190(1): Fundamental Equations of Motion

These are:

$$n(r) = 2 - \exp\left(2\exp\left(-\frac{r}{3R}\right)\right) \quad -(1)$$

$$\frac{d\phi}{dr} = \frac{1}{r^2}\left(\frac{1}{b^2} - n(r)\left(\frac{1}{a^2} + \frac{1}{r^2}\right)\right)^{-1/2} \quad -(2)$$

$$b = \frac{cL}{E}$$

$$\frac{dt}{dr} = \frac{E}{c^2 L}\, n(r)\left(\frac{1}{b^2} - n(r)\left(\frac{1}{a^2} + \frac{1}{r^2}\right)\right)^{-1/2} \quad -(3)$$

$$\boxed{\frac{d\phi}{dt} = \frac{1}{r^2}\, c^2 \frac{L}{E}\, n(r)} \quad -(4)$$

The classical result is:

$$\frac{d\phi}{dt} = \frac{L}{mr^2} \quad -(5)$$

where m is the mass of the planet, so in order to obtain the Newtonian result:

$$E \to mc^2 \quad -(6)$$

$$n(r) \to 1. \quad -(7)$$

$$-(8)$$

The total energy equation is:

$$\underbrace{\frac{1}{2}\left(\frac{E^2}{mc^2} - n(r)mc^2\right)}_{\text{total}} = \underbrace{\frac{1}{2}m\left(\frac{dr}{dt}\right)^2}_{\text{kinetic}} + \underbrace{\frac{1}{2}n(r)\left(mc^2 + \frac{L^2}{mr^2}\right)}_{\text{potential}}$$

2) As in the graph fig (1), $n(r)$ is very

Similar to:

$$n(r) = 1 - \frac{r_0}{r} \quad -(9)$$

Three variable least square fitting can be used to express $n(r)$ as:

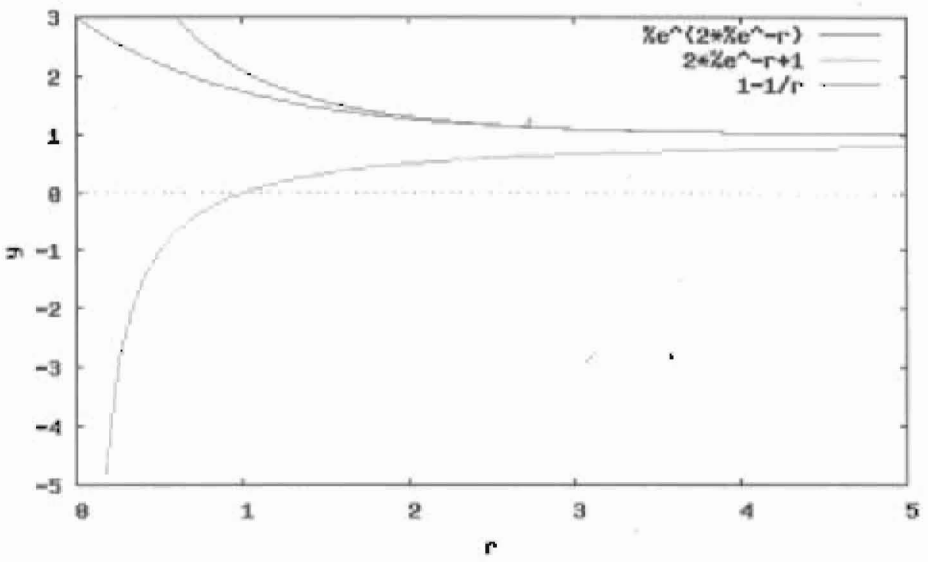
$$n(r) = 1 - \frac{r_0}{r} - \frac{a}{r^2} - \frac{b}{r^3} - \dots \quad -(10)$$

i.e. to make eqs. (1) and (10) equivalent.

The fundamental function is eq. (1), various laws in the history of physics are seen as approximation to (1). The fundamental constant R of eq. (1) is re-expressed as $r_0, a, b, \dots$ of eq. (10). The match can be made as close as desired.

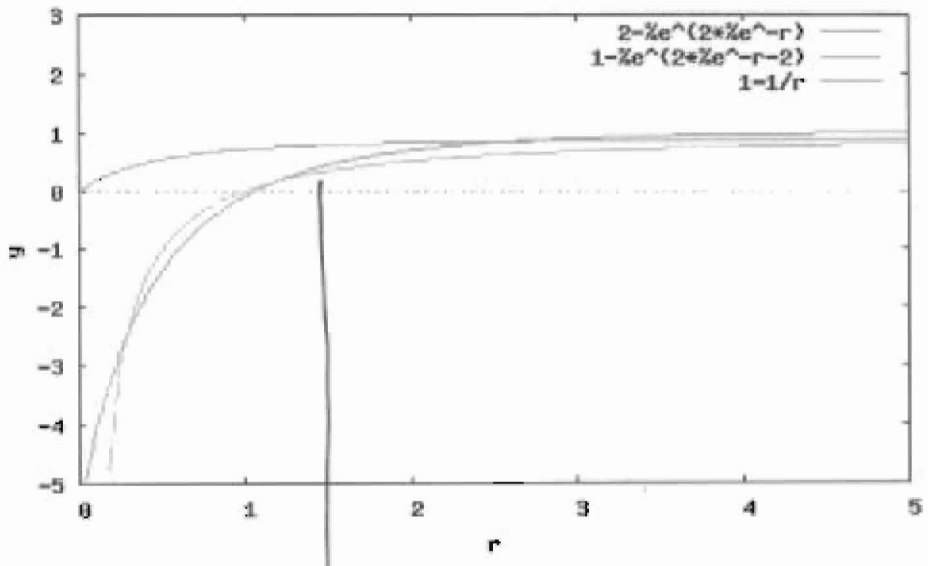
```
(%i4) wxplot2d([exp(2*exp(-r)),1+2*exp(-r),1-1/r], [r,0,5], [y,-5,3])$
plot2d: some values were clipped.
plot2d: expression evaluates to non-numeric value somewhere in plotting rang
plot2d: some values were clipped.
```

(%t4)




```
(%i7) wxplot2d([2-exp(2*exp(-r)),1-1/%e^2*exp(2*exp(-r)),1-1/r], [r,0,5], [
plot2d: some values were clipped.
plot2d: expression evaluates to non-numeric value somewhere in plotting rang
plot2d: some values were clipped.
```

(%t7)



Fig(1)

Almost identical, a fitting program can make this match even better.