217(9) : Binary Pulsar Orbit

The binary pulsar orbit decreases experimentally for each orbit. It would be interesting to find whether this can be produced by varying constant x. In one of the graphs produced by Horst Eckardt the ellipse changed dramatically when x was reduced from 1.0. to 0.5 for $\epsilon = 0.5$.

The first curve is:

$$r = \frac{\alpha}{1 + 0.5 \cos\theta} \quad -(1)$$

and the second is

$$r = \frac{\alpha}{1 + 0.5 \cos 0.5\theta} \quad -(2)$$

If the distance of closest approach is defined by:

$$\cos(x\theta) = 1 \quad -(3)$$

the closest approach is the same for both curves:

$$R_0 = 0.667\,\alpha \quad -(4)$$

This needs to be checked graphically. However the orbit (2) is dramatically different from orbit (1), and seems to spiral inwards.

Therefore eq. (2) needs to be graphed for:

$$\theta \rightarrow \infty \quad -(5)$$

2) in order to find whether the orbit will spiral inwards to a given radius.

Finally this graphical exercise needs to be repeated for:

$$x = 0.5,\ 0.6,\ 0.7,\ 0.8,\ 0.9,\ 1.0,\ 1.1,\ 1.2,\ 1.3,\ 1.4,\ 1.5.$$

keeping α and ϵ constant.

The distance of closest approach is given by:

$$R_0 = \frac{\alpha}{1+\epsilon} = \frac{a(1-\epsilon^2)}{1+\epsilon} \quad -(6)$$

$$= a(1-\epsilon)$$

where

$$\epsilon = \left(1 - \frac{b^2}{a^2}\right)^{1/2} \quad -(7)$$

so

$$R_0 = a - (a^2 - b^2)^{1/2} \quad -(8)$$

For $x = 1$: