CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

COURSE CODE	:	LGB 12203
COURSE NAME	:	MATHEMATICS 1
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	BACHELOR OF ELECTRICAL ENGINEERING
DATE	:	30 MAY 2016
TIME	:	09.00 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

Find all the roots of $h(x)=x^3-7x^2+4x+12=0$.(using trial and error and division).

(8 marks)

Question 2

Given that matrix $A=\begin{bmatrix}3 & -4\\ 2 & -2\end{bmatrix}$ and $B=m\begin{bmatrix}n & 4\\ -2 & 3\end{bmatrix}$ such that $AB=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$,

Find the values of *m* and *n*.

(8 marks)

Question 3

If x and y are real, solve the equation:

$$\frac{jx}{1+jy}=\frac{3x+4j}{x+3y}.$$

(8 marks)

Question 4

If $f(x,y)=3e^{2x}y-\dfrac{2}{x^2}-7(\cos y)$, determine:

(a) $f_{xy}(x,y)$.

(3 marks)

(b) $f_{yx}(x,y)$.

(3 marks)

(c) $f_{xx}(x,y)$

(2 marks)

Question 5

Evaluate $\int_{-1}^{0} x^3(1-2x^4)^3\,dx$.

(8 marks)

SECTION B (Total: 60 marks)

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

Question 6

(a) Evaluate the value of x, y and z from the following system of equation using Cramer's rule :

$$2x + y - 3z = 13$$
$$x = y + z + 1$$
$$-3x + 2y = -5z - 10$$

(15 marks)

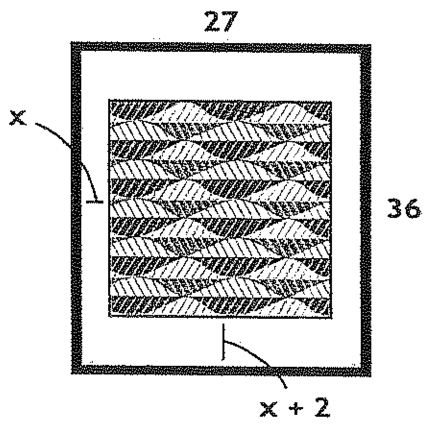

Figure 1

(b) A picture frame has a white mat surrounding the picture. The frame has a width of 27 cm and a length of 36 cm. The mat is 2 cm wider at the top and bottom than it is on the sides. Express the area of the mat in Figure 1 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 - 6j ohms. Evaluate the total impedance in the circuit.

(2 marks)

(b) The voltage in a circuit is 45 + 10j 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

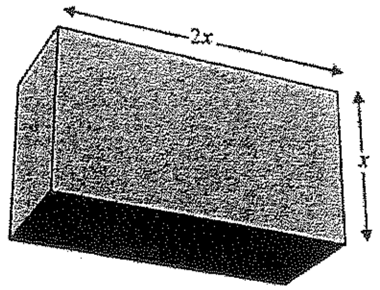

Figure 2

A cuboid has a rectangular cross-section where the lenght of the rectangle is equal to twice its width, x cm, as shown in Figure 2. The volume of the cuboid is 81 cubic centimetres.

(a) Show that the total length L cm, of the twelve edges of the cuboid is given by $L = 12x + \dfrac{162}{x^2}$.

(4 marks)

(b) Evaluate the total length L. Then, by further differentiation, justify that the value is minimum.

(7 marks)

(c)

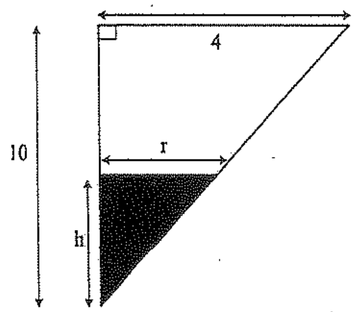

Figure 3

Consider a conical tank whose radius at the top is 4 feet and whose depth is 10 feet as in Figure 3. It is being filled with water at the rate of 2 cubic feet per minute. How fast is the water level rising when it is at 5 feet depth? HINT: $V = \frac{1}{3}\pi r^2 h$.

(9 marks)

Question 9

(a) Evaluate $\int \frac{x^2+1}{x^2-1}dx.$

(10 marks)

(b) Use Simpson's Theorem to evaluate $\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{1-\frac{1}{5}\sin^2\theta}}$ giving your answer correct to 4 decimal places.

(10 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 : $f(x) = ax + b$
$\int \dfrac{1}{x} dx = \ln\lvert x\rvert + c$	$\int \dfrac{1}{f(x)} dx = \dfrac{\ln\lvert f(x)\rvert}{f'(x)} + c$

HYPERBOLIC FUNCTION

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