1. Calculate the following integrals:

   (a) $\int_0^1 dx x^{2.1}$

   (b) $\int_0^\pi d\theta \sin\theta$

   (c) $\int_0^\pi d\theta \sin^2\theta$

   (d) $\int_0^\pi d\theta \tan\theta$

   (e) $\int_1^2 d\theta \frac{1}{x}$

   (f) $\int_0^3 dx e^{-x}$

   (g) $\int_0^3 dx x^2 e^{-x}$

   (h) $\int_0^\infty dx e^{-x^2}$

2. Calculate the derivatives of the following functions with respect to x. Also evalute the value of this derivative at $x = 1$

   (a) x, $x^{1.5}$

   (b) $\cos x$, $\sin x$, $\tan x$

   (c) $x^2 \tan x$, $\frac{1}{x}\sin x$

3. How many atoms are there in a person of 73 kg if the composition (by mass) of human body is 65% O_2, 18.5% C_2, 9.5% H_2, 3.3% N_2, 1.5% Ca, 1% P and 0.35% other elements? (Hint: Ignore other elements)

4. The motion of a rocket burning its fuel at aconstant rate while moving through empty interstellar space can be described by

$$x = u_{ex}t + u_{ex}(\frac{1}{b} - t)\ln(1 - bt)$$

   where u_{ex} and b are constants (u_{ex} is the exhaust velocity of the gasses at the tail of the rocket and b is proportional to the rate of fuel consumption).

   (a) Find a formula for the instantaneous velocity of the rocket

   (b) Find a formula for the instantaneous acceleration.

(c) Suppose that a rocket with $u_{ex} = 3.0 \times 10^3\ m/s$ and $b = 7.5 \times 10^{-3}\ /s$ takes 120 s to burn all its fuel. What is the instantaneous velocity at $t = 0\ s$? At $t = 120\ s$

(c) What is the instantaneous acceleration at $t = 0\ s$? At $t = 120\ s$?