PENINSULA COLLEGE GEORGETOWN DK266-03(P)

FINAL EXAMINATION

Semester	:	**SEPTEMBER 2025 SEMESTER**
Programme Name	:	**FOUNDATION IN ARTS**
Course Code & Name	:	**FA1134 MATHEMATICS**
Duration	:	**3 HOURS**

INSTRUCTIONS TO CANDIDATES:

1. Please read the instructions given in the question paper **CAREFULLY.**
2. The question paper consists of **FOUR (4)** questions.
3. Answer **ALL** questions in the question paper.
4. Answers to the questions are to be written into the examination booklet.
5. Electronic dictionaries, lecture notes, files or any unauthorised materials except writing equipment are strictly prohibited.

This question paper must be submitted along with all used and/or unused rough papers and/ or graph papers (if any). Candidates are **NOT ALLOWED** to take any examination paper(s) used or unused out of the examination hall.

WARNING:

The Examination Board of Peninsula College Georgetown regards cheating as a very serious offence and will not hesitate to mete out the appropriate punitive actions according to the severity of the offence committed, and in accordance with the clauses stipulated in the Students' Handbook, up to and including expulsion from Peninsula College Georgetown.

(*This booklet contains 6 printed pages including this page*)

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE ALLOWED TO DO SO

Answer **ALL** questions on the separate sheet provided. **[100 marks]**

1. a) Define each of the following subsets of the real numbers and give one distinct example for each:

i) Natural numbers (2 marks)

ii) Whole numbers (2 marks)

iii) Integers (2 marks)

iv) Rational numbers (2 marks)

v) Irrational numbers (2 marks)

b) i) Simplify and give your answer as an integer:

$$\frac{4^3 . 4^{-1}}{4^2}$$

(3 marks)

ii) Simplify and express with positive indices only:

$$\frac{a^5 b^{-2}}{a^{-1} b^3}$$

(3 marks)

iii) Simplify the below:

$$\frac{5}{\sqrt{8}}$$

(3 marks)

c) i) Let $f(x) = 2x + 1$ with domain $\{1,2,3,4\}$, state the range of ***f.*** (2 marks)

ii) Evaluate the limit (showing a suitable algebraic method):

$$\lim_{x \to 3} \frac{x^2 - 2x - 3}{x - 3}$$

(4 marks)

Total: [25 marks]

2. a) Given α and β are the roots of the quadratic equation $x^2 - 7x + 14 = 0$, form a new quadratic equation with roots $\frac{\alpha}{3}$ and $\frac{\beta}{3}$

(7 marks)

b) Solve by completing the square, give answers correct to four decimal places:

i) $3x^2 - 12x - 9 = 0$ (5 marks)

ii) $2x^2 = 2(4x + 7)$ (5 marks)

c) Using the Laws of Indices, simplify each expression and give your answers with positive indices only.

i) $\left(\frac{a^{-2}b^{3}}{a\,b^{-1}}\right)^{2} \cdot a^{-1}b$

(4 marks)

ii) $\frac{32^{\frac{3}{5}} \cdot 8^{-\frac{1}{3}}}{2^{-4}}$

(4 marks)

Total: [25 marks]

3. a) A progression is: **160, 80, 40, 20, …**

i) Identify the progression type (4 marks)

ii) Find S_n, the sum of the first n terms, in terms of n (7 marks)

iii) Hence compute S_6 and the 6th term T_6. (8 marks)

b) Geometric progression: $6, 12, 24, \ldots$

i) Determine the common ratio r (3 marks)

ii) Find S_5 (3 marks)

Total: [25 marks]

4. a) i) Apply the rules of differentiation to find the derivative $\frac{dy}{dx}$ for the function:

$$y = 5x^4 - 2x^2 + 8x - 10$$

(5 marks)

ii) Apply the rules of indefinite integration to find the integral $\int f(x)\ dx$ for the function:

$$f(x) = 9x^2 + 3x - 5$$

(5 marks)

b) The revenue (R) in Ringgit Malaysia (RM) for selling x units of a product is given by the function:

$$R(x) = 2x^3 - 9x^2 + 12x + 50$$

i) Differentiate the function $R(x)$ with respect to x to determine the rate of change of revenue with respect to the number of units sold.

(6 marks)

ii) Hence, find the rate of change when $x = 2$ units. (4 marks)

c) Calculate the definite integral:

$$\int_{1}^{3} (4x - 2)\ dx$$

(5 marks)

Total: [25 marks]

- END OF QUESTIONS -

FORMULAE LIST

Real Number

$$Addition, (a+bi)+(c+di)=(a+c)+(b+d)i$$

$$Subtraction, (a+bi)-(c+di)=(a-c)+(b-d)i$$

$$Multiplication, (a+bi)(c+di)=(ac-bd)+(ad+bc)i$$

$$Division, \frac{a+bi}{c+di}\cdot\frac{c+di}{c+di}=\frac{(a+bi)(c-di)}{c^2+d^2}$$

$$Multiplication\ Laws, a^m\cdot a^n=a^{m+n}$$

$$Division\ Laws, \frac{a^m}{a^n}=a^{m-n}$$

$$Power, (a^m)^n=a^{m-n}$$
$$Multiply, a^n.b^n=(ab)^n$$

$$Fractional\ Powers, a^{\frac{1}{n}}=\sqrt[n]{a}$$

$$a^0=1\ (for\ a\neq 0)$$
$$a^{-n}=\frac{1}{a^n}$$

$$Law\ (a>0, b>0)$$

$$Multiply, \sqrt{a}\cdot\sqrt{b}=\sqrt{ab}$$

$$Division, \frac{\sqrt{a}}{\sqrt{b}}=\sqrt{\frac{a}{b}}$$

Functions

$$Linear\ functions: y = mx+c$$

$$m: \frac{y2-y1}{x2-x1}$$

$$x-axis, y=0$$

$$y-axis, x=0$$

$$Quadratic\ Functions: ax^2+bx+c$$

$$Quadratic\ Formula: x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$Completing\ the\ square: x^2+bx+\left(\frac{b}{2}\right)^2=c+(\frac{b}{2})^2$$

$$Forming\ quadratic\ equations\ from\ the\ given\ roots:$$

$$x^2 - (sum\ of\ roots)x + (product\ of\ roots) = 0$$

$$Log_a(MN) = log_a M + log_a N$$

$$Log_a(\frac{M}{N}) = log_a M - log_a N$$

$$Log_a M^k = k\ log_a M$$

$$log\ a = 1$$

$$log\ 1 = 0$$

$$Limits: \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n = e$$

Sequence

$$T_n = a + (n-1)d$$

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

$$S_n = \frac{n}{2}(a + l)$$

$$T_n = S_n - S_{n-1}$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}\ ,\ r \neq 1$$

$$Alternative\ form\ (when\ |r| < 1):$$
$$S_n = \frac{a(1 - r^n)}{1 - r}$$

$$Sum\ to\ infinity\ (when\ |r| < 1):$$
$$S_\infty = \frac{a}{1 - r}$$

$$T_n = S_n - S_{n-1}$$

Differentiation

$$Gradient = \frac{f(x+h) - f(x)}{h}$$

$$f'(x) = \lim_{h\to 0}\frac{f(x+h) - f(x)}{h}$$

$$Contant\ function, If\ y = f(x) = k, hence\ \frac{dy}{dx} = f'(x) = 0$$

$$Indentity\ Function, If\ y = f(x) = x, hence\ \frac{dy}{dx} = f'(x) = 1$$

$$Power\ function, If\ y = f(x) = x^n, hence\ \frac{dy}{dx} = f'(x) = nx^{n-1}$$

$$Power\ and\ constant\ function, If\ y = f(x) = kx^n, hence\ \frac{dy}{dx} = f'(x) = knx^{n-1}$$

$$Sum/Difference\ \ rule, If\ y = (f \pm g)(x), hence\ \frac{dy}{dx} = (f \pm g)'(x) = f'(x) \pm g'(x)$$

$$Product\ rule, If\ y = (fg)(x), hence\ \frac{dy}{dx} = (fg)'(x) = f(x)g'(x) + g(x)f'(x)$$

$$uv' + u'v$$

$$Quotient\ rule, If\ y = \left(\frac{f}{g}\right)(x), hence \frac{dy}{dx} = \left(\frac{f}{g}\right)'(x) = \frac{g(x)f'(x) - f(x)g'(x)}{(g(x))^2}\ , g(x) \neq 0$$

$$Chain\ rule, If\ y = (f \cdot g)(x), hence \frac{dy}{dx} = (f \cdot g)'(x) = f'\big(g(x)\big)g'(x)$$

$$Power\ rule, If\ y = [f(x)]^n, \frac{dy}{dx} = n[f(x)]^{n-1}f'(x)$$

$$If\ y = f(x)g(x), y' = f'(x)g(x) + f(x)g'(x)$$

Integrals

$$Constant\ Function, \frac{d}{dx}(C) = 0$$

$$Identity\ Function, \frac{d}{dx}(x) = 1$$

$$Power, \frac{d}{dx}(x^n) = nx^{n-1}$$

$$Constant\ Multiple, \frac{d}{dx}\big(kf(x)\big) = k\frac{d}{dx}\big(f(x)\big)$$

$$Linearity, \frac{d}{dx}\big(f(x) \pm g(x)\big) = \frac{d}{dx}\big(f(x)\big) \pm \frac{d}{dx}\big(g(x)\big)$$

$$Constant\ Function, \int 0\,dx = c$$

$$Identity\ Function, \int 1\,dx = x + C$$

$$Power \int x^n\,dx = \frac{x^{n+1}}{n+1} + c, n \neq -1$$

$$Constant\ Multiple, \int kf\,(x)dx = k\int f(x)\,dx$$

$$Linearity, \int [f(x) + g(x)]\,dx = \int f(x)\,dx + \int g(x)\,dx$$

$$Antiderivative, \int (ax+b)^n \, dx = \frac{(ax+b)^{n+1}}{a(n+1)} + C, n \neq 1$$

$$Definite\ Integrals, \int_a^b f(x)\, dx = F(x)|_{x=a}^{b} = F(b) - F(a)$$

Property:

$$\int_a^a f(x)\, dx = 0$$

$$\int_{b.}^{a.} f(x)\, dx = -\int_a^b f(x)\, dx$$

$$\int_a^b kf(x)\, dx = k\int_a^b f(x)\, dx, where\ k\ is\ a\ constant$$

$$\int_a^b [f(x)+g(x)]\, dx = \int_a^b f(x)\, dx + \int_a^b g(x)\, dx$$

$$\int_a^b f(x)\, dx = \int_a^c f(x)\, dx + \int_c^b g(x)\, dx, a < c < b$$

$$\int_a^b f\big(g(x)\big)g'(x)dx = \int_{g(a)}^{g(b)} f(u)\, du$$

- END OF FORMULAE LIST -