King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
Math 605: Asymptotic Expansions and Perturbation Methods
Final Exam-Part I: In Class
Instructor: Prof. B. Chanane

Name:_____ ID:_____

Thursday 12 January 2017 at 7 PM

Problem 1 *Use the Laplace method (not the formula) to obtain an asymptotic approximation of the integral*

$$f(x) = \int_{-\infty}^{+\infty} \exp\left(-2\pi x \cosh t\right) dt \quad , \quad x \to +\infty$$

Problem 2 *Obtain an asymptotic solution of the equation*

$$xy'' + 2(1-x)y' - y = 0$$

for $x \to +\infty$ *in the form*

$$y(x) \approx e^{\lambda x} x^{\sigma} \left(\alpha_0 + \frac{\alpha_1}{x} + \cdots \right)$$

Problem 3 *Use the WKB method to find asymptotic approximations of the eigenvalues μ^2 and corresponding eigenfunctions for large μ^2 for the following eigenvalue problem,*

$$\begin{cases} -\frac{d^2y}{dt^2} = \mu^2(1+x^2)y \\ y(0) = 1,\ y(1) = 0 \end{cases}$$

(provide all details)