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INTERNATIONAL COLLEGE PENANG (507232-U)
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

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Session : AUGUST 2012

Programme : DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING

Course : MAT1121: Engineering Mathematics 1

Date of Examination : 13 December 2012

Time : 11a.m. – 1p.m. 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 Cheng

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 2012 SESSION**

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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) $\log_2(x^2 + 2) = 1 + \log_2(x + 5)$ (3 marks)

(ii) $5^{x+1} = 10(8^{2x-3})$ (3 marks)

(iii) $1 + \sqrt{x+3} = \sqrt{2x-1}$ (3 marks)

(b) The polynomial $f(x) = 2x^3 + ax^2 + bx + 36$ is exactly divisible by $(x - 3)$ and has a remainder of -30 when it is divided by $(x + 2)$. Find the values of a and b , and hence factorize the expression completely. (6 marks)

(c) Find the range of values of k for which the equation: $(x + 1)^2 + p - 16 = 0$ has real roots. (3 marks)

(d) Express $y = 4x^2 - 3x + 1$ in the form $y = 4(x - p)^2 + q$. Hence find the minimum value of y and the value of x at which the minimum value occurs. Sketch the curve of $y = 4x^2 - 3x + 1$. (4 marks)

(e) Change $(-\sqrt{3}, -1)$ from rectangular coordinates to polar coordinates. (3 marks)



Question 2

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

(i) $\sin^2 x = \frac{1}{9}$

(3 marks)

(ii) $2 \tan^2 x + 5 \tan x - 3 = 0$

(5 marks)

(iii) $2 \cos 2x = 3 - 2 \cos x$

(4 marks)

(b) Prove the identity:

(i) $(\sec x - \tan x)^2 = \frac{1 - \sin x}{1 + \sin x}$

(4 marks)

(ii) $\sec^2 x + \operatorname{cosec}^2 x = \sec^2 x \operatorname{cosec}^2 x$

(4 marks)

(c) State the amplitude, period and phase shift of $y = 3 \sin\left(\frac{1}{2}x + \pi\right)$. Hence, sketch the curve for one oscillation.

(5 marks)

Question 3

(a) In an Arithmetic Progression, the sum of the first ten terms is 50 and the 5th term is three times the 2nd term. Find:

(i) the first term and the common difference,

(4 marks)

(ii) the sum of the first 20 terms.

(3 marks)

(b) The first three terms of a Geometric Progression are $x - 2$, x and $2x - 3$. Calculate:

(i) the value of x ,

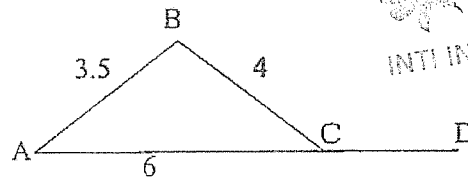
(3 marks)

(ii) the value of the fifth term.

(3 marks)

- (c) (i) Find the 10th term in the expansion of $(x^2 - x)^{12}$. (3 marks)
- (ii) Find the term independent of x in the expansion of $(2x^3 - \frac{1}{x})^{12}$. (4 marks)

- (d) Given the triangle as shown in the Figure (1) below:



- (i) Find the angle $\angle BCD$. (3 marks)
- (ii) Find the area of the triangle ABC. (2 marks)

Question 4

- (a) Differentiate the given products with respect to the variable:

(i) $y = \frac{1}{(2x^4 - x^2 + 1)^3}$ (3 marks)

(ii) $y = x^2 \sin 3x$ (3 marks)

(iii) $y = \frac{e^{4x} + 1}{e^{4x} - 1}$ (3 marks)

- (b) Find the equation of the tangent to the curve $2x^2 - xy + 3y^2 = 18$ at the point of (3, 1). (5 marks)

- (c) Find the stationary points of the function $y = x^3 - 6x^2 + 12$ and determine the nature of the stationary points. Hence sketch the graph of the function. (7 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. (4 marks)

Question 5

(a) Evaluate the following integrals:

(i) $\int 4\sin 2x + 3\cos \frac{1}{2}x \, dx.$

(3 marks)

(ii) $\int \frac{x+1}{x^2+2x+5} \, dx$

(3 marks)

(iii) $\int_1^2 3e^{2x} + 3 \, dx$

(3 marks)

(b) Use the trapezoidal rule to evaluate $\int_0^{\frac{\pi}{2}} \frac{1}{1+\sin x} \, dx$ using 6 equal intervals. Show your working in the form of a table and give your final answer to 4 significant figures.

(5 marks)

(c) Use Newton's Method to obtain a root of the equation $\ln x - 2 + x = 0$ with the initial value, $x_0 = 2$. Give your answer correct to three decimal places.

(5 marks)

(d) Find the area enclosed by the curve $y = 4x^2$ and $y^2 = 2x$.

(6 marks)