



FINAL
Examination Paper

(COVER PAGE)

Session : January 2019

Programme : Foundation in Science (CFSI)

Course : MAT1210 : MATHEMATICS 1

Date of Examination : 22 March 2019 (Friday)

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. Choong Yin Ling

Moderator : Dr. Ch'ng Pei Eng

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

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FOUNDATION IN SCIENCE (CFSI)

MAT 1210 : MATHEMATICS 1

FINAL EXAMINATION : JANUARY 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) Express $\frac{3x^2-3x+10}{(x-2)(x^2+4)}$ in partial fractions. (4marks)
- (b) Solve $2 = \sqrt{3x-2} - \sqrt{10-x}$. Check for extraneous solutions. (5marks)
- (c) Simplify the expression $\left(\frac{8a^3b^{-6}}{c^{-9}}\right)^{\frac{1}{3}}$. (2 marks)
- (d) Prove that $\frac{\tan x - 1}{\tan x + 1} = \frac{1 - \cot x}{1 + \cot x}$. (5marks)
- (e) If $f(x) = x \sin(4x)$, find $f'(x)$. Hence, evaluate $\int_0^{\frac{\pi}{8}} x \cos(4x) dx$. (5marks)
- (f) Find the equation of the tangent to the curve $y = x^2 \ln x$ at the point (e, e^2) . (4marks)

Question 2

- (a) Find the remainder when $f(x) = 12x^3 + 16x^2 - 5x - 3$ is divided by $(2x - 1)$. Hence, find all the zeros of $f(x)$. (5marks)
- (b) Find the exact value of $\left(\sin\left(\cos^{-1}\left(\frac{\sqrt{21}}{7}\right)\right)\right)$. (3marks)
- (c) A 5m flag pole is not standing up straight. There is a wire attached to the top of the pole and anchored on the ground. The wire is 4.4m long. The wire makes a 65° angle with the ground. What angle does the flag pole make with the wire? (4marks)
- (d) Find the exact value of $\sec\left(-\frac{\pi}{3}\right)$ without using calculator. (3 marks)
- (e) Solve $\cos 2x + \cos x + 1 = 0$ to the nearest degree on $[0, 360)$. (6marks)
- (f) Given that $g(x) = \frac{x-4}{x-2}$, find $g^{-1}(x)$. (4marks)

Question 3

(a) Let $f(x) = 4x - 3$, $g(x) = 4x^2 - 7x + 3$ and $h(x) = x - 1$.

(i) Find $fh(-1)$ and $\left(\frac{g}{f}\right)(5)$.

(ii) Solve for x when $f(x) = g(x)$.

(5marks)

(b) The total cost and total revenue in RM from producing x items are given by:

$$C(x) = 5000 + 600x$$

$$R(x) = -\frac{1}{2}x^2 + 1000x$$

The total-profit function is given by $P(x) = R(x) - C(x)$. Find the maximum profit and the number of items, x , for which the total profit is maximum. (5marks)

(c) Given that $f(x) = \ln(\sin(x^2))$, show that $f'(x) = 2x\cot(x^2)$. (5marks)

(d) Solve the equations:

(i) $8^{4x-3} = 4^{3x+5}$ (4marks)

(ii) $-\log(x - 2) = 1 - \log(x^2 - 4)$ (6marks)

Question 4

(a) Given that $\sin(x^2y^2) = x$, show by implicit differentiation $2xy^2 + 2x^2y \left(\frac{dy}{dx}\right) = \sec(x^2y^2)$. (5marks)

(b) If $y = (x^2 - 1)(1 + x)$, show that $x \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + 2x - 2 = 0$. (5marks)

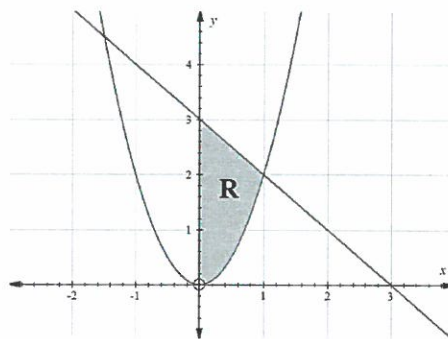
(c) Consider the function $f(x) = x^5 - x^3 + 2x^2 - 1$.

(i) Using sign changes, show that $f(x) = 0$ has a root between 0.5 and 1.

(ii) Use Newton's Raphson Method to evaluate the root, correct to 6 decimal places.

(iii) How many iterations are needed in order to produce the same accuracy in part (ii)? (6marks)

(d) The diagram shows the region R, bounded by $y = 2x^2$, $y = 3 - x$, and $x \geq 0$. Given that the curves $y = 2x^2$ intersects the line $y = 3 - x$ at the point $(1, 2)$ and $(-1.5, 4.5)$. Find the area of the shaded region R.

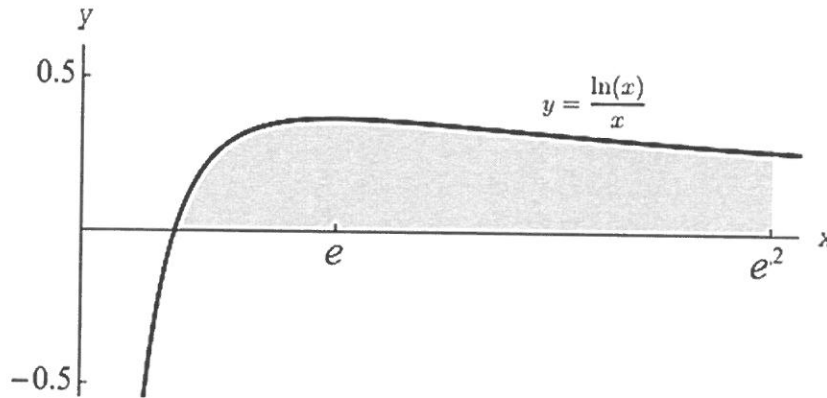


(5marks)

(e) Use Binomial Theorem to expand $(1 + x)^{-3}$ up to and including the term x^3 . (4marks)

Question 5

- (a) Find the function $f(x)$ whose tangent has slope $(x + 1)e^{-x}$ for each value of x and whose graph passes through the point $(1, 5)$. (6marks)
- (b) The diagram shows the shaded region enclosed by the curve $y = \frac{\ln x}{x}$ and the line $x = e^2$. Set up and evaluate the integral that gives the volume of the solid formed by revolving the shaded region about the x-axis. (7 marks)



- (c) Find $\int \frac{\sin x}{(2+3\cos x)^2} dx$ by substitution method. (6marks)
- (d) Find $\int \frac{\ln x}{x^3} dx$ by using integration by parts. (6marks)

~ The End ~
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