INTI
International College Penang
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session	:	**January 2016**
Programme	:	Diploma in Electrical and Electronic Engineering (DEEI)
Course	:	**MAT1121: Engineering Mathematics 1**
Date of Examination	:	11 March 2016 (Friday)
Time	:	8:00am – 10:00am
Duration	:	2 Hours Reading Time : Nil
Special Instructions	:	

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

IMPORTANT NOTE	:	**THIS PAPER SHOULD NOT BE TAKEN OUT OF THE EXAMINATION HALL**
Materials Permitted	:	Non-Programmable Calculator
Materials Provided	:	Formula Booklet 1
Examiner(s)	:	**Ms. 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: JANUARY 2016 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) $3^{2x} - 3^{x+1} + 2 = 0$, (5 marks)

(ii) $\sqrt{(3x+1)} + \sqrt{x} = 3$. (4 marks)

(b) Express $\dfrac{\sqrt{5}+3}{\sqrt{5}-2}$ as a single fraction with rational denominator. (3 marks)

(c) Given that $f(x) = 6x^3 + 19x^2 - 19x + k$ where k is a constant. If $(2x-1)$ is a factor of $f(x)$, find the value of k. Hence, factorize $f(x)$ completely. (6 marks)

(d) Find the range of values of k for which the equation $(k+1)x^2 + 2kx + (k+2) = 0$ has real roots. (3 marks)

(e) Express $y = 2x^2 + 8x + 5$ in the form $y = 2(x+p)^2 - q$ 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 $0^o \leq x \leq 360^o$.

(i) $2\tan x - \dfrac{1}{\tan x} = 1$, (6 marks)

(ii) $\cos 2x = 4\cos^2 x - 2\sin^2 x$. (6 marks)

(b) Prove the identity: $\cos^2 x(\operatorname{cosec}^2 x - \cot^2 x) \equiv \cos^2 x$. (5 marks)

(c) State the amplitude, period and phase shift of $y = 3\sin\left(2x + \frac{\pi}{2}\right)$. Hence, sketch the curve for one oscillation. (5 marks)

(d) Rewrite $r = \frac{4}{2 - \cos\theta}$ from polar equation into its rectangular form. (3 marks)

Question 3

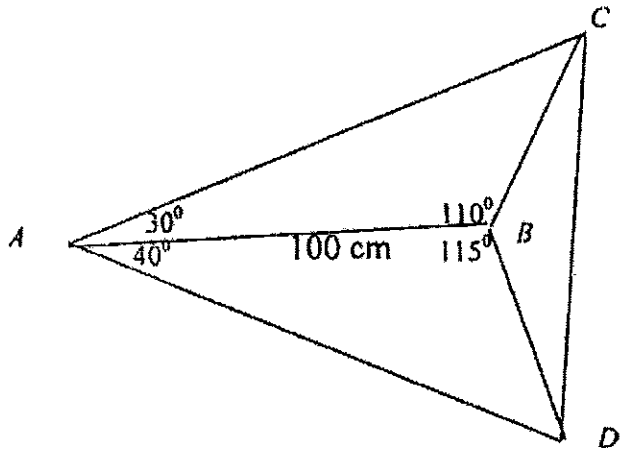
(a) The second term of a geometric series is $\frac{2}{5}$ and the fourth term is $\frac{8}{125}$. Find the sum to infinity of this series. (5 marks)

(b) The sum of the first 13 terms of an arithmetic series is 312 and the sum of the next 13 terms is 819. Find the first term and common difference of this series. (7 marks)

(c) (i) Obtain the first three terms in ascending power of x, of the expansion of $(1 + kx)^6$, where k is a non-zero constant. (2 marks)

(ii) Given that, in the expansion of $(1 + 6x + 4x^2)(1 + kx)^6$, the coefficient of x^2 is 31, find the possible values of k. (6 marks)

(d) Based on the figure shown below, calculate:



(i) the length of BC, (3 marks)

(ii) the area of ΔABC. (2 marks)

Question 4

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

(i) $y = \ln 2x + \sqrt{5x-2}$, (3 marks)

(ii) $y = \sin^4 x \cos^3 x$, (3 marks)

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

(b) Find the tangent equation of the curve $x^2 y + xy^2 = 12$ at the point $(1, -4)$. (5 marks)

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

(d) The variables u and v are connected by the equation $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$ where f is a constant. Given that $f = 10$ cm and u decreases at the rate of 2 cm per second, calculate the rate of increase of v when $u = 40$ cm. (5 marks)

Question 5

(a) Find the following integrals:

(i) $\int \sqrt{4-2x}\ dx$, (3 marks)

(ii) $\int 3\sin(6x-1)\ dx$, (3 marks)

(iii) $\int \frac{1-6x}{3+2x-6x^2}\ dx$. (3 marks)

(b) Use Simpson's rule to evaluate $\int_{0.2}^{1} \sqrt{1+x^3}\ dx$ using 8 equal intervals. Show your workings in the form of a table with answers correct to 4 significant figures. (6 marks)

(c) Use the Newton's Method to obtain a root of the equation $x^3 - 12x + 8 = 0$ with the initial value, $x_o = 3$. Give your answer correct to three decimal places. (5 marks)

(d) Find the area enclosed by the functions: $y = 5e^x$, $y = x^3$, $x = 1$ and $x = 4$. Let your answer be corrected to two decimal places. (5 marks)

--THE END--

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