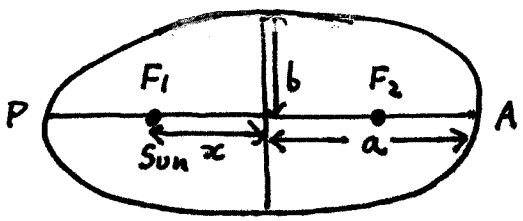
The basic ellipse

The size and shape of the ellipse are defined in terms of its <u>semi-major</u> and <u>semi-minor</u> axes, a and b, and its <u>eccentricity</u>, e. These quantities are related:

$$\frac{b^2}{a^2} = 1 - e$$

If $e = 0$, the figure is a circle ($a = b$). (If $e = 1$, the figure becomes a parabola and if $e > 1$, the figure is a hyperbola. The distances, x, of the two foci, F_1 and F_2, from the centre of the ellipse are given by the product of the semi-major axis and the eccentricity, that is

$$x = \pm ae$$

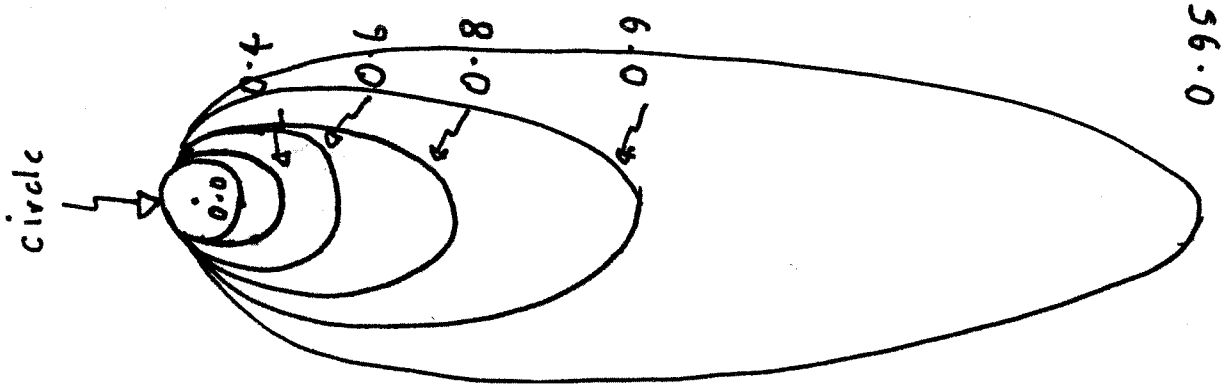


A = aphelion
P = perihelion

It is useful to be able to calculate the distances from the Sun of the perihelion and aphelion points, q and Q, respectively. These quantities are related to a and e by the following expressions:

$$q = a(1 - e)$$
$$Q = a(1 + e)$$

As e has no units associated with it, the equations "work" regardless of the units of q and Q (as long as they are all in the <u>same</u> units as each another). If the value of the perihelion distance is held constant and the eccentricity increased, then the semi-major axis (and thus the aphelion distance) must also increase.



This rough sketch shows the general idea.

DF
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