FINAL
Alternative Assessment

Session	:	**January 2022**
Programme	:	Foundation in Science (CFSI)
Course	:	**MAT1210: Mathematics 1**
Date of Examination	:	8 March 2022 (Tuesday)
Time	:	2:00pm – 4:30pm Reading Time : Nil
Duration	:	2 hours + 30 minutes (uploading time)
Special Instructions	:	

This paper consists of **FOUR (4)** questions. Answer **ALL** the questions handwritten showing all steps in either **BLUE/BLACK** ink on foolscap papers.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Formula Booklet 1

Examiner(s)	:	**Ms. Teng Mei Tuan**
Chief Moderator	:	Mr. Foo Kim Eng

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

FOUNDATION IN SCIENCE (CFSI)
MAT1210: MATHEMATICS 1
FINAL ALTERNATIVE ASSESSMENT: JANUARY 2022 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer **ALL** the questions handwritten showing all steps in either **BLUE/BLACK** ink on foolscap papers.

Question 1

(a) By rationalizing the denominators, express $\frac{1}{3-\sqrt{2}}-\frac{1}{3+\sqrt{2}}$ in simplest form. (3 marks)

(b) Solve $\left(\frac{14x^3y^{-5}z^7}{-2xy^{10}}\right)^{-1}$ to the simplest form with positive exponents. (4 marks)

(c) Find the exact solution for the following equations:
(i) $3e^x = 5\left(e^x - 2e^{-x}\right)$. (3 marks)

(ii) $\log_9 4x = \log_3(8-x)$. (5 marks)

(d) Show that $x-2$ is a factor of $P(x) = x^3 + 2x^2 - 5x - 6$ and hence factorise the expression completely. (5 marks)

(e) Use the binomial theorem to find the fifth term of $\left(x-\frac{1}{x}\right)^6$. (2 marks)

(f) Find the exact value $\sin 75°$ by using difference identities without using calculator. (3 marks)

Question 2

(a) Given $\tan x = \frac{5}{12}$ where x located at $180° < x < 270°$, find $\cos 2x$. (4 marks)

(b) (i) Prove $\left(\frac{1}{\cos x} - \tan x\right)^2 = \frac{1-\sin x}{1+\sin x}$. (4 marks)

(ii) Hence, solve the equation $\left(\frac{1}{\cos x} - \tan x\right)^2 = \frac{1}{3}$, for $0 \le x < \pi$. (3 marks)

(c) Given that $f(x) = \frac{48}{x-1}, x \ne 1$ and $g(x) = 2x - 4$. Find

(i) the expression of $g \circ f(x)$. (3 marks)

(ii) the inverse function of $f(x)$ and the condition that satisfied it. (3 marks)

(iii) the expression of $g \bullet f^{-1}(x)$ in the factorized form. (1 mark)

(d) Differentiate each of the followings with respect to *x*, simplify and factorise the answer:

(i) $e^{2x} \sin(x+1)$. (3 marks)

(ii) $\frac{\ln^2 x}{x}$. (4 marks)

Question 3

(a) Find $\frac{dy}{dx}$ for $x^2 - 2xy^2 + y = 16x$ by using implicit differentiation. (7 marks)

(b) Consider the curve given by $f(x) = x^3 - 6x^2 + 9x + 1$.

(i) Find the coordinates of the stationary points. (4 marks)

(ii) Determine the nature of the stationary points. (3 marks)

(iii) Find the coordinates of the point of inflection. (3 marks)

(c) A cube is expanding in such a way that its sides are changing at the rate of 2cm/s.

Find the rate of change of the total surface area when its volume is 125cm^3. (4 marks)

(d) The straight line $y = x - 4$ and the curve $y = x^2 - 4x$ intersect at two points. Find the *x*-ordinates of these two points. Hence, find the area of region enclosed by $y = x - 4$ and $y = x^2 - 4x$. (4 marks)

Question 4

(a) Find each of the followings:

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

(ii) $\int x^3\sqrt{9x^4+4}\,dx$, by using the substitution method. (4 marks)

(b) Find the volume of the solid generated when the region enclosed by $y = x^3, y = 8$, and the *y*-axis is rotated through $360°$ about the *x*-axis. (4 marks)

(c) Evaluate the following definite integral, correct your answers to 2 decimal places.

(i) $\int_1^2 x\left(e^{x^2}-1\right)dx$. (3 marks)

(ii) $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}}(2\cos\theta-3)(\cos\theta+1)\,d\theta$. (6 marks)

(d) Find the exact value of the definite integral $\int_0^{\frac{\pi}{2}}\theta\sin\frac{\theta}{2}\,d\theta$ of by using integration by parts. (5 marks)

~THE END~