1. Solve each equation for x.

(a) $2^{x-5} = 3$ (b) $\ln x + \ln(x-1) = 1$

2. Let f be the function defined by

$$f(x) = \begin{cases} x+2 & \text{if } x < 0 \\ e^x & \text{if } 0 \leq x \leq 1 \\ 2-x & \text{if } x > 1. \end{cases}$$

Find the values of x at which f is discontinuous. For these values, is f continuous from the right, left or neither?

3.Use logarithmic differentiation to find the derivative of the function

$$f(x) = \sqrt[4]{\frac{x^2+1}{x^2-1}}$$

4. Use a linear approximation to estimate $\sqrt{99.8}$

5. Compute the following limits:

$$(a) \lim_{x \to -\infty} x^2 e^x$$

$$(b) \lim_{x \to 0} (1-2x)^{1/x}$$

6. Find two positive integers such that the sum of the first number and four times the second number is 1000 and the product of the numbers is as large as possible.

7. If $F(x) = \int_1^x f(t)dt$ and $f(t) = \int_1^{t^2} \frac{\sqrt{1+u^4}}{u} du$, find $F''(2)$.

8. Compute the following integrals

$$(a) \int \frac{\sin x}{1+\cos^2 x} dx$$

$$(b) \int x^3 \sqrt{x^2+1} dx$$

$$(c) \int_e^{e^4} \frac{dx}{x\sqrt{\ln x}}$$

9. Find the area of the region enclosed by the curves $y = 3x^2$, $y = 8x^2$, $4x + y = 4$, $x \geq 0$.

10. Find the volume of the solid obtained by rotation the region enclosed by the curves $x = 0$, $x = 9 - y^2$ about the line $x = -1$.

11. The height of a monument is 20 m. An horizontal cross-section at the distance x meters from the top is an equilateral triangle of edge $x/4$. Find the volume of the monument.

12. The linear density of a rod 8m long is $12/\sqrt{x+1}$ kg/m, where x is measured in meters from one end of the rod. Find the average density of the rod.