

**Queen Mary, UNIVERSITY OF LONDON**

**MAE 111 ENGINEERING MATHEMATICS II– IN-TERM TEST**

Date: XXXXX Time: 17:10 - 18:00 (50 minutes)

*Duration: 50 minutes*

*This test has SIX questions each worth 4 marks.*

*You should attempt ALL questions.*

*Write your calculations and answers in the space provided.*

*Cross out any work you do not wish marked.*

**Calculators are NOT permitted in this test.**

*Vectors are in boldface, thus: **A**.*

*A table of standard integrals is provided at the end of this examination paper.*

**Complete the following information:**

<b>Name</b>	
<b>Student Number (9 digit code)</b>	

*THIS IS A SAMPLE TEST*

1. Find the first three terms of the Maclaurin's series for the function  $e^{\sin x}$  (i.e.,  $\exp[\sin x]$ ).

2. Decide whether the series  $S = \sum_{n=1}^{\infty} u_n$  is convergent or divergent when

(a)  $u_n = \frac{n-3}{2n+4},$

(b)  $u_n = \frac{3^n}{(1+n)!}.$

3. Find the range of values for which

$$\sum_{n=1}^{\infty} \frac{5^n}{n^2} x^{2n}$$

converges. [You need not consider the convergence properties at the endpoints of the range.]

4. Using integration by parts, evaluate

$$\int x \sin x \, dx.$$

5. Evaluate, using partial fractions, the following integral

$$I = \int \frac{1}{x^2 + 2x - 8} dx.$$

6. Evaluate the double integral

$$I = \int_0^{\pi/2} \int_0^{\pi/2} \cos(x + y) \, dx \, dy$$



## Table of Standard Integrals

$f(x)$	$\int f(x)dx$
$x^n, n \neq -1$	$\frac{x^{n+1}}{n+1}$
$\frac{1}{x}, x > 0$	$\ln  x $
$e^{ax}$	$\frac{1}{a}e^{ax}$
$\sin x$	$-\cos x$
$\cos x$	$\sin x$
$\tan x$	$-\ln  \cos x  = \ln  \sec x $
$\cot x$	$\ln  \sin x $
$\sec x$	$\ln  \sec x + \tan x  = \ln \tan \left(\frac{\pi}{4} + \frac{1}{2}x\right)$
$\operatorname{cosec} x$	$-\ln  \operatorname{cosec} x + \cot x  = \ln \left \tan\left(\frac{1}{2}x\right)\right $
$\sec^2 x$	$\tan x$
$\operatorname{cosec}^2 x$	$-\cot x$
$\sec x \tan x$	$\sec x$
$\operatorname{cosec} x \cot x$	$-\operatorname{cosec} x$
$\sinh x$	$\cosh x$
$\cosh x$	$\sinh x$
$\operatorname{sech}^2 x$	$\tanh x$
$\operatorname{cosech}^2 x$	$-\operatorname{coth} x$
$\tanh x$	$\ln \cosh x$
$\operatorname{coth} x$	$\ln  \sinh x $
$\operatorname{sech} x \tanh x$	$-\operatorname{sech} x$
$\operatorname{cosech} x \operatorname{coth} x$	$-\operatorname{cosech} x$
$\frac{1}{a^2+x^2}$	$\frac{1}{a} \tan^{-1} \left(\frac{x}{a}\right)$
$\frac{1}{a^2-x^2}$	$\frac{1}{2a} \ln \frac{a+x}{a-x}, (x < a)$
$\frac{1}{\sqrt{(a^2-x^2)}}$	$\sin^{-1} \left(\frac{x}{a}\right)$
$\frac{1}{\sqrt{(x^2+a^2)}}$	$\sinh^{-1} \left(\frac{x}{a}\right) = \ln \left[ \frac{x+\sqrt{(x^2+a^2)}}{a} \right]$
$\frac{1}{\sqrt{x^2-a^2}}$	$\cosh^{-1} \left(\frac{x}{a}\right) = \ln \left[ \frac{x+\sqrt{(x^2-a^2)}}{a} \right]$
$\frac{1}{x\sqrt{(x^2-a^2)}}$	$\frac{1}{a} \sec^{-1} \left(\frac{x}{a}\right)$