Cálculo de la ubicación en el tetrahedro de una composición de 4 componentes.

```
>
```

```
> with(linalg):
Warning: new definition for   norm
Warning: new definition for   trace
```

Los vectores a,b,c que están dibujados en la figura anterior, esta figura tiene el vértice 1 en el origen.

```
> i:='i'; j:='j';k:='k';p1 := 'p1';p2:='p2';p3:='p3';p4:='p4';x :='x';y :='y';z:='z';
```

$$i := i$$
$$j := j$$
$$k := k$$
$$p1 := p1$$
$$p2 := p2$$
$$p3 := p3$$
$$p4 := p4$$
$$x := x$$
$$y := y$$
$$z := z$$

```
> #a=v2, b=v3, c=v4, d=(0,0,0)=v1
```

```
> a := vector([sqrt(3/2),0,0]); b := vector([(1/2)*sqrt(3/2),0,(3/2)*sqrt(1/2)]); c := vector
> ([(1/2)*sqrt(3/2),1,(1/2)*sqrt(1/2)]); d := vector([0,0,0]);
```

$$a := \left[\frac{1}{2}\sqrt{6} \quad 0 \quad 0\right]$$
$$b := \left[\frac{1}{4}\sqrt{6} \quad 0 \quad \frac{3}{4}\sqrt{2}\right]$$
$$c := \left[\frac{1}{4}\sqrt{6} \quad 1 \quad \frac{1}{4}\sqrt{2}\right]$$
$$d := [0 \quad 0 \quad 0]$$

```
> M1 := matrix([[x-a[1], y-a[2], z-a[3]], [b[1]-a[1], b[2]-a[2], b[3]-a[3]],[c[1]-a[1], c[2]-a[
> 2], c[3]-a[3]]]);
```

$$M1 := \begin{bmatrix} x - \frac{1}{2}\sqrt{6} & y & z \\ -\frac{1}{4}\sqrt{6} & 0 & \frac{3}{4}\sqrt{2} \\ -\frac{1}{4}\sqrt{6} & 1 & \frac{1}{4}\sqrt{2} \end{bmatrix}$$

```
> S1 := solve(det(M1)=0, {x, y, z});
```

$$S1 := \left\{x = x, y = y, z = -\frac{1}{2}\sqrt{2}\left(\sqrt{6}\,x - 3 + y\right)\right\}$$

```
>
```

```
> M2 := matrix([[x-d[1], y-d[2], z-d[3]], [b[1]-d[1], b[2]-d[2], b[3]-d[3]],[c[1]-d[1], c[2]-d
> [2], c[3]-d[3]]]);
```

$$M2 := \begin{bmatrix} x & y & z \\ \frac{1}{4}\sqrt{6} & 0 & \frac{3}{4}\sqrt{2} \\ \frac{1}{4}\sqrt{6} & 1 & \frac{1}{4}\sqrt{2} \end{bmatrix}$$

```
> S2 := solve(det(M2)=0, {x, y, z});
```

$$S2 := \left\{z = \frac{1}{2}\sqrt{2}\left(\sqrt{6}\,x - y\right), x = x, y = y\right\}$$

```
>
```

```
> M3 := matrix([[x-a[1], y-a[2], z-a[3]], [d[1]-a[1], d[2]-a[2], d[3]-a[3]],[c[1]-a[1], c[2]-a[
> 2], c[3]-a[3]]]);
```

$$M3 := \begin{bmatrix} x - \frac{1}{2}\sqrt{6} & y & z \\ -\frac{1}{2}\sqrt{6} & 0 & 0 \\ -\frac{1}{4}\sqrt{6} & 1 & \frac{1}{4}\sqrt{2} \end{bmatrix}$$

```
> S3 := solve(det(M3)=0, {x, y, z});
```

$$S3 := \left\{x = x, y = y, z = \frac{1}{4}y\sqrt{2}\right\}$$

```
>
```

```
> M4 := matrix([[x-a[1], y-a[2], z-a[3]], [b[1]-a[1], b[2]-a[2], b[3]-a[3]],[d[1]-a[1], d[2]-a[
> 2], d[3]-a[3]]]);
```

$$M4 := \begin{bmatrix} x - \frac{1}{2}\sqrt{6} & y & z \\ -\frac{1}{4}\sqrt{6} & 0 & \frac{3}{4}\sqrt{2} \\ -\frac{1}{2}\sqrt{6} & 0 & 0 \end{bmatrix}$$

```
> S4 := solve(det(M4)=0, {x,y,z});
```

$$S4 := \{x = x, y = 0, z = z\}$$

```
> D1 := det(M1);D2 := det(M2);D3 := det(M3);D4 := det(M4);
```

$$D1 := -\frac{3}{4}\sqrt{2}\,x + \frac{3}{8}\sqrt{2}\,\sqrt{6} - \frac{1}{8}\sqrt{6}\,y\sqrt{2} - \frac{1}{4}\sqrt{6}\,z$$

$$D2 := -\frac{3}{4}\sqrt{2}\,x + \frac{1}{8}\sqrt{6}\,y\sqrt{2} + \frac{1}{4}\sqrt{6}\,z$$

$$D3 := \frac{1}{2}\sqrt{6}\left(\frac{1}{4}y\sqrt{2} - z\right)$$

$$D4 := -\frac{3}{8}\sqrt{6}\,y\sqrt{2}$$

```
> D3 := expand(D3);
```

$$D3 := \frac{1}{8}\sqrt{6}\,y\sqrt{2} - \frac{1}{2}\sqrt{6}\,z$$

```
> simplify('');
```

$$\frac{1}{4}\sqrt{3}\,y - \frac{1}{2}\sqrt{2}\,\sqrt{3}\,z$$

```
> Ec1 := p1= ( (D1) / sqrt(coeff(D1,x)**2+coeff(D1,y)**2+coeff(D1,z)**2));
```

$$Ec1 := p1 = \frac{4}{9}\left(-\frac{3}{4}\sqrt{2}\,x + \frac{3}{8}\sqrt{2}\,\sqrt{6} - \frac{1}{8}\sqrt{6}\,y\sqrt{2} - \frac{1}{4}\sqrt{6}\,z\right)\sqrt{3}$$

```
> simplify('');
```

$$p1 = -\frac{1}{9}\left(3\sqrt{2}\,x - 3\sqrt{3} + \sqrt{3}\,y + \sqrt{2}\,\sqrt{3}\,z\right)\sqrt{3}$$

```
> factor('');
```

$$p1 = -\frac{1}{6}\sqrt{2}\left(2\sqrt{3}\,x - 3\sqrt{2} + y\sqrt{2} + 2z\right)$$

```
> Ec2 := p2 = ( (-D2) / sqrt(coeff(D2,x)**2+coeff(D2,y)**2+coeff(D2,z)**2));
```

$$Ec2 := p2 = -\frac{4}{9}\left(-\frac{3}{4}\sqrt{2}\,x + \frac{1}{8}\sqrt{6}\,y\sqrt{2} + \frac{1}{4}\sqrt{6}\,z\right)\sqrt{3}$$

```
> simplify('');
```

$$p2 = -\frac{1}{9}\left(-3\sqrt{2}\,x + \sqrt{3}\,y + \sqrt{2}\,\sqrt{3}\,z\right)\sqrt{3}$$

```
> factor('');
```

$$p2 = -\frac{1}{6}\sqrt{2}\left(-2\sqrt{3}\,x + y\sqrt{2} + 2z\right)$$

```
> Ec3 := p3 = ( (-D3) / sqrt(coeff(D3,x)^2+coeff(D3,y)^2+coeff(D3,z)^2));
```

$$Ec3 := p3 = -\frac{4}{9}\left(\frac{1}{8}\sqrt{6}\,y\sqrt{2} - \frac{1}{2}\sqrt{6}\,z\right)\sqrt{3}$$

```
> simplify('');
```

$$p3 = -\frac{1}{3}y + \frac{2}{3}\sqrt{2}\,z$$

```
> factor('');
```

$$p3 = \frac{1}{6}\sqrt{2}\,(-y\sqrt{2} + 4z)$$

```
> Ec4 := p4= ( (-D4) / sqrt(coeff(D4,x)**2+coeff(D4,y)**2+coeff(D4,z)**2));
```

$$Ec4 := p4 = \frac{1}{6}\sqrt{6}\,y\sqrt{2}\,\sqrt{3}$$

```
> simplify('');
```

$$p4 = y$$

```
> solve({ Ec2, Ec3, Ec4},{x,y,z});
```

$$\left\{y = \frac{1}{6}\sqrt{6}\,\sqrt{2}\,p4\,\sqrt{3},\ x = \frac{1}{4}(2\,p2 + p4 + p3)\,\sqrt{2}\,\sqrt{3},\ z = \frac{1}{12}\sqrt{3}\,\sqrt{6}\,(3\,p3 + p4)\right\}$$

```
> simplify('');
```

$$\left\{x = \frac{1}{4}(2\,p2 + p4 + p3)\,\sqrt{2}\,\sqrt{3},\ y = p4,\ z = \frac{1}{4}\sqrt{2}\,(3\,p3 + p4)\right\}$$

```
> p1 := 0.0:p2 :=0.0:p3:=0.0:p4:=1:

> solve({ Ec2, Ec3, Ec4},{x,y,z});
```

$$\left\{z = \frac{1}{12}\sqrt{6}\,\sqrt{3},\ x = \frac{1}{4}\sqrt{2}\,\sqrt{3},\ y = \frac{1}{6}\sqrt{6}\,\sqrt{3}\,\sqrt{2}\right\}$$

```
>

> p1 := 0.0:p2 :=0.0:p3:=1.0:p4:=0.0:

> solve({ Ec2, Ec3, Ec4},{x,y,z});
```

$$\{z = 1.060660172,\ x = .6123724358,\ y = 0\}$$

```
>

> p1 := 0.0:p2 :=0.0:p3:=0.0:p4:=1:

> solve({ Ec2, Ec3, Ec4},{x,y,z});
```

$$\left\{z = \frac{1}{12}\sqrt{6}\,\sqrt{3},\ x = \frac{1}{4}\sqrt{2}\,\sqrt{3},\ y = \frac{1}{6}\sqrt{6}\,\sqrt{3}\,\sqrt{2}\right\}$$

```
>

> p1 := 0.0:p2 :=1.0:p3:=0.0:p4:=0:

> solve({ Ec2, Ec3, Ec4},{x,y,z});
```

$$\{x = 1.224744872,\ y = 0,\ z = 0\}$$

```
>

> p1 := 0.5:p2 :=0.3:p3:=0.1:p4:=0.1:

> solve({ Ec2, Ec3, Ec4},{x,y,z});
```

$$\{y = .09999999997, x = .4898979486, z = .1414213562\}$$

```
>
```

```
> p1 := 0.8:p2 :=0.1:p3:=0.05:p4:=0.05:
```

```
> solve({ Ec2, Ec3, Ec4},{x,y,z});
```

$$\{z = .07071067810, y = .04999999999, x = .1837117307\}$$

```
>
> p1 := 0.1:p2 :=0.2:p3:=0.3:p4:=0.4:
```

```
> solve({ Ec2, Ec3, Ec4},{x,y,z});
```

$$\{z = .4596194076, y = .3999999999, x = .6736096793\}$$

```
>
```