

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:

Name	
Student Number (9 digit code)	

THIS IS A SAMPLE TEST

1. Calculate $\frac{dy}{dx}$ when $y(x)$ is given by

$$y = x^3 \ln x \cos 2x.$$

2. Calculate $\frac{dy}{dx} = \frac{dy}{dt} / \frac{dx}{dt}$ in terms of the parameter t where

$$y(t) = 3t^2 - 6t + 4$$

$$x(t) = t^4 - 2t^2 - 7.$$

3. By differentiating implicitly, determine $\frac{dy}{dx}$ when $y(x)$ is given by

$$2x^3 + 3y^2 = xy + y.$$

4. Two points P and Q have position vectors relative to the origin O : $\mathbf{p} = \mathbf{i} + 3\mathbf{j} - \mathbf{k}$ and $\mathbf{q} = 2\mathbf{i} - \mathbf{j} + 4\mathbf{k}$, respectively. Determine the work done by force $\mathbf{F} = 4\mathbf{i} - 3\mathbf{j} - 2\mathbf{k}$, as it moves from P to Q , assuming path independence.

5. Two points C and D have position vectors relative to the origin O : $\mathbf{c} = 3\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ and $\mathbf{d} = 2\mathbf{i} + \mathbf{j} - \mathbf{k}$, respectively.
Determine: (i) $\mathbf{c} \times \mathbf{d}$, and (ii) the area of the triangle OCD .



6. Two points A and B have position vectors relative to the origin O : $\mathbf{a} = \mathbf{i} - 2\mathbf{j} + 4\mathbf{k}$ and $\mathbf{b} = -\mathbf{i} + -3\mathbf{j} + 2\mathbf{k}$, respectively.
Find the parametric vector equation of the line which passes through A and B , and the coordinates of the point C where the line passes through the plane $x = 2$.

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 $
$\operatorname{sech} x \tanh x$	$-\operatorname{sech} x$
$\operatorname{cosech} x \operatorname{coth} x$	$-\operatorname{cosech} x$
$\frac{1}{a^2+x^2}$	$\frac{1}{a} \tan^{-1} \left(\frac{x}{a}\right)$
$\frac{1}{a^2-x^2}$	$\frac{1}{2a} \ln \frac{a+x}{a-x}, (x < a)$
$\frac{1}{\sqrt{(a^2-x^2)}}$	$\sin^{-1} \left(\frac{x}{a}\right)$
$\frac{1}{\sqrt{(x^2+a^2)}}$	$\sinh^{-1} \left(\frac{x}{a}\right) = \ln \left[\frac{x+\sqrt{(x^2+a^2)}}{a} \right]$
$\frac{1}{\sqrt{x^2-a^2}}$	$\cosh^{-1} \left(\frac{x}{a}\right) = \ln \left[\frac{x+\sqrt{(x^2-a^2)}}{a} \right]$
$\frac{1}{x\sqrt{(x^2-a^2)}}$	$\frac{1}{a} \sec^{-1} \left(\frac{x}{a}\right)$