,d}{a}\right)}-\frac{g}{a} & -\frac{h-\frac{b\,g}{a}}{e-\frac{b\,d}{a}} & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & -\frac{b\,f}{a\left(e-\frac{b\,d}{a}\right)} \\ 0 & 1 & \frac{f}{e-\frac{b\,d}{a}} \\ 0 & 0 & 1 \end{pmatrix}\begin{pmatrix} \frac{b\,d}{a^2\left(e-\frac{b\,d}{a}\right)}+\frac{1}{a} & -\frac{b}{a\left(e-\frac{b\,d}{a}\right)} & 0 \\ -\frac{d}{a\left(e-\frac{b\,d}{a}\right)} & \frac{1}{e-\frac{b\,d}{a}} & 0 \\ \frac{\frac{d\,\Gamma h-\frac{b\,g}{a}\Delta}{a\,\Gamma e-\frac{b\,d}{a}\Delta}-\frac{g}{a}}{i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}} & -\frac{h-\frac{b\,g}{a}}{\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)} & \frac{1}{i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}} \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & \frac{f}{e-\frac{b\,d}{a}} \\ 0 & 0 & 1 \end{pmatrix}\begin{pmatrix} \frac{b\,f\left(\frac{d\,\Gamma h-\frac{b\,g}{a}\Delta}{a\,\Gamma e-\frac{b\,d}{a}\Delta}-\frac{g}{a}\right)}{a\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}+\frac{b\,d}{a^2\left(e-\frac{b\,d}{a}\right)}+\frac{1}{a} & -\frac{b\,f\left(h-\frac{b\,g}{a}\right)}{a\left(e-\frac{b\,d}{a}\right)^2\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}-\frac{b}{a\left(e-\frac{b\,d}{a}\right)} & -\frac{b\,f}{a\left(\right.} \\ -\frac{d}{a\left(e-\frac{b\,d}{a}\right)} & \frac{1}{e-\frac{b\,d}{a}} & \\ \frac{\frac{d\,\Gamma h-\frac{b\,g}{a}\Delta}{a\,\Gamma e-\frac{b\,d}{a}\Delta}-\frac{g}{a}}{i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}} & -\frac{h-\frac{b\,g}{a}}{\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)} & \end{pmatrix}$$

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

(%o33)

$$\begin{pmatrix} \frac{b\,f\left(\frac{d\,\Gamma h-\frac{b\,g}{a}\Delta}{a\,\Gamma e-\frac{b\,d}{a}\Delta}-\frac{g}{a}\right)}{a\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}+\frac{b\,d}{a^2\left(e-\frac{b\,d}{a}\right)}+\frac{1}{a} & -\frac{b\,f\left(h-\frac{b\,g}{a}\right)}{a\left(e-\frac{b\,d}{a}\right)^2\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}-\frac{b}{a\left(e-\frac{b\,d}{a}\right)} & \frac{b\,f}{a\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h}{e}\right.} \\ -\frac{f\left(\frac{d\,\Gamma h-\frac{b\,g}{a}\Delta}{a\,\Gamma e-\frac{b\,d}{a}\Delta}-\frac{g}{a}\right)}{\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}-\frac{d}{a\left(e-\frac{b\,d}{a}\right)} & \frac{f\left(h-\frac{b\,g}{a}\right)}{\left(e-\frac{b\,d}{a}\right)^2\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}+\frac{1}{e-\frac{b\,d}{a}} & -\frac{f}{\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h}{e}\right.} \\ \frac{\frac{d\,\Gamma h-\frac{b\,g}{a}\Delta}{a\,\Gamma e-\frac{b\,d}{a}\Delta}-\frac{g}{a}}{i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}} & -\frac{h-\frac{b\,g}{a}}{\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)} & \frac{1}{i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}} \end{pmatrix}$$

(%i34) `P . F;`

(%o34)

$$\begin{pmatrix} a\left(\frac{b\,f\left(\frac{d\,\Gamma h-\frac{b\,g}{a}\Delta}{a\,\Gamma e-\frac{b\,d}{a}\Delta}-\frac{g}{a}\right)}{a\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}+\frac{b\,d}{a^2\left(e-\frac{b\,d}{a}\right)}+\frac{1}{a}\right)+d\left(-\frac{b\,f\left(h-\frac{b\,g}{a}\right)}{a\left(e-\frac{b\,d}{a}\right)^2\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}-\frac{b}{a\left(e-\frac{b\,d}{a}\right)}\right)+\frac{}{a\left(e-\right.} \\ a\left(-\frac{f\left(\frac{d\,\Gamma h-\frac{b\,g}{a}\Delta}{a\,\Gamma e-\frac{b\,d}{a}\Delta}-\frac{g}{a}\right)}{\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}-\frac{d}{a\left(e-\frac{b\,d}{a}\right)}\right)+d\left(\frac{f\left(h-\frac{b\,g}{a}\right)}{\left(e-\frac{b\,d}{a}\right)^2\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}+\frac{1}{e-\frac{b\,d}{a}}\right)-\frac{}{\left(e-\frac{b\,d}{a}\right)\left(i\right.} \\ \frac{a\left(\frac{d\,\Gamma h-\frac{b\,g}{a}\Delta}{a\,\Gamma e-\frac{b\,d}{a}\Delta}-\frac{g}{a}\right)}{i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}}-\frac{d\left(h-\frac{b\,g}{a}\right)}{\left(e-\frac{b\,d}{a}\right)\left(i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}\right)}+\frac{g}{i-\frac{f\,\Gamma h-\frac{b\,g}{a}\Delta}{e-\frac{b\,d}{a}}} \end{pmatrix}$$

(%i35) `ratsimp(P . F);`

(%o35) $$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

(%i36) `kill(A,F,P);`

(%o36) DONE

(%i37) `A : matrix([1,0,2,0,3],[4,0,5,0,6],[7,0,8,0,9]);`

(%o37) $$\begin{pmatrix} 1 & 0 & 2 & 0 & 3 \\ 4 & 0 & 5 & 0 & 6 \\ 7 & 0 & 8 & 0 & 9 \end{pmatrix}$$

(%i38) `getpq(A);`

$$\begin{pmatrix} 1 & 0 & 2 & 0 & 3 \\ 4 & 0 & 5 & 0 & 6 \\ 7 & 0 & 8 & 0 & 9 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 2 & 0 & 3 \\ 0 & 0 & -3 & 0 & -6 \\ 7 & 0 & 8 & 0 & 9 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ -4 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 2 & 0 & 3 \\ 0 & 0 & -3 & 0 & -6 \\ 0 & 0 & -6 & 0 & -12 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ -4 & 1 & 0 \\ -7 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 2 & 0 & 3 \\ 0 & 0 & 1 & 0 & 2 \\ 0 & 0 & -6 & 0 & -12 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ \frac{4}{3} & -\frac{1}{3} & 0 \\ -7 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & 2 \\ 0 & 0 & -6 & 0 & -12 \end{pmatrix} \begin{pmatrix} -\frac{5}{3} & \frac{2}{3} & 0 \\ \frac{4}{3} & -\frac{1}{3} & 0 \\ -7 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & 2 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix} \begin{pmatrix} -\frac{5}{3} & \frac{2}{3} & 0 \\ \frac{4}{3} & -\frac{1}{3} & 0 \\ 1 & -2 & 1 \end{pmatrix}$$

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

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

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

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

(%o38) $$\left[\begin{pmatrix} -\frac{5}{3} & \frac{2}{3} & 0 \\ \frac{4}{3} & -\frac{1}{3} & 0 \\ 1 & -2 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & -2 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix} \right]$$

(%i39) `P : first(%o38);`

(%o39) $$\begin{pmatrix} -\frac{5}{3} & \frac{2}{3} & 0 \\ \frac{4}{3} & -\frac{1}{3} & 0 \\ 1 & -2 & 1 \end{pmatrix}$$

```
(%i40) Q : first(rest(%o38));
```

(%o40) $$\begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & -2 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

```
(%i41) P . A. Q;
```

(%o41) $$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

```
(%i42) kill(ALL);
```

(%o0) DONE

(%i1)