INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2018**
Programme	:	Diploma In Mechanical Engineering (DMEN)
Course	:	**MAT1121 : Engineering Mathematics 1**
Date of Examination	:	December 14, 2018 (Friday)
Time	:	8:00 am-10:00 am 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 Dennis Koh Mui Siang
Moderator	:	Assoc Prof Chan Kait Loon

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

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
MAT1121: ENGINEERING MATHEMATICS 1
FINAL EXAMINATION: AUGUST 2018 SESSION

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Question 1

(a) Solve the followings:

(i) $\log_5 81 \div \log_5 27$ (3 marks)

(ii) $2^x 2^3 = 3^x 5^x$ (4 marks)

(b) Given $\log_3 2 = p$ and $\log_3 5 = q$, evaluate $\log_3 1\frac{3}{5}$ in terms of p and q. (3 marks)

(c) By completing the square, solve the quadratic equation $x^2 + 3x + 1 = 0$. (5 marks)

(d) If the roots of the equation $m^2x^2 - (m+2)x + 1 = 0$ are equal, find the possible values of m. (4 marks)

(e) Given that the polynomial $P(x) = tx^4 + 3x^3 + 2x^2 + x - 8$ can be divided by $(x+1)$. Find the value of t. (3 marks)

(f) Show that $(x-3)$ is a factor of $f(x) = x^3 + 3x^2 - 13x - 15$. (3 marks)

Question 2

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

(i) $5\cos 2x + 8\sin x = 3$, (7 marks)

(ii) $\tan^2 x - \tan x = 2$. (6 marks)

(b) Prove the identity: $\dfrac{\cos x}{1-\sin x} - \dfrac{1}{\cos x} = \tan x$ (5 marks)

(c) Given that $\tan A = -\frac{3}{4}$ and $\tan B = 2$ and that both A and B are between 90° and 270°, find the values of $\sin A$ and $\cos B$ without using a calculator. (4 marks)

(d) Convert $(3\sqrt{2}, -2)$ from rectangular to polar coordinates. (3 marks)

Question 3

(a) State the amplitude, period and phase shift of $y = \sin(x - \frac{\pi}{6})$. Hence, sketch the curve for one oscillation. (5 marks)

(b) Solve the equation $7\sinh x - 5\cosh x = -1$. (7 marks)

(c) Expand $(3x + 2y^2)^5$. (5 marks)

(d) Find the fifth term of $\left(\frac{1}{2} + x\right)^{10}$. (4 marks)

(e) Solve the triangle ABC, given $a = 525$ cm, $c = 421$ cm and $A = 130°$. (4 marks)

Question 4

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

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

(ii) $y = (e^x - \frac{1}{e^x})^2$ (3 marks)

(iii) $y = \ln \frac{x-1}{x+1}$ (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 point of the function $y = x^2 - 8x$ and determine the nature of the stationary point. Hence sketch the graph of the function. (6 marks)

(d) The length of a side of a square is increasing at a rate of 0.2 cm/s. At what rate is the area increasing when the length of the side is 10 cm? (5 marks)

Question 5

(a) Find the following integrals:

(i) $\int (x + \frac{2}{x})^2 \, dx$ (4 marks)

(ii) $\int \frac{3 + e^x}{e^x} \, dx$ (4 marks)

(iii) $\int \frac{1}{3x+2} \, dx$ (2 marks)

(b) Use the trapezoidal rule to evaluate $\int_1^5 \sqrt{1 + x^2} \, dx$ using 8 equal intervals. Show your working in the form of a table and give your final answer to 2 decimal places. (6 marks)

(c) Find the area of the shaded region enclosed by the curve $y = x^2 - 4x + 3$ and the x axis as shown in **Figure Q5(c)**. (4 marks)

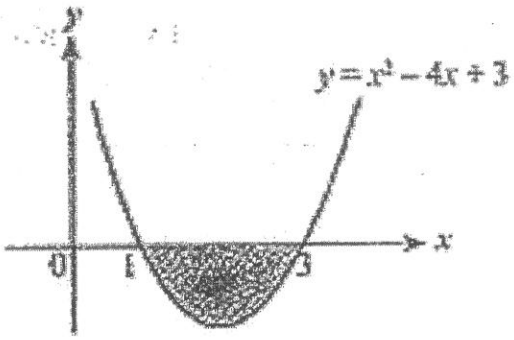

Figure Q5 (c)

(d) Find the volume of the solid generated when the shaded region is revolved through $360°$ about the y-axis as shown in **Figure Q5 (d)**. (5 marks)

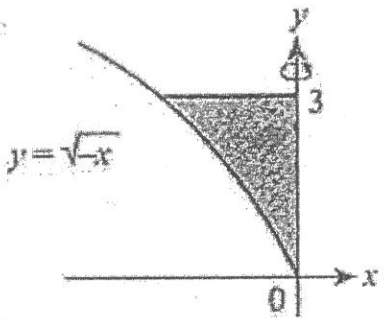

Figure Q5 (d)

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