



**INTI**  
International College Penang

**FINAL**  
Examination Paper

(COVER PAGE)

Session : April 2019

Programme : Diploma In Electrical & Electronic Engineering (DEEI)

Course : MAT1134: Engineering Mathematics 1

Date of Examination : 28 July 2019 (Sunday)

Time : 11:00am – 1:00pm 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 Eng

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

## INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING PROGRAMME (DEEI)  
 MAT 1134: ENGINEERING MATHEMATICS 1  
 FINAL EXAMINATION: APRIL 2019 SESSION

**Instructions:** 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)  $2 \log_3(x + 4) - \log_3 9 = 2$  (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 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  $0^\circ \leq x \leq 360^\circ$ . (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) The first term of an arithmetic progression is 3000 and the tenth term is 1200.
- (i) Find the sum of the first 20 terms of the progression. (4 marks)
- (ii) After how many terms does the sum of the progression become negative? (3 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  $a = 25 \text{ cm}$ ,  $b = 18 \text{ cm}$  and  $A = 63^\circ$ . (4 marks)

**Question 4**

- (a) Find  $\frac{dy}{dx}$  for each of the following:
- (i)  $y = \frac{1}{1+x+x^2}$  (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 points. Hence, sketch the graph of the function. (6 marks)
- (d) The volume of a spherical balloon contracts at the rate of  $4\pi \text{ cm}^3/\text{s}$ . Use derivatives to estimate the rate of change in its radius when the radius is  $5 \text{ cm}$ . (5 marks)

**Question 5**

(a) Find the following integrals:

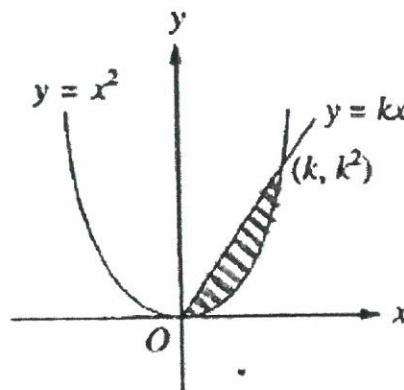
(i)  $\int_2^3 x^2 + x - 6 dx$  (3 marks)

(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 below 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  $0.288 \text{ units}^2$ . (5 marks)



(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  $360^\circ$  about the x-axis. (5 marks)