a simple integral

```
> Int(Int(Int(x+y^2+z^3, x=1..3), y=-1..2),z=0..1)=
  int(int(int(x+y^2+z^3, x=1..3), y=-1..2),z=0..1);
   Int(Int(Int(x+y^2+z^3, x=1..3), y=-1..2),z=0..1)=
  Int(Int(int(x+y^2+z^3, x=1..3), y=-1..2),z=0..1);
  Int(Int(Int(x+y^2+z^3, x=1..3), y=-1..2),z=0..1)=
  Int(int(int(x+y^2+z^3, x=1..3), y=-1..2),z=0..1);
```

$$\int_0^1\int_{-1}^2\int_1^3 x+y^2+z^3\,dx\,dy\,dz=\frac{39}{2}$$

$$\int_0^1\int_{-1}^2\int_1^3 x+y^2+z^3\,dx\,dy\,dz=\int_0^1\int_{-1}^2 4+2\,y^2+2\,z^3\,dy\,dz$$

$$\int_0^1\int_{-1}^2\int_1^3 x+y^2+z^3\,dx\,dy\,dz=\int_0^1 18+6\,z^3\,dz$$

```
> interface(showassumed=0): assume(z,real):
  Int(Int(Int(1, z=sqrt(x^2+y^2)..5),y=-sqrt(25-x^2)..sqrt(25-x^2)),
  x=-5..5)
  = int(int(int(1,
  z=sqrt(x^2+y^2)..5),y=-sqrt(25-x^2)..sqrt(25-x^2)), x=-5..5);
```

let 's change the orderbecause maple seems to be having a problem

```
> Int(Int(Int(1, y=-sqrt(z^2-x^2)..sqrt(z^2-x^2)), x = -z..z),
  z=0..5)
  = int(int(int(1, y=-sqrt(z^2-x^2)..sqrt(z^2-x^2)), x = -z..z),
  z=0..5);
```

$$\int_{-5}^5\int_{-\sqrt{25-x^2}}^{\sqrt{25-x^2}}\int_{\sqrt{x^2+y^2}}^5 1\,dz\sim\,dy\,dx=$$

$$\int_{-5}^5 -\frac{1}{2}x^2\ln(\sqrt{-(x-5)\,(x+5)}+5)+5\sqrt{25-x^2}+\frac{1}{2}x^2\ln(-\sqrt{-(x-5)\,(x+5)}+5)\,dx$$

$$\int_0^5\int_{-z\sim}^{z\sim}\int_{-\sqrt{z\sim^2-x^2}}^{\sqrt{z\sim^2-x^2}} 1\,dy\,dx\,dz\sim=\frac{125}{3}\pi$$

ex 27 in text

```
> 8*Int(Int(Int(1, z=0
  ..sqrt(36-4*x^2-9*y^2)),y=0..sqrt((36-4*x^2)/9)), x=0..3)
  = 8*Int(Int(int(1, z=0
```

```
..sqrt(36-4*x^2-9*y^2)),y=0..sqrt((36-4*x^2)/9)), x=0..3)
;
```

$$8\int_0^3\int_0^{2/3\sqrt{9-x^2}}\int_0^{\sqrt{36-4x^2-9y^2}} 1\,dz\sim\,dy\,dx = 8\int_0^3\int_0^{2/3\sqrt{9-x^2}}\sqrt{36-4x^2-9y^2}\,dy\,dx$$

```
> 8*Int(int(int(1, z=0
  ..sqrt(36-4*x^2-9*y^2)),y=0..sqrt((36-4*x^2)/9)), x=0..3);
```

$$8\int_0^3 \frac{1}{12}\frac{\sqrt{36-4x^2}\,\pi}{\sqrt{\frac{1}{36-4x^2}}}\,dx$$

```
> 8*int(int(int(1, z=0
  ..sqrt(36-4*x^2-9*y^2)),y=0..sqrt((36-4*x^2)/9)), x=0..3);
```

$$48\,\pi$$

another problem ex 29

```
> 4*Int(Int(Int(1, z=x^2+y^2 ..sqrt(6-x^2-y^2)),y=0..sqrt(2-x^2)),
  x=0..2)
  = 4*int(int(int(1, z=x^2+y^2 ..sqrt(6-x^2-y^2)),y=0..sqrt(2-x^2)),
  x=0..2);
```

$$4\int_0^2\int_0^{\sqrt{2-x^2}}\int_{x^2+y^2}^{\sqrt{6-x^2-y^2}} 1\,dz\sim\,dy\,dx = 4\int_0^2 -\frac{1}{4}\sqrt{6-x^2}\left(-2\frac{\sqrt{\pi}\,(2-x^2)}{-6+x^2}\right.$$
$$+\left(-2\ln(2)-1-\ln(2-x^2)-\ln\left(\frac{1}{-6+x^2}\right)\right)\sqrt{\pi}-\frac{1}{4}\frac{\sqrt{\pi}\,(2-x^2)\left(-4\frac{-6+x^2}{2-x^2}-8\right)}{-6+x^2}$$
$$\left.-\frac{2\sqrt{\pi}\,(2-x^2)\sqrt{1+\frac{-6+x^2}{2-x^2}}}{-6+x^2}-2\sqrt{\pi}\ln\left(\frac{1}{2}+\frac{1}{2}\sqrt{1+\frac{-6+x^2}{2-x^2}}\right)\right)\Big/\left(\sqrt{\pi}\sqrt{\frac{1}{-6+x^2}}\right)$$
$$-x^2\sqrt{2-x^2}+\frac{1}{3}(-2+x^2)\sqrt{2-x^2}\,dx$$

since maple is having trouble let's try cylindricals

```
> Int(Int(Int(r, z=r^2 ..sqrt(6-r^2)),r=0..sqrt(2)), theta=0..2*Pi)

  = int(int(int(r, z=r^2 ..sqrt(6-r^2)),r=0..sqrt(2)),
```

```
theta=0..2*Pi);
```

$$\int_{0}^{2\pi}\int_{0}^{\sqrt{2}}\int_{r^2}^{\sqrt{6-r^2}} r \, dz{\sim} \, dr \, d\theta = -\frac{22}{3}\pi + 4\sqrt{6}\,\pi$$

```
>
```