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

```
(%i1) load("tensor-tmp.mac");
```

```
Warning - you are redefining the MACSYMA function EIGENVALUES
Warning - you are redefining the MACSYMA function EIGENVECTORS
```

(%o1) tensor-tmp.mac

```
(%i2) a : [1,2] @x@ [sin(x), cos(x), tan(x)] @x@ [1, x, x^2, x^4]$
```

```
Incorrect syntax: Premature termination of input at ;.
 ;
^
```

```
(%i3) a;
```

(%o3) $[[[\sin x, x\sin x, x^2\sin x, x^4\sin x], [\cos x, x\cos x, x^2\cos x, x^4\cos x], [\tan x, x\tan x, x^2\tan x, x^4\tan x]], [[2\sin x, 2x\sin x, 2x^2\sin x, 2x^4\sin x], [2\cos x, 2x\cos x, 2x^2\cos x, 2x^4\cos x], [2\tan x, 2x\tan x, 2x^2\tan x, 2x^4\tan x]]]$

```
(%i4) tensortype(a);
```

(%o4) $[2,3,4]$

```
(%i5) tensorrank(a);
```

(%o5) 3

```
(%i6) b : [s,t];
```

(%o6) $[s,t]$

```
(%i7) c : a @x@ b;
```

(%o7) $[[[[s\sin x, t\sin x], [sx\sin x, tx\sin x], [sx^2\sin x, tx^2\sin x], [sx^4\sin x, tx^4\sin x]], [[s\cos x, t\cos x], [sx\cos x, tx\cos x], [sx^2\cos x, tx^2\cos x], [sx^4\cos x, tx^4\cos x]], [[s\tan x, t\tan x], [sx\tan x, tx\tan x], [sx^2\tan x, tx^2\tan x], [sx^4\tan x, tx^4\tan x]]], [[[2s\sin x, 2t\sin x], [2sx\sin x, 2tx\sin x], [2sx^2\sin x, 2tx^2\sin x], [2sx^4\sin x, 2tx^4\sin x]], [[2s\cos x, 2t\cos x], [2sx\cos x, 2tx\cos x], [2sx^2\cos x, 2tx^2\cos x], [2sx^4\cos x, 2tx^4\cos x]], [[2s\tan x, 2t\tan x], [2sx\tan x, 2tx\tan x], [2sx^2\tan x, 2tx^2\tan x], [2sx^4\tan x, 2tx^4\tan x]]]]$

```
(%i8) tensortype(c);
```

(%o8) $[2,3,4,2]$

```
(%i9) d : b @x@ a;
```

(%o9) $[[[[s\sin x, s\,x\sin x, s\,x^2\sin x, s\,x^4\sin x], [s\cos x, s\,x\cos x, s\,x^2\cos x, s\,x^4\cos x], [s\tan x, s\,x\tan x, s\,x^2\tan x, s\,x^4\tan x]], [[2\,s\sin x, 2\,s\,x\sin x, 2\,s\,x^2\sin x, 2\,s\,x^4\sin x], [2\,s\cos x, 2\,s\,x\cos x, 2\,s\,x^2\cos x, 2\,s\,x^4\cos x], [2\,s\tan x, 2\,s\,x\tan x, 2\,s\,x^2\tan x, 2\,s\,x^4\tan x]]], [[[t\sin x, t\,x\sin x, t\,x^2\sin x, t\,x^4\sin x], [t\cos x, t\,x\cos x, t\,x^2\cos x, t\,x^4\cos x], [t\tan x, t\,x\tan x, t\,x^2\tan x, t\,x^4\tan x]], [[2\,t\sin x, 2\,t\,x\sin x, 2\,t\,x^2\sin x, 2\,t\,x^4\sin x], [2\,t\cos x, 2\,t\,x\cos x, 2\,t\,x^2\cos x, 2\,t\,x^4\cos x], [2\,t\tan x, 2\,t\,x\tan x, 2\,t\,x^2\tan x, 2\,t\,x^4\tan x]]]]$

```
(%i10) tensortype(d);
```

(%o10) $[2, 2, 3, 4]$

```
(%i11) e : [-1, 2, 0 , 3]
```

(%o11) $[-1, 2, 0, 3]$

```
(%i12) tensortype(e);
```

(%o12) $[4]$

```
(%i13) f : d @tvc e;
```

(%o13) $[[[(3\,s\,x^4+2\,s\,x-s)\sin x, (3\,s\,x^4+2\,s\,x-s)\cos x, (3\,s\,x^4+2\,s\,x-s)\tan x], [(6\,s\,x^4+4\,s\,x-2\,s)\sin x, (6\,s\,x^4+4\,s\,x-2\,s)\cos x, (6\,s\,x^4+4\,s\,x-2\,s)\tan x]], [[(3\,t\,x^4+2\,t\,x-t)\sin x, (3\,t\,x^4+2\,t\,x-t)\cos x, (3\,t\,x^4+2\,t\,x-t)\tan x], [(6\,t\,x^4+4\,t\,x-2\,t)\sin x, (6\,t\,x^4+4\,t\,x-2\,t)\cos x, (6\,t\,x^4+4\,t\,x-2\,t)\tan x]]]$

```
(%i14) tensortype(f);
```

(%o14) $[2, 2, 3]$

```
(%i15) g : d @x@ e;
```

(%o15) $[[[[[-s\sin x, 2\,s\sin x, 0, 3\,s\sin x], [-s\,x\sin x, 2\,s\,x\sin x, 0, 3\,s\,x\sin x], [-s\,x^2\sin x, 2\,s\,x^2\sin x, 0, 3\,s\,x^2\sin x], [-s\,x^4\sin x, 2\,s\,x^4\sin x, 0, 3\,s\,x^4\sin x]], [[-s\cos x, 2\,s\cos x, 0, 3\,s\cos x], [-s\,x\cos x, 2\,s\,x\cos x, 0, 3\,s\,x\cos x], [-s\,x^2\cos x, 2\,s\,x^2\cos x, 0, 3\,s\,x^2\cos x], [-s\,x^4\cos x, 2\,s\,x^4\cos x, 0, 3\,s\,x^4\cos x]], [[-s\tan x, 2\,s\tan x, 0, 3\,s\tan x], [-s\,x\tan x, 2\,s\,x\tan x, 0, 3\,s\,x\tan x], [-s\,x^2\tan x, 2\,s\,x^2\tan x, 0, 3\,s\,x^2\tan x], [-s\,x^4\tan x, 2\,s\,x^4\tan x, 0, 3\,s\,x^4\tan x]]], [[[-2\,s\sin x, 4\,s\sin x, 0, 6\,s\sin x], [-2\,s\,x\sin x, 4\,s\,x\sin x, 0, 6\,s\,x\sin x], [-2\,s\,x^2\sin x, 4\,s\,x^2\sin x, 0, 6\,s\,x^2\sin x], [-2\,s\,x^4\sin x, 4\,s\,x^4\sin x, 0, 6\,s\,x^4\sin x]], [[-2\,s\cos x, 4\,s\cos x, 0, 6\,s\cos x], [-2\,s\,x\cos x, 4\,s\,x\cos x, 0, 6\,s\,x\cos x], [-2\,s\,x^2\cos x, 4\,s\,x^2\cos x, 0, 6\,s\,x^2\cos x], [-2\,s\,x^4\cos x, 4\,s\,x^4\cos x, 0, 6\,s\,x^4\cos x]], [[-2\,s\tan x, 4\,s\tan x, 0, 6\,s\tan x], [-2\,s\,x\tan x, 4\,s\,x\tan x, 0, 6\,s\,x\tan x], [-2\,s\,x^2\tan x, 4\,s\,x^2\tan x, 0, 6\,s\,x^2\tan x], [-2\,s\,x^4\tan x, 4\,s\,x^4\tan x, 0, 6\,s\,x^4\tan x]]]], [[[[-t\sin x, 2\,t\sin x, 0, 3\,t\sin x], [-t\,x\sin x, 2\,t\,x\sin x, 0, 3\,t\,x\sin x], [-t\,x^2\sin x, 2\,t\,x^2\sin x, 0, 3\,t\,x^2\sin x], [-t\,x^4\sin x, 2\,t\,x^4\sin x, 0, 3\,t\,x^4\sin x]], [[-t\cos x, 2\,t\cos x, 0, 3\,t\cos x], [-t\,x\cos x, 2\,t\,x\cos x, 0, 3\,t\,x\cos x], [-t\,x^2\cos x, 2\,t\,x^2\cos x, 0, 3\,t\,x^2\cos x], [-t\,x^4\cos x, 2\,t\,x^4\cos x, 0, 3\,t\,x^4\cos x]], [[-t\tan x, 2\,t\tan x, 0, 3\,t\tan x], [-t\,x\tan x, 2\,t\,x\tan x, 0, 3\,t\,x\tan x], [-t\,x^2\tan x, 2\,t\,x^2\tan x, 0, 3\,t\,x^2\tan x], [-t\,x^4\tan x, 2\,t\,x^4\tan x, 0, 3\,t\,x^4\tan x]]], [[[-2\,t\sin x, 4\,t\sin x, 0, 6\,t\sin x], [-2\,t\,x\sin x, 4\,t\,x\sin x, 0, 6\,t\,x\sin x], [-2\,t\,x^2\sin x, 4\,t\,x^2\sin x, 0, 6\,t\,x^2\sin x], [-2\,t\,x^4\sin x, 4\,t\,x^4\sin x, 0, 6\,t\,x^4\sin x]], [[-2\,t\cos x, 4\,t\cos x, 0, 6\,t\cos x], [-2\,t\,x\cos x, 4\,t\,x\cos x, 0, 6\,t\,x\cos x], [-2\,t\,x^2\cos x, 4\,t\,x^2\cos x, 0, 6\,t\,x^2\cos x], [-2\,t\,x^4\cos x, 4\,t\,x^4\cos x, 0, 6\,t\,x^4\cos x]], [[-2\,t\tan x, 4\,t\tan x, 0, 6\,t\tan x], [-2\,t\,x\tan x, 4\,t\,x\tan x, 0, 6\,t\,x\tan x], [-2\,t\,x^2\tan x, 4\,t\,x^2\tan x, 0, 6\,t\,x^2\tan x], [-2\,t\,x^4\tan x, 4\,t\,x^4\tan x, 0, 6\,t\,x^4\tan x]]]]$

```
(%i16) tensortype(g);
```

(%o16) $[2, 2, 3, 4, 4]$

```
(%i17) ff : cntrlst2(g);
```

(%o17) $\left[\left[\left[3\,s\,x^4\sin x+2\,s\,x\sin x-s\sin x, 3\,s\,x^4\cos x+2\,s\,x\cos x-s\cos x, 3\,s\,x^4\tan x+2\,s\,x\tan x-s\tan x\right], \left[6\,s\,x^4\sin x+4\,s\,x\sin x-2\,s\sin x, 6\,s\,x^4\cos x+4\,s\,x\cos x-2\,s\cos x, 6\,s\,x^4\tan x+4\,s\,x\tan x-2\,s\tan x\right]\right], \left[\left[3\,t\,x^4\sin x+2\,t\,x\sin x-t\sin x, 3\,t\,x^4\cos x+2\,t\,x\cos x-t\cos x, 3\,t\,x^4\tan x+2\,t\,x\tan x-t\tan x\right], \left[6\,t\,x^4\sin x+4\,t\,x\sin x-2\,t\sin x, 6\,t\,x^4\cos x+4\,t\,x\cos x-2\,t\cos x, 6\,t\,x^4\tan x+4\,t\,x\tan x-2\,t\tan x\right]\right]\right]$

```
(%i18) tensortype(ff);
```

(%o18) $[2, 2, 3]$

```
(%i19) ff[2][1][2];
```

(%o19) $3\,t\,x^4\cos x+2\,t\,x\cos x-t\cos x$

```
(%i20) ratsimp(f - ff);
```

(%o20) $[[[0, 0, 0], [0, 0, 0]], [[0, 0, 0], [0, 0, 0]]]$

```
(%i21) fff : cntrct(g, 4, 5);
```

(%o21) $\left[\left[\left[3\,s\,x^4\sin x+2\,s\,x\sin x-s\sin x, 3\,s\,x^4\cos x+2\,s\,x\cos x-s\cos x, 3\,s\,x^4\tan x+2\,s\,x\tan x-s\tan x\right], \left[6\,s\,x^4\sin x+4\,s\,x\sin x-2\,s\sin x, 6\,s\,x^4\cos x+4\,s\,x\cos x-2\,s\cos x, 6\,s\,x^4\tan x+4\,s\,x\tan x-2\,s\tan x\right]\right], \left[\left[3\,t\,x^4\sin x+2\,t\,x\sin x-t\sin x, 3\,t\,x^4\cos x+2\,t\,x\cos x-t\cos x, 3\,t\,x^4\tan x+2\,t\,x\tan x-t\tan x\right], \left[6\,t\,x^4\sin x+4\,t\,x\sin x-2\,t\sin x, 6\,t\,x^4\cos x+4\,t\,x\cos x-2\,t\cos x, 6\,t\,x^4\tan x+4\,t\,x\tan x-2\,t\tan x\right]\right]\right]$

```
(%i22) ratsimp(ff - fff);
```

(%o22) $[[[0, 0, 0], [0, 0, 0]], [[0, 0, 0], [0, 0, 0]]]$

```
(%i23) tensortype(fff);
```

(%o23) $[2, 2, 3]$

```
(%i24) cntrct(fff,1,2);
```

(%o24) $\left[6\,t\,x^4\sin x+3\,s\,x^4\sin x+4\,t\,x\sin x+2\,s\,x\sin x-2\,t\sin x-s\sin x, 6\,t\,x^4\cos x+3\,s\,x^4\cos x+4\,t\,x\cos x+2\,s\,x\cos x-2\,t\cos x-s\cos x, 6\,t\,x^4\tan x+3\,s\,x^4\tan x+4\,t\,x\tan x+2\,s\,x\tan x-2\,t\tan x-s\tan x\right]$

```
(%i25) tensortype(%o24);
```

(%o25) $[3]$

```
(%i26) kill(ALL);
```

(%o0) DONE

```
(%i1) load("tensor-tmp.mac");
```

```
Warning - you are redefining the MACSYMA function EIGENVALUES
Warning - you are redefining the MACSYMA function EIGENVECTORS
```
(%o1) tensor-tmp.mac

```
(%i2) a : ([1,2] @x@ [3,4,5]) @x@ ([6,5,4,3] @x@ [-1,2,-3,4,-5]);
```

(%o2) $[[[[-18,36,-54,72,-90],[-15,30,-45,60,-75],[-12,24,-36,48,-60],[-9,18,-27,36,-45]],[[-24,48,-72,96,-120],[-20,40,-60,80,-100],[-16,32,-48,64,-80],[-12,24,-36,48,-60]],[[-30,60,-90,120,-150],[-25,50,-75,100,-125],[-20,40,-60,80,-100],[-15,30,-45,60,-75]]],[[[-36,72,-108,144,-180],[-30,60,-90,120,-150],[-24,48,-72,96,-120],[-18,36,-54,72,-90]],[[-48,96,-144,192,-240],[-40,80,-120,160,-200],[-32,64,-96,128,-160],[-24,48,-72,96,-120]],[[-60,120,-180,240,-300],[-50,100,-150,200,-250],[-40,80,-120,160,-200],[-30,60,-90,120,-150]]]]$

```
(%i3) tensortype(a);
```

(%o3) $[2,3,4,5]$

```
(%i4) b : [x,y];
```

(%o4) $[x,y]$

```
(%i5) c : a @x@ b;
```

(%o5) $[[[[[-18x,-18y],[36x,36y],[-54x,-54y],[72x,72y],[-90x,-90y]],[[-15x,-15y],[30x,30y],[-45x,-45y],[60x,60y],[-75x,-75y]],[[-12x,-12y],[24x,24y],[-36x,-36y],[48x,48y],[-60x,-60y]],[[-9x,-9y],[18x,18y],[-27x,-27y],[36x,36y],[-45x,-45y]]],[[[-24x,-24y],[48x,48y],[-72x,-72y],[96x,96y],[-120x,-120y]],[[-20x,-20y],[40x,40y],[-60x,-60y],[80x,80y],[-100x,-100y]],[[-16x,-16y],[32x,32y],[-48x,-48y],[64x,64y],[-80x,-80y]],[[-12x,-12y],[24x,24y],[-36x,-36y],[48x,48y],[-60x,-60y]]],[[[-30x,-30y],[60x,60y],[-90x,-90y],[120x,120y],[-150x,-150y]],[[-25x,-25y],[50x,50y],[-75x,-75y],[100x,100y],[-125x,-125y]],[[-20x,-20y],[40x,40y],[-60x,-60y],[80x,80y],[-100x,-100y]],[[-15x,-15y],[30x,30y],[-45x,-45y],[60x,60y],[-75x,-75y]]]],[[[[-36x,-36y],[72x,72y],[-108x,-108y],[144x,144y],[-180x,-180y]],[[-30x,-30y],[60x,60y],[-90x,-90y],[120x,120y],[-150x,-150y]],[[-24x,-24y],[48x,48y],[-72x,-72y],[96x,96y],[-120x,-120y]],[[-18x,-18y],[36x,36y],[-54x,-54y],[72x,72y],[-90x,-90y]]],[[[-48x,-48y],[96x,96y],[-144x,-144y],[192x,192y],[-240x,-240y]],[[-40x,-40y],[80x,80y],[-120x,-120y],[160x,160y],[-200x,-200y]],[[-32x,-32y],[64x,64y],[-96x,-96y],[128x,128y],[-160x,-160y]],[[-24x,-24y],[48x,48y],[-72x,-72y],[96x,96y],[-120x,-120y]]],[[[-60x,-60y],[120x,120y],[-180x,-180y],[240x,240y],[-300x,-300y]],[[-50x,-50y],[100x,100y],[-150x,-150y],[200x,200y],[-250x,-250y]],[[-40x,-40y],[80x,80y],[-120x,-120y],[160x,160y],[-200x,-200y]],[[-30x,-30y],[60x,60y],[-90x,-90y],[120x,120y],[-150x,-150y]]]]$

```
(%i6) tensortype(c);
```

(%o6) $[2,3,4,5,2]$

```
(%i7) d : exchnext(c, 4)$
(%i8) tensortype(d);
```

(%o8) $[2,3,4,2,5]$

```
(%i9) f : exchnext(d, 3)$
(%i10) tensortype(f);
```

(%o10) $[2,3,2,4,5]$

```
(%i11) g : exchnext(f, 2)$
(%i12) tensortype(g);
```

(%o12) $[2,2,3,4,5]$

```
(%i13) h : exchnext(g, 1);
```

(%o13) $[[[[[-18\,x,36\,x,-54\,x,72\,x,-90\,x],[-15\,x,30\,x,-45\,x,60\,x,-75\,x],[-12\,x,24\,x,-36\,x,48\,x,-60\,x],[-9\,x,18\,x,-27\,x,36\,x,-45\,x]],[[-24\,x,48\,x,-72\,x,96\,x,-120\,x],[-20\,x,40\,x,-60\,x,80\,x,-100\,x],[-16\,x,32\,x,-48\,x,64\,x,-80\,x],[-12\,x,24\,x,-36\,x,48\,x,-60\,x]],[[-30\,x,60\,x,-90\,x,120\,x,-150\,x],[-25\,x,50\,x,-75\,x,100\,x,-125\,x],[-20\,x,40\,x,-60\,x,80\,x,-100\,x],[-15\,x,30\,x,-45\,x,60\,x,-75\,x]]],[[[-36\,x,72\,x,-108\,x,144\,x,-180\,x],[-30\,x,60\,x,-90\,x,120\,x,-150\,x],[-24\,x,48\,x,-72\,x,96\,x,-120\,x],[-18\,x,36\,x,-54\,x,72\,x,-90\,x]],[[-48\,x,96\,x,-144\,x,192\,x,-240\,x],[-40\,x,80\,x,-120\,x,160\,x,-200\,x],[-32\,x,64\,x,-96\,x,128\,x,-160\,x],[-24\,x,48\,x,-72\,x,96\,x,-120\,x]],[[-60\,x,120\,x,-180\,x,240\,x,-300\,x],[-50\,x,100\,x,-150\,x,200\,x,-250\,x],[-40\,x,80\,x,-120\,x,160\,x,-200\,x],[-30\,x,60\,x,-90\,x,120\,x,-150\,x]]]],[[[[-18\,y,36\,y,-54\,y,72\,y,-90\,y],[-15\,y,30\,y,-45\,y,60\,y,-75\,y],[-12\,y,24\,y,-36\,y,48\,y,-60\,y],[-9\,y,18\,y,-27\,y,36\,y,-45\,y]],[[-24\,y,48\,y,-72\,y,96\,y,-120\,y],[-20\,y,40\,y,-60\,y,80\,y,-100\,y],[-16\,y,32\,y,-48\,y,64\,y,-80\,y],[-12\,y,24\,y,-36\,y,48\,y,-60\,y]],[[-30\,y,60\,y,-90\,y,120\,y,-150\,y],[-25\,y,50\,y,-75\,y,100\,y,-125\,y],[-20\,y,40\,y,-60\,y,80\,y,-100\,y],[-15\,y,30\,y,-45\,y,60\,y,-75\,y]]],[[[-36\,y,72\,y,-108\,y,144\,y,-180\,y],[-30\,y,60\,y,-90\,y,120\,y,-150\,y],[-24\,y,48\,y,-72\,y,96\,y,-120\,y],[-18\,y,36\,y,-54\,y,72\,y,-90\,y]],[[-48\,y,96\,y,-144\,y,192\,y,-240\,y],[-40\,y,80\,y,-120\,y,160\,y,-200\,y],[-32\,y,64\,y,-96\,y,128\,y,-160\,y],[-24\,y,48\,y,-72\,y,96\,y,-120\,y]],[[-60\,y,120\,y,-180\,y,240\,y,-300\,y],[-50\,y,100\,y,-150\,y,200\,y,-250\,y],[-40\,y,80\,y,-120\,y,160\,y,-200\,y],[-30\,y,60\,y,-90\,y,120\,y,-150\,y]]]]]$

```
(%i14) tensortype(h);
```

(%o14) $[2,2,3,4,5]$

```
(%i15) i : b @x@ a$
(%i16) tensortype(i);
```

(%o16) $[2,2,3,4,5]$

```
(%i17) ratsimp(i - h);
```

(%o17) $[[[[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]],[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]],[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]]],[[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]],[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]],[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]]]],[[[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]],[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]],[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]]],[[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]],[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]],[[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0],[0,0,0,0,0]]]]]$

```
(%i18) tensortype(c);
```

(%o18) $[2,3,4,5,2]$

```
(%i19) exchttype(c, 2, 4);
```

(%o19) $[[[[[-18x,-18y],[-24x,-24y],[-30x,-30y]],[[-15x,-15y],[-20x,-20y],[-25x,-25y]],[[-12x,-12y],[-16x,-16y],[-20x,-20y]],[[-9x,-9y],[-12x,-12y],[-15x,-15y]]],[[[36x,36y],[48x,48y],[60x,60y]],[[30x,30y],[40x,40y],[50x,50y]],[[24x,24y],[32x,32y],[40x,40y]],[[18x,18y],[24x,24y],[30x,30y]]],[[[-54x,-54y],[-72x,-72y],[-90x,-90y]],[[-45x,-45y],[-60x,-60y],[-75x,-75y]],[[-36x,-36y],[-48x,-48y],[-60x,-60y]],[[-27x,-27y],[-36x,-36y],[-45x,-45y]]],[[[72x,72y],[96x,96y],[120x,120y]],[[60x,60y],[80x,80y],[100x,100y]],[[48x,48y],[64x,64y],[80x,80y]],[[36x,36y],[48x,48y],[60x,60y]]],[[[-90x,-90y],[-120x,-120y],[-150x,-150y]],[[-75x,-75y],[-100x,-100y],[-125x,-125y]],[[-60x,-60y],[-80x,-80y],[-100x,-100y]],[[-45x,-45y],[-60x,-60y],[-75x,-75y]]]],[[[[-36x,-36y],[-48x,-48y],[-60x,-60y]],[[-30x,-30y],[-40x,-40y],[-50x,-50y]],[[-24x,-24y],[-32x,-32y],[-40x,-40y]],[[-18x,-18y],[-24x,-24y],[-30x,-30y]]],[[[72x,72y],[96x,96y],[120x,120y]],[[60x,60y],[80x,80y],[100x,100y]],[[48x,48y],[64x,64y],[80x,80y]],[[36x,36y],[48x,48y],[60x,60y]]],[[[-108x,-108y],[-144x,-144y],[-180x,-180y]],[[-90x,-90y],[-120x,-120y],[-150x,-150y]],[[-72x,-72y],[-96x,-96y],[-120x,-120y]],[[-54x,-54y],[-72x,-72y],[-90x,-90y]]],[[[144x,144y],[192x,192y],[240x,240y]],[[120x,120y],[160x,160y],[200x,200y]],[[96x,96y],[128x,128y],[160x,160y]],[[72x,72y],[96x,96y],[120x,120y]]],[[[-180x,-180y],[-240x,-240y],[-300x,-300y]],[[-150x,-150y],[-200x,-200y],[-250x,-250y]],[[-120x,-120y],[-160x,-160y],[-200x,-200y]],[[-90x,-90y],[-120x,-120y],[-150x,-150y]]]]$

```
(%i20) tensortype(%o19);
```

(%o20) $[2,5,4,3,2]$

```
(%i21) zerotensor([4,3,2]);
```

(%o21) $[[[0,0],[0,0],[0,0]],[[0,0],[0,0],[0,0]],[[0,0],[0,0],[0,0]],[[0,0],[0,0],[0,0]]]$

(%i22)