1. Recall some properties of logarithms:

$$\log_a b^n = n \log_a b$$
$$\log_a(bc) = \log_a b + \log_a c$$
$$\log_a(b/c) = \log_a b - \log_a c$$
$$\frac{\log_a b}{\log_a c} = \log_c b$$

Here are some exercises to review these properties (and some of the properties of exponents). Compute the following (simplify as much as possible):

(a) $(2^{4x} \cdot 2^{-x})^{1/2}$

(b) $8^{x/3} \cdot 16^{3x/4}$

(c) $\ln 4 + 2 \ln 3$

(d) $\log_2(3) \cdot \log_3(4)$

(e) $6^a - 6^b$

(f) $\log_3(100) - \log_3(10)$

2. Differentiate the following with respect to x:

(a) $f(x) = x^2 e^x$

(b) $f(x) = e^{1/x}$

(c) $f(x) = \sqrt{1 + xe^{-2x}}$

(d) $f(x) = e^{e^{e^x}}$

(e) $f(x) = \ln(x^2 + 2)$

(f) $f(x) = \ln(x + \sqrt{x^2 - 1})$

(g) $f(x) = \ln(\ln(\ln x))$

(h) $f(x) = \frac{x^2\sqrt{x^2+1}}{(3x+2)^5}$

(i) Find the equation of the tangent line to the curve $y = \ln(x^3 - 7)$ at the point $(2, 0)$.

3. A certain population of bacteria grows at a rate proportional to its size. At 12:00 (noon) the population is 30000, while at 1pm the population is 40000. Calculate the size of the population at 3pm.

4. If dairy cows eat hay containing too much iodine 131, their milk will be unfit to drink. If the hay contains 10 times the maximum allowable level of iodine 131, how many days should the hay be stored before it is fed do dairy cows? (Information: the half-live of iodine 131 is 8 days).