



FINAL
Examination Paper

(COVER PAGE)

Session : April 2019

Programme : Foundation in Science (CFSI)

Course : **MAT1210 : MATHEMATICS 1**

Date of Examination : 25 July 2019 (Thursday)

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 & Graph Paper

Examiner(s) : **Ms. Teng Mei Tuan**

Moderator : **Dr. Ch'ng Pei Eng**

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

INTI INTERNATIONAL COLLEGE PENANG
 FOUNDATION IN SCIENCE (CFSI)
 MAT1210: MATHEMATICS 1
 FINAL EXAMINATION: APRIL 2019 SESSION

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Question 1

(a) Solve the following equations:

(i) $3^{x^2+5x} = \frac{1}{9^2}$. (5 marks)

(ii) $(\lg x)^2 - \lg x^2 - 3 = 0$ (5 marks)

(b) Solve $\csc 3x = -2$ for $0^\circ < x < 360^\circ$. (5 marks)

(c) Find the exact value of the following without using calculator:

(i) $\sec 600^\circ$ (3 marks)

(ii) $\cot \frac{7\pi}{4}$ (3 marks)

(e) Rationalize the denominator of $\frac{\sqrt{3}+2}{2-\sqrt{3}}$. (4 marks)

Question 2

(a) Solve the radical equation $\sqrt{2x-5} - \sqrt{x-1} = 1$. (6 marks)

(b) Use the factor theorem to prove that $2x-1$ is a factor of $P(x) = 2x^3 - 3x^2 - 3x + 2$.
 Hence, factorize the $P(x)$. (6 marks)

(c) Solve the equation $2 \sin^2 x = 3 \cos x + 1$ for $0^\circ < x < 360^\circ$. (6 marks)

(d) Given $f(x) = \ln(x+1)e^{2x}$, find $f'(x)$ and $f''(x)$. (7 marks)

Question 3

- (a) Expand $(1+x)^{-\frac{3}{2}}$ in ascending powers of x up to and including the term in x^3 , simplifying the coefficients. (6 marks)

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{3!}x^3 \dots, \text{ where } n \text{ is rational and } |x| < 1$$

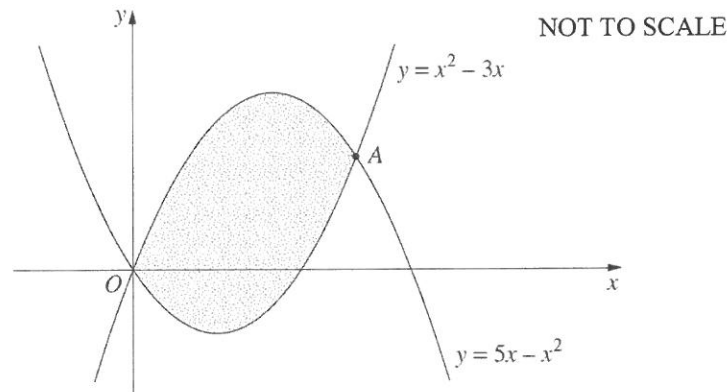
- (b) Given that $f(x) = 1 - 2x$, $x \in \mathfrak{R}$ and $g(x) = x^2 - 1$. Find
- (i) the function of $fg(x)$, (3 marks)
 - (ii) the value of x if $fg(x) = f(x)$, (4 marks)
 - (iii) the inverse function of $f(x)$. (3 marks)
- (c) Find $\frac{dy}{dx}$ for $x^2 + y - 2xy^2 + 5 = 3x$ by using implicit differentiation. (5 marks)
- (d) In a triangle ABC , $AB = 10\text{cm}$, $BC = x\sqrt{3}\text{cm}$, $AC = 5\sqrt{13}\text{cm}$ and $\angle ABC = 150^\circ$. Find the value of x . (4 marks)

Question 4

- (a) Consider the curve given by $f(x) = x^4 - 4x^3$.
- (i) Find the coordinates of the stationary points. (4 marks)
 - (ii) Determine the nature of the stationary points. (4 marks)
 - (iii) Find all values of x for which $\frac{d^2y}{dx^2} = 0$. (5 marks)
 - (iv) Sketch the graph of the curve $y = f(x)$, label all the stationary points, and the x -intercept(s). (6 marks)
 - (v) Find the interval(s) of x where the curve $y = f(x)$ is concave down. (1 marks)
- (b) Differentiate each of the following with respect to x .
- (i) $(x+2)^2 \sin x$ (2 marks)
 - (ii) $\frac{\tan x}{e^x}$ (3 marks)

Question 5

- (a) The diagram shows the parabolas $y = 5x - x^2$ and $y = x^2 - 3x$. The parabolas intersect at the origin O and the point A . The region between the two parabolas is shaded.



- (i) Find the x -coordinate of the point A . (1 mark)
- (ii) Find the area of the shaded region. (3 marks)
- (iii) Find the volume of the solid generated when the shaded region is revolved about y -axis by using Washer method. (5 marks)
- (b) Evaluate each of the following:
- (i) $\int \frac{3}{(x-6)^2} dx$ (2 marks)
- (ii) $\int \left(\sqrt{x} + \frac{x^2+1}{x} \right) dx$ (2 marks)
- (iii) $\int_2^5 \frac{2x+3}{x^2+3x} dx$ (3 marks)
- (iv) $\int_0^{\frac{\pi}{2}} \cos^2 x dx$ (4 marks)
- [Note: $\cos 2x = 2 \cos^2 x - 1$]
- (c) By using integration by parts, show that $\int_0^1 (1-x)e^{-\frac{1}{2}x} dx = 4e^{-\frac{1}{2}} - 2$. (5 marks)