INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2019**
Programme	:	Diploma In Mechanical Engineering (DMEN)
Course	:	**MAT1121 : Engineering Mathematics 1**
Date of Examination	:	December 13, 2019 (Friday)
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)	:	**Mohd Hafis Zakaria** and Chong Mee Teng
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: AUGUST 2019 SESSION

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Question 1

(a) Solve the following equations.

(i) $\log_3 2x - \log_3(x-1) = 2$ (4 marks)

(ii) $2^{2x} - 5(2^{x+1}) + 24 = 0$ (5 marks)

(b) Simplify $\frac{\sqrt{5}+3}{\sqrt{5}-2}$ by rationalizing the denominator. (3 marks)

(c) Given that $(x-4)$ is a factor of $p(x) = ax^3 - 13x^2 - 41x - 2a$. Find the value of a. Then factorize $p(x)$ completely. (6 marks)

(d) Find the values of k for which $x^2 - 5x + 9 = k(5-x)$ has two equal roots. (3 marks)

(e) Express $y = x^2 - 3x - 4$ in the form of $y = (x-p)^2 - q$. Hence find the minimum vertex of the equation. Sketch the curve of $y = x^2 - 3x - 4$. (4 marks)

Question 2

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

(i) $2\sin^2 x + 3\cos x - 3 = 0$ (6 marks)

(ii) $5\cos 2x + 8\sin x = 3$ (6 marks)

(b) Convert $(3, \frac{\pi}{6})$ from polar to rectangular coordinates. (3 marks)

(c) Prove the identity $\frac{1+\sin x}{\cos x} + \frac{\cos x}{1+\sin x} = \frac{2}{\cos x}$, (5 marks)

(d) Given that $\sin A = \frac{4}{5}$ and $\cos B = \frac{5}{13}$, where A is obtuse and B is acute, find the value of $\cos(A-B)$. (5 marks)

Question 3

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

(b) Solve the equation $4\cosh x - \sinh x = 8$. (7 marks)

(c) Find the term in x^5 in the expansion of $(5 - 2x)^8$. (4 marks)

(d) Find the first three terms, in ascending power of x, in the expansion of $(2 - 3x)^4(1 + 2x)^{10}$. (5 marks)

(e) Solve the triangle ABC, given $c = 25$, $A = 35°$ and $B = 68°$. (4 marks)

Question 4

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

(i) $y = 2(4 - 7x)^4$ (2 marks)

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

(iii) $y = \frac{3x}{\sin 2x}$ (4 marks)

(b) Find the equation of the tangent to the curve $3x^2 + 2xy + y^2 = 6$ at the point of $(-1, -1)$. (5 marks)

(c) Find the stationary points of the function $y = x^3 - 12x + 5$ and determine the nature of each stationary point. Hence, sketch the graph of the function. (6 marks)

(d) Oil is leaking from a pipeline under the sea and a circular patch is formed on the surface of the sea. The radius of the patch increases at a rate of 2 meters per hour. Find the rate at which the area is increasing when the radius of the patch is 25 meters. (5 marks)

Question 5

(a) Find the following integrals:

(i) $\int_1^2 \frac{6x^4-1}{x^2}\, dx$ (4 marks)

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

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

(b) Use the trapezium rule with 4 intervals to estimate the value of $\int_0^4 2\sqrt{4x-x^2}\, dx$, giving your answer correct to 2 decimal places. (5 marks)

(c) Find the total area of the shaded regions in **Figure Q5 (c).** (5 marks)

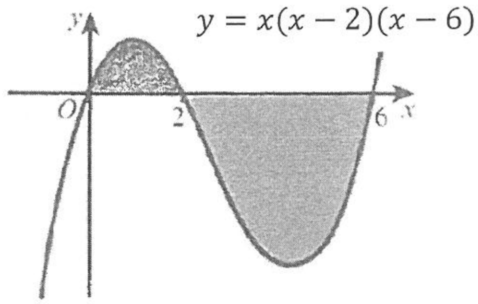

Figure Q5 (c)

(d) Find the volume obtained when the shaded region is rotated through 360^0 about the y-axis in **Figure Q5 (d)**. (5 marks)

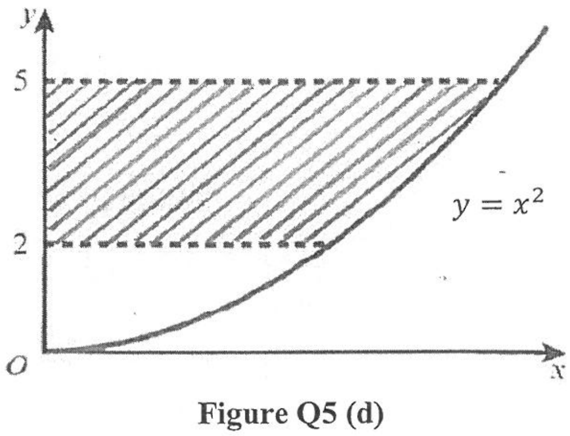

Figure Q5 (d)

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