(1) (a) Evaluate the integral: $\int_0^\infty e^{-x}cos(2x)dx$. (10%)

(b) Evaluate the integral: $\int_0^\infty e^{-x}sin(2x)dx$. (10%)

(c) Evaluate the integral to the second order in ϵ: $\int_0^1 [e^{\epsilon x}/cos(\epsilon x)]dx$, where $\epsilon \ll 1$. (10%)

(2) (a) Solve for the differential equation (15%):

$$\frac{df}{dx} - \frac{2f}{x} = 0.$$

(b) Solve for the differential equation (15%):

$$\frac{df}{dx} - \frac{2f}{x} = x^2.$$

(3) Show that $tan(ix) = i\ \ tanh(x)$, where $i \equiv \sqrt{-1}$. (20%).

(4) Show that $cosh^{-1}(x) = \ln(x + \sqrt{x^2 - 1})$, where $cosh^{-1}$ is the inverse function of $cosh$. (20%)