Homework -1

AST 422 Spring 2007

(1) Use the given (or looked up) values to show the each constant in page 3 of Ryden:
Newtonian gravitational constant:
$G = 6.7 \times 10^{-11}\, m^3\, kg^{-1}\, s^{-2}$
Speed of light:
$c = 3.0 \times 10^8\, m\, s^{-1}$
reduced Planck constant:
$\hbar = h/(2\pi) = 1.1 \times 10^{-34}\, J\, s\, (= 6.6 \times 10^{-16}\, eV)$

(a) 1.1, Planck Length

$$l_p \equiv \left(\frac{G\hbar}{c^3}\right)^{1/2} = 1.6 \times 10^{-35}\, m$$

(b) 1.2, Planck Mass

$$M_p \equiv \left(\frac{\hbar c}{G}\right)^{1/2} = 2.2 \times 10^{-8}\, kg$$

(c) 1.3, Planck Time

$$t_p \equiv \left(\frac{G\hbar}{c^5}\right)^{1/2} = 5.4 \times 10^{-44}\, s$$

(d) 1.4, Planck Energy

$$E_p = M_p c^2 = 2.0 \times 10^9\, J (= 1.2 \times 10^{28}\, eV)$$

(2) And give meaning for those constants.