

CITY UNIVERSITY OF HONG KONG

Course code and title : MA1201 Calculus and Basic Linear Algebra II

Session : Semester A, 2014/2015

Time allowed : Two hours

This paper has **THREE** pages (including this cover page and the attached table).

Instructions to candidates:

1. Attempt all **SIX** questions in this paper.
 2. Start each question on a new page.
 3. Show all steps clearly.
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*This is a **closed-book** examination.*

Candidates are allowed to use the following materials/aids:

Non-programmable calculators

Materials/aids other than those stated above are not permitted. Candidates will be subject to disciplinary action if any unauthorised materials or aids are found on them.

NOT TO BE TAKEN AWAY

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PUT FORWARDED TO LIB**

Question 1

Compute the following integrals.

- (a) $\int (3x+2)^{1/4} dx$ [5]
- (b) $\int \frac{2x+1}{(x-3)^2} dx$ [5]
- (c) $\int_{-\pi}^{\pi} \frac{\sin(x^3)}{x^2+2} dx$ [5]

Question 2

Evaluate the following indefinite integrals.

- (a) $\int \frac{1}{(x^2+9)^{5/2}} dx$ [8]
- (b) $\int x^2 \tan^{-1} x dx$ [7]
- (c) $\int \frac{8}{(x+1)(x^2-2x+5)} dx$ [10]

Question 3

Find the volume of the solid generated by revolving the region bounded above by the hyperbola $\frac{y^2}{4} - \frac{x^2}{4} = 1$ and bounded below by the parabola $y = \sqrt{3}x^2$ about the x -axis.

[10]

Question 4

- (a) Given three vectors $\vec{a} = \vec{i} - 2\vec{j} + 3\vec{k}$, $\vec{b} = -3\vec{i} + 2\vec{k}$ and $\vec{c} = 2\vec{i} + 3\vec{j} - \vec{k}$ in R^3 , evaluate $\vec{a} \cdot \vec{b} \times \vec{c}$. [5]
- (b) Convert the complex number $\frac{2-3i}{-3-i}$ into Cartesian form. [5]
- (c) Compute the matrix product $\begin{pmatrix} 1 & -2 & 3 \\ -4 & 5 & -6 \end{pmatrix} \begin{pmatrix} 7 & 8 \\ 9 & 0 \\ -1 & -2 \end{pmatrix}$. [5]

Question 5

- (a) Use vector's method to determine the plane equation in R^3 containing $A(1,2,3)$, $B(-3,1,2)$ and $C(2,-3,-1)$. [10]
- (b) Solve the complex equation $z^3 + \sqrt{3} = i$ and list all possible solutions in Euler form with principal arrangements. [10]

Question 6

Given a system of linear equations as follows.

$$\begin{aligned} x + 2y - 3z - 4w &= 1 \\ -2x - 3y + 4z + 5w &= -3 \\ 3x + 4y - 5z - 6w &= 5 \end{aligned}$$

- (a) Solve the above linear system by Gaussian elimination and express the solution in vector form. [11]
- (b) Write down the corresponding homogeneous system and determine all possible linearly independent solutions from (a) without resolving it. [4]

Brief Table of Integrals

$\int x^p dx = \frac{x^{p+1}}{p+1} + C, \quad p \neq -1$	$\int \frac{1}{x} dx = \ln x + C$
$\int e^x dx = e^x + C$	
$\int \sin x dx = -\cos x + C$	$\int \cos x dx = \sin x + C$
$\int \sec^2 x dx = \tan x + C$	$\int \csc^2 x dx = -\cot x + C$
$\int \sec x \tan x dx = \sec x + C$	$\int \csc x \cot x dx = -\csc x + C$
$\int \sec x dx = \ln \sec x + \tan x + C$	$\int \csc x dx = -\ln \csc x + \cot x + C$
$\int \frac{dx}{\sqrt{1-x^2}} = \sin^{-1} x + C$	$\int \frac{dx}{1+x^2} = \tan^{-1} x + C$

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