INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**April 2019**
Programme	:	Diploma In Mechanical Engineering (DMEN)
Course	:	**MAT1121 : Engineering Mathematics 1**
Date of Examination	:	July 28, 2019 (Sunday)
Time	:	11:00 am -1:00 pm Reading Time: Nil
Duration	:	2 Hours
Special Instructions	:	

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

Materials permitted :
Non-Programmable Scientific Calculator

Materials provided :
Formula Booklet 1

Examiner (s)	:	**Chong Mee Teng** and Mohd Hafis Zakaria
Moderator	:	Assoc Prof Chan Kait Loon

*This paper consists of **4** printed pages, including the cover page.*

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
MAT1121: ENGINEERING MATHEMATICS 1
FINAL EXAMINATION: APRIL 2019 SESSION

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Question 1

(a) Solve the following equations:

(i) $2\log_3(x+4) - \log_3 9 = 2$ (5 marks)

(ii) $81^{2x+1} = \frac{1}{27}$ (3 marks)

(b) Simplify $\frac{\sqrt{x}}{1-2\sqrt{x}}$ by rationalizing the denominator. (3 marks)

(c) Use factor theorem to determine whether $(x+2)$ is a factor of $f(x) = x^3 - 4x^2 - 19x - 14$. Then factorize $f(x)$ completely. (6 marks)

(d) Find the range of values of p for which the equation $px^2 + 2(p-3)x + 2(p+1) = 0$ has real and distinct roots. (3 marks)

(e) Express $y = x^2 - 8x + 12$ in the form of $y = a(x-p)^2 - q$. Hence find the minimum vertex of the equation. Sketch the curve of $y = x^2 - 8x + 12$. (5 marks)

Question 2

(a) Express $\tan 3\theta$ in terms of $\tan\theta$. (7 marks)

(b) Solve $3\cos^2 x - \sin^2 x = 1$ for $0^o \leq x \leq 360^o$. (6 marks)

(c) Convert the polar equation into rectangular form: $r^2 = 4\sin 2\theta$. (4 marks)

(d) Prove the identity $(1-\cos A)(1+\sec A)=\sin A\tan A$. (5 marks)

(e) Find the exact value of $\sin 45^\circ + \sin 135^\circ + \sin 225^\circ + \sin 315^\circ$. (3 marks)

Question 3

(a) State the amplitude, period and phase shift of $y=7\sin(2x-\frac{\pi}{3})$. Hence, sketch the curve for one oscillation. (5 marks)

(b) Solve the equation $2\cosh 2x + 10\sinh 2x = 5$. (7 marks)

(c) In the expansion of $(1+ax)^4$, the coefficient of x^3 is 1372. Find the constant a. (4 marks)

(d) Use the Binomial Theorem to find the expansion of $(3x-2)^5$. Hence, use the expansion to estimate $(0.75)^5$. (5 marks)

(e) Solve the triangle ABC, given $a = 25\ cm$, $b = 18\ cm$ and $A = 63^\circ$. (4 marks)

Question 4

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

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

(ii) $y = e^{x^2}\ln 2x^2$ (3 marks)

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

(b) Find the equation of the tangent to the curve $3x^2-7y^2+4xy-8x=0$ at the point of $(-1,\ 1)$. (5 marks)

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

(d) The volume of a spherical balloon contracts at the rate of $4\pi\ cm^3/s$. Use derivatives to estimate the rate of change in its radius when the radius is $5\ cm$. (5 marks)

Question 5

(a) Find the following integrals:

(i) $\int_2^3 x^2 + x - 6\ \ dx$ (3 marks)

(ii) $\int \frac{\cos x}{1+\sin x}\, dx$ (3 marks)

(iii) $\int x(x-1)^5 dx$ (using the substitution $x = 1 + u$) (4 marks)

(b) Use the trapezoidal rule to evaluate $\int_0^1 \sqrt{x^2+1}\, dx$ using $n = 5$. Show your working in the form of table and give your final answer to 4 decimal places. (5 marks)

(c) The **Figure Q5 (c)** shows part of the curve $y = x^2$ and of the line $y = kx$, where k is a positive constant. Calculate the value of k for which the area of the shaded region is 0.288 units^2. (5 marks)

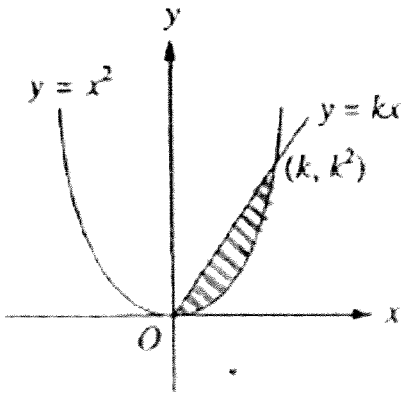

Figure Q5 (c)

(d) Find the volume of revolution of the solid generated when the part of the curve $y = x(1-x)$ above the x-axis is rotated 360° about the x-axis. (5 marks)

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