

Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Total mark

Table of Marks

King Fahd University of Petroleum and Minerals

Midterm Exam for Math 513

Semester 2, Academic year 2010-2011

Time allowed 1 hour and 30 minutes

Full Name:

ID Number:

Note: Show all your work and write clear steps

Question 1 Find the Laplace transform of $f(t) = (t - 2)e^t H(t - 1)$.

Question 2 Find the Laplace inverse of $F(s) = \frac{e^{-s}}{s^2 - 4s}$.

Question 3 Use the contour integration technique to find the inverse Fourier transform of

$$F(s) = \frac{1}{s^2 - 2is - 5}.$$

Question 4 Use Fourier transform to solve the differential equation:

$$y'' - 4y = e^{-3t}H(t).$$

Question 5 Find a Fourier series expansion of

$$f(t) = \begin{cases} t & -1 \leq t < 0 \\ \sin(\pi t) - t & 0 \leq t < 1. \end{cases}$$

Question 6 a) Use $\mathcal{L}\left(\frac{1}{\sqrt{\pi t}}\right) = \frac{1}{\sqrt{s}}$ to show that $\mathcal{L}(\sqrt{t}) = \frac{\sqrt{\pi}}{2s^{3/2}}$.

b) Use Laplace transform to solve the integro-differential equation:

$$\frac{dy}{dt} + \frac{1}{\sqrt{\pi}} \int_0^t \frac{y(q)}{\sqrt{t-q}} dq = \frac{t^2}{2} + \frac{2\sqrt{t}}{\sqrt{\pi}} \quad \text{with } y(0) = 0.$$