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INTERNATIONAL COLLEGE PENANG (507232-U)
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session : AUGUST 2014

Programme : DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING

Course : MAT1121: Engineering Mathematics 1

Date of Examination : December 11, 2014 (Thursday)

Time : 3.00pm – 5.00pm Reading Time : Nil

Duration : 2 Hours

Special Instructions :

This paper consists of FIVE (5) questions. Answer any FOUR (4) questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :
Non-Programmable Calculator

Materials provided :
Formula Booklet 1

Examiner(s) : Chong Mee Teng

Moderator : Dr. Ch'ng Pei Eng

This paper consists of 5 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG
DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME

MAT 1121: ENGINEERING MATHEMATICS 1
FINAL EXAMINATION: AUGUST 2014 SESSION

This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) Solve the following equations:

(i) $\ln(2x - 2) - \ln(x - 1) = \ln x$

(5 marks)

(ii) $4^x - 2^{x+1} - 3 = 0$

(4 marks)

(iii) $\sqrt{x+10} - \sqrt{x} = 3$

(4 marks)

(b) The expression $f(x) = 3x^3 - px^2 - 2x - q$ leaves a remainder of 44 and 40 when divided by $x - 2$ and $x - 4$ respectively. Find the values of p and q .

(5 marks)

(c) The roots of the equation $x^2 + 2ax + 2 - 5a = 2a^2$ are real and equal. Find the possible values of a .

(3 marks)

(d) Express $y = -2x^2 + 8x - 5$ in the form $y = p - 2(x - q)^2$ where p and q are constants. Hence sketch the graph of $y = -2x^2 + 8x - 5$.

(4 marks)

Question 2

(a) Find x for each of the following cases for $0^\circ \leq x \leq 360^\circ$:

(i) $\sin^2 x + 2 \cos 2x = 2 \cos x$

(6 marks)

(ii) $(\tan x - 1)(\tan x + 1) = \frac{1}{\cos x}$

(6 marks)

(b) Prove the identity: $\cos^2 x(\csc^2 x - \cot^2 x) = \cos^2 x$

(5 marks)

- (c) State the amplitude, period and phase shift of $y = \sqrt{2} \sin(x - \frac{\pi}{4})$. Hence, sketch the curve for one oscillation. (5 marks)
- (d) Convert $(-3, \frac{5\pi}{4})$ from polar to rectangular coordinates. (3 marks)

Question 3

- (a) The sixth term of an arithmetic progression, AP is twice the 3rd term and the first term is $1\frac{1}{2}$. Find the common difference and the 10th term. (5 marks)
- (b) The first three terms in a geometric progression are 144, x and 64 respectively, where x is positive. Find:
- The value of x , (2 marks)
 - The sum to infinity of the progression. (3 marks)
- (c) (i) Find the first three terms, in descending powers of x , in the expansion of $(x - \frac{2}{x})^6$. Hence, find the coefficient of x^4 in the expansion of $(1 + x^2)(x - \frac{2}{x})^6$. (5 marks)
- (ii) Find the term in x^6 in the expansion of $(2x + \frac{1}{4})^{20}$. (5 marks)
- (d) In the **Figure (1)** below, $KL = 12$, $\angle M$ is a right angle, $\angle LKN = 20^\circ$ and $\angle MLN = 65^\circ$. Find the value p . (5 marks)

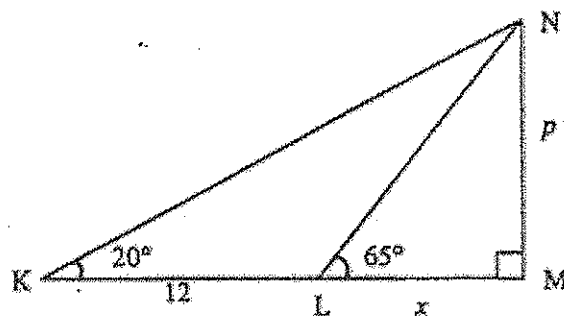


Figure (1)

Question 4

(a) Find $\frac{dy}{dx}$ for each of the following:

(i) $y = e^{-2x}(3\sin 3x - 2\cos 3x)$ (5 marks)

(ii) $y = \frac{3x^2 + 2x}{\sqrt{x}}$ (4 marks)

(b) Find the equation of the tangent line to the curve $3x^2 + 2y^2 = 2xy + 23$ at the point $(3, 2)$. (5 marks)

(c) Find the stationary points of the function $y = 2x^3 + x^2 - 4x + 1$ and determine the nature of the stationary points. Hence, sketch the graph of the function. (6 marks)

(d) Variables x and y are connected by the equation $2xy = 195$. If x is increasing at a rate of $\frac{3}{2}$ units per second, find the rate of change of y at the instant when $x = 15$ units. (5 marks)

Question 5

(a) Evaluate the following integrals:

(i) $\int \frac{x^{-3} - 7x^2}{\sqrt{x}} dx$. (3 marks)

(ii) $\int \frac{2x^2}{3x^3 + 5} dx$. (3 marks)

(iii) $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} (3\cos x + 2\sin 2x) dx$. (3 marks)

(b) Use the Simpson's rule to evaluate $\int_0^{\pi} \cos^2 x dx$ using six intervals. Show your working in the form of a table and give your final answer to 4 significant figures. (5 marks)

(c) The equation $x^3 - 6x + 3 = 0$ has a root between $x = -2$ and $x = -3$. Use Newton's method to find its root and leave your answer in 4 decimal places. (5 marks)

- (d) Find the area of the region bounded by the curve $y = x^2$ and $y = 2 - x^2$ as shown in Figure (2).

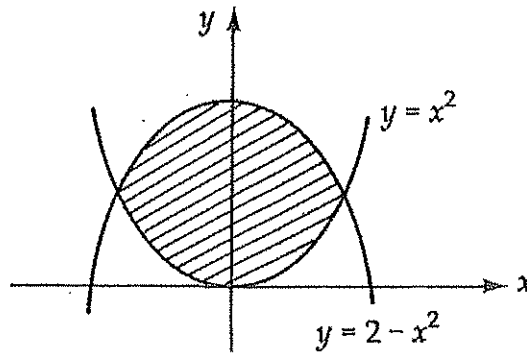


Figure (2)

(6 marks)

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