Obtencion de elementos orbitales a partir de posicion y velocidad. Curso Mecanica Celeste 2005. Tabare Gallardo.

```
<<Calculus`VectorAnalysis`
```

```
SetCoordinates[Cartesian[x, y, z]]

Cartesian[x, y, z]
```

DotProduct[v_1, v_2]	compute the dot product of the vectors v_1 and v_2 given in default coordinates
CrossProduct[v_1, v_2]	compute the cross product of the vectors given in default coordinates
ScalarTripleProduct[v_1, v_2, v_3]	compute the scalar triple product of the vectors given in default coordinates
DotProduct[v_1, v_2, *coordsys*], CrossProduct[v_1, v_2, *coordsys*], etc.	give the result when the vectors are given in the coordinate system *coordsys*

unidad de tiempo = dia
unidad de distancia = ua
unidad de masa = sol

```
M := 1.0
m := 0.0009548
kgauss := 0.01720209895
μ := kgauss * kgauss * (M + m)
pos := {4.53377, 1.93230, -0.109540}
```

```
vel := {-1.12006, 2.67368, 0.0140043} / 365.25
```

```
t := 0
```

$$r := \sqrt[2]{\text{DotProduct}[pos, pos]}$$

```
v2 := DotProduct[vel, vel]
```

```
v := √v2
```

```
vech = CrossProduct[pos, vel]
```

```
{0.000875935, 0.000162078, 0.0391133}
```

```
{hx, hy, hz} = vech
```

```
{0.000875935, 0.000162078, 0.0391133}
```

```
h := ²√DotProduct[vech, vech]
```

```
rv := DotProduct[pos, vel]
```

```
i := ArcCos[hz / h]
```

```
Ω := ArcTan[-hy, hx]
```

```
vecz := {0, 0, 1}
n1 := CrossProduct[vecz, vech]
```

General::spell1 : Possible spelling error: new symbol name "vecz" is similar to existing symbol "vech". More…

- **versor nodo**

```
n = n1 / ²√DotProduct[n1, n1]
```

```
{-0.181946, 0.983309, 0.}
```

```
{nx, ny, nz} = n
```

```
{-0.181946, 0.983309, 0.}
```

```
vex = CrossProduct[vel, vech] / μ - pos / r

{0.0469177, 0.0130807, -0.00110492}
```

```
{ex, ey, ez} = vex

{0.0469177, 0.0130807, -0.00110492}
```

$$e := \sqrt[2]{\text{DotProduct}[\text{vex}, \text{vex}]}$$

$$a := (2 / r - v2 / \mu)^{-1}$$

```
cosenow := DotProduct[n, vex] / e
```

$$\text{senow} := \frac{\text{ez}}{e * \text{Sin}[i]}$$

```
ω := ArcTan[cosenow, senow]
```

```
p = a * (1 - e * e)

5.1677
```

$$\text{cosenoverd} := \frac{p / r - 1}{e}$$

$$\text{senoverd} := \frac{\text{ScalarTripleProduct}[\text{vex}, \text{pos}, \text{vech}]}{r\, e\, h}$$

```
θ = ArcTan[cosenoverd, senoverd]

0.130959
```

```
cosaex := 1/e - r/(a e)
```

$$\text{cosaex} := \frac{1}{e} - \frac{r}{a\,e}$$

$$\text{senaex} := \frac{rv}{e\sqrt{a\,\mu}} \;/;\; a > 0$$

```
AE := ArcTan[cosaex, senaex] /; a > 0
```

```
AM := AE - e * Sin[AE] /; a > 0
```

$$T := t - (AE - e * \text{Sin}[AE]) * \sqrt{a^3/\mu} \;/;\; a > 0$$

```
Z := cosaex /; a < 0
```

$$F := \text{Log}\left[Z + \sqrt{Z * Z - 1}\right] * \text{Sign}[rv] \;/;\; a < 0$$

$$T := t - (e * \text{Sinh}[F] - F)\sqrt{\frac{-a^3}{\mu}}$$

```
q := a * (1 - e)
```

```
Q := a * (1 + e)
```

$$\epsilon := \frac{-\mu}{2 * a}$$

```
{r, v, ϵ}

{4.92959, 0.0079366, -0.0000285902}
```

```
{a, e, p, q, Q, T}

{5.18, 0.0487196, 5.1677, 4.92763, 5.43236, -81.2995}
```

```
{i, ω, Ω, θ, AE, AM} * 180 / Pi

{1.30468, -84.9059, 100.483, 7.50337, 7.14724, 6.79994}
```