UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
SEPTEMBER 2016 SEMESTER

COURSE CODE	:	LGB 12203
COURSE NAME	:	MATHEMATICS 1
PROGRAMME NAME	:	BACHELOR
DATE	:	23 JANUARY 2017
TIME	:	9.00 AM – 12.00 PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections; Section A and Section B.
4. Answer ALL questions in Section A. For Section B, answer THREE (3) questions only.
5. Please write your answers in the answer booklet provided.
6. Answer all questions in English.
7. Answers should be written in blue or black ink except for sketching, graphic and illustration.

THERE ARE 7 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

Given that p and q are roots of the quadratic equation $x^2 - 6x + h = 0$, whereas 3p and 3q are roots of the quadratic equation $3x^2 + wx - 2 = 0$. Identify the possible values of h and w.

(8 marks)

Question 2

Given that matrix $A = \begin{bmatrix} 2 & -1 \\ -5 & 3 \end{bmatrix}$.Compute:

(a) A^2.

(2 marks)

(b) the values of m and n such that $A^2 + mA + nI = 0$ (I is the 2×2 identity matrix, and 0 is the 2×2 null matrix).

(6 marks)

Question 3

Calculate the following in terms of a+jb:

(a) $2j(j-1) + (\overline{\sqrt{3} + j})^2 + (1 + j) + (\overline{1 + j})$.

(3 marks)

(b) $\dfrac{1+j}{1-j} - (1+2j)(2+2j) + \dfrac{3-j}{1+j}$.

(5 marks)

Question 4

Given that $y = 2x(2x-1)$.

(a) Express $y\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 2$ in terms of x.

(6 marks)

(b) Hence, calculate the values of x that satisfy the equation $y\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 2 = 0$

(2 marks)

Question 5

Given $\int_0^2 f(x)dx = \int_2^3 f(x)dx = 5$, determine:

(a) $\int_0^3 f(x)dx.$

(2 marks)

(b) $\int_0^2 f(x)dx + \int_3^2 f(x)dx.$

(2 marks)

(c) $\int_0^2 [4f(x) + 2]dx.$

(4 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE(3) questions only.
Please use the answer booklet provided.

Question 6

(a) An electrical circuit comprises three closed loops giving the following equations for the currents i_1, i_2 and i_3. Evaluate the values of i_1, i_2 and i_3 using Gaussian Elimination method.

$$i_1 + i_2 + i_3 - 3 = 0$$
$$2i_1 + 3i_2 = -7i_3$$
$$i_1 + 3i_2 - 2i_3 = 17$$

(15 marks)

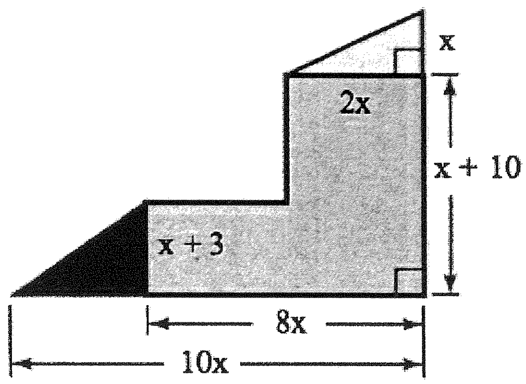

Figure 1

(b) Express the area of the Figure 1 above in terms of *x*.

(5 marks)

Question 7

(a) The impedance in one part of a series circuit is -2 + 8j ohms, and the impedance in another part of the circuit is 4 - 5j ohms. Evaluate the total impedance in the circuit.

(2 marks)

(b) The voltage in a circuit is 45 - 15j volts and the impedance is -3 + 4j ohms. Calculate the current in the circuit. (in terms of *a+bj*) HINT:E = IZ.

(8 marks)

(c) Represent the current in the circuit from (b) as a complex number in exponential form.

(10 marks)

Question 8

(a) A missile fired from ground level rises *x* metres vertically upwards in *t* seconds and $x = 100t - \frac{25}{2}t^2$. Determine:

i. the initial velocity of the missile.

(3 marks)

ii. the time when the height of the missile is a maximum.

(3 marks)

iii. the maximum height reached.

(2 marks)

iv. the acceleration at the maximum position.

(2 marks)

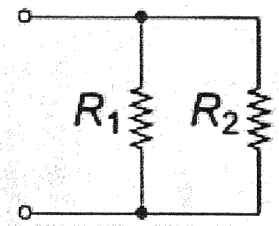

Figure 2

(b) The combined electrical resistance R of R_1 and R_2connected in parallel shown in Figure 2 is given by the equation $\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}$.

i. Calculate the value of R if given$R_1 = 80\Omega$ and $R_2 = 100\Omega$.

(3 marks)

ii. Evaluate the rate of R changing when R_1 and R_2 are increasing at the rates of 0.3Ω and 0.2Ω per second respectively.

(7 marks)

Question 9

(a) Evaluate $\int \frac{x^3 - 4x - 10}{x^2 - x - 6} dx.$

(10 marks)

(b) Evaluate $\int_0^{\frac{\pi}{2}} \frac{d\theta}{1+3\cos\theta}$ giving your answer correct to 4 decimal places by using:

(n = 6)

i. Simpson's rule.

(4 marks)

ii. Trapezoidal rule.

(3 marks)

iii. Mid ordinate rule.

(3 marks)

END OF EXAMINATION PAPER

DIFFERENTIATION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}(\sin x) = \cos x$	$\frac{d}{dx}(\sin f(x)) = f'(x)\cos f(x)$
$\frac{d}{dx}(\cos x) = -\sin x$	$\frac{d}{dx}(\cos f(x)) = -f'(x)\sin f(x)$
$\frac{d}{dx}(\tan x) = \sec^2 x$	$\frac{d}{dx}(\tan f(x)) = f'(x)\sec^2 f(x)$
$\frac{d}{dx}(\csc x) = -\csc x \cot x$	$\frac{d}{dx}(\csc f(x)) = -f'(x)\csc f(x)\cot f(x)$
$\frac{d}{dx}(\sec x) = \sec x \tan x$	$\frac{d}{dx}(\sec f(x)) = f'(x)\sec f(x)\tan f(x)$
$\frac{d}{dx}(\cot x) = -\csc^2 x$	$\frac{d}{dx}(\cot f(x)) = -f'(x)\csc^2 f(x)$

EXPONENTIAL FUNCTION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}e^x = e^x$	$\frac{d}{dx}e^{f(x)} = f'(x)e^{f(x)}$

LOGARITHMIC FUNCTION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}\ln x = \frac{1}{x}$	$\frac{d}{dx}\ln f(x) = \frac{f'(x)}{f(x)}$

INTEGRATION

STANDARD FORM	GENERAL FORM Where : $f(x) = ax + b$
$\int \cos x\,dx = \sin x + c$	$\int \cos f(x)dx = \frac{\sin f(x)}{f'(x)} + c$
$\int \sin x\,dx = -\cos x + c$	$\int \sin f(x)dx = \frac{-\cos f(x)}{f'(x)} + c$
$\int \sec^2 x\,dx = \tan x + c$	$\int \sec^2 f(x)dx = \frac{\tan f(x)}{f'(x)} + c$

$\int \sec x \tan x \, dx = \sec x + c$	$\int \sec f(x) \tan f(x) dx = \dfrac{\sec f(x)}{f'(x)} + c$
$\int \csc x \cot x \, dx = -\csc x + c$	$\int \csc f(x) \cot f(x) dx = \dfrac{-\csc f(x)}{f'(x)} + c$
$\int \csc^2 x \, dx = -\cot x + c$	$\int \csc^2 f(x) dx = \dfrac{-\cot f(x)}{f'(x)} + c$

EXPONENTIAL FUNCTION

STANDARD FORM	GENERAL FORM Where : $f(x) = ax + b$
$\int e^x dx = e^x + c$	$\int e^{f(x)} dx = \dfrac{e^{f(x)}}{f'(x)} + c$

LOGARITHMIC FUNCTION

STANDARD FORM	GENERAL FORM Where : $f(x) = ax + b$
$\int \frac{1}{x} dx = \ln\lvert x\rvert + c$	$\int \dfrac{1}{f(x)} dx = \dfrac{\ln\lvert f(x)\rvert}{f'(x)} + c$

HYPERBOLIC FUNCTION

$\cosh x = \dfrac{e^x + e^{-x}}{2}$
$\sinh x = \dfrac{e^x - e^{-x}}{2}$