CITY UNIVERSITY OF HONG KONG

Course code and title	:	MA1201 Calculus and Basic Linear Algebra II
Session	:	Semester B, 2017/2018
Time allowed	:	Three 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 in details in order to get full credits.

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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

Question 1 [15]
Compute the following elementary integrals.

(a) $\int \frac{e^{3x} - 3e^{-x-2}}{e^{x+1}} dx$ [5]

(b) $\int x^3 \sec^2(x^4 + 2)\, dx$ [4]

(c) $\int_0^2 |x - 1|\, dx$ [6]

Question 2 [20]
Evaluate the following indefinite integrals.

(a) $\int \frac{x^2}{\sqrt{9 - x^2}} dx$ [6]

(b) $\int (x + 1) \tan^{-1} x\, dx$ [6]

(c) $\int \frac{10x}{(x + 3)(x^2 + 4x + 13)} dx$ [8]

Question 3 [15]
(a) Find the area of the region bounded by the parabola $x = y^2 - 5$ and the straight line $y = x - 1$. [8]
(b) Calculate the area of the surface generated by rotating about the x-axis, the parametric curve $x = \cos^2 t,\ y = \sin^2 t,\ 0 \le t \le \frac{\pi}{2}$. [7]

Question 4 [15]
(a) Find the coordinates of the point R on the line segment between $P(1, 2, 3)$ and $Q(-3, 1, -2)$ such that $2|\overrightarrow{PR}| = 3|\overrightarrow{QR}|$. [6]
(b) Determine the equation of the plane containing $A(-1, -2, -3)$, $B(3, -1, 2)$ and $C(1, 3, 0)$. [9]

Question 5 [15]
(a) Simplify the complex expression $\left(\frac{1+i}{1-i}\right)^{2018}$ into the polar form. [5]
(b) Solve the complex equation $(iz)^3 = 3 + \sqrt{3}i$ and list all the solutions in Euler's form with principal arguments. [10]

Question 6 [20]
Given the matrix

$$A = \begin{pmatrix} 3 & 1 & -2 \\ -2 & 2 & 2 \\ 0 & -1 & -1 \end{pmatrix}.$$

(a) Calculate the determinant of A by the cofactor expansion and then compute $|A^T A^{-2}|$. [5]
(b) Reduce the matrix A into a row echelon form. [5]
(c) Find the inverse of A by the Gauss-Jordan elimination. [10]

- END -

Brief Table of Integrals

$\int x^p dx = \frac{x^{p+1}}{p+1} + C, \quad p \neq -1$	$\int \frac{1}{x} dx + C$
$\int e^x dx = e^x + C$	$\int \sec^3 x \, dx = \frac{1}{2}\sec x \tan x + \frac{1}{2}\ln \lvert \sec x + \tan x \rvert + C$
$\int \sin x \, dx = -\cos x + C$	$\int \cos x \, dx = \sin x + C$
$\int \sec^2 x \, dx = \tan x + C$	$\int \csc^2 x \, dx = -\cot x + C$
$\int \sec x \tan x \, dx = \sec x + C$	$\int \csc x \cot x \, dx = -\csc x + C$
$\int \sec x \, dx = \ln \lvert \sec x + \tan x \rvert + C$	$\int \csc x \, dx = -\ln \lvert \csc x + \cot x \rvert + C$
$\int \frac{1}{\sqrt{1-x^2}} dx = \sin^{-1} x + C$	$\int \frac{1}{1+x^2} dx = \tan^{-1} x + C$