UNIVERSITI POLY-TECH MALAYSIA
UPTM

FINAL EXAMINATION

DIPLOMA IN COMPUTER SCIENCE

COURSE	:	**CALCULUS**
COURSE CODE	:	**MAT2113/MAT2024**
DURATION	:	**2 HOURS AND 30 MINUTES**

INSTRUCTIONS TO CANDIDATES:

1. This question paper consists of **FOUR (4)** questions.
2. Answer ALL questions in the Answer Booklet provided.
3. Please check to make sure that this examination pack consists of:
   i. The Question Paper
   ii. An Answer Booklet
   iii. Appendix 1(1), Appendix 1(2) and Appendix 1(3).
4. Do not bring any material into the examination hall. Electronic calculator is allowed.
5. Please write your answer using permanent ink.

MYKAD/ PASSPORT NO : _____

ID. NO. : _____

LECTURER : _____

SECTION : _____

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO

This question paper consists of 5 printed pages including the front page

QUESTION 1

a. Calculate

$$\lim_{x\to 4}\left(\frac{-7}{\sqrt{4x}}\right)+\lim_{x\to 5}\left(\frac{2x^3-3}{6x+1}\right)$$

(4 marks)

b. Find

$$\lim_{x\to\infty}\frac{6x^5-3x^3+9x^7}{2x^3-3x^7+4}$$

(4 marks)

c. Evaluate

$$\lim_{x\to 2}\frac{4x-8}{x^2-9x+14}$$

(5 marks)

d. Find

$$\lim_{x\to 3}\frac{2x-6}{\sqrt{5}-\sqrt{3x-4}}$$

(6 marks)

e. Given $f(x)=\begin{cases}5x-2\ , & x<6\\ -2x^2+mx+8\ , & x\geq 6\end{cases}$

Find the value of m such that the $\lim_{x\to 6} f(x)$ exists.

(6 marks)

(Total: 25 marks)

QUESTION 2

a. Determine $\frac{dy}{dx}$ for the following equations:

i. $y = 6x^4 - 2x^3 + 7x$

(3 marks)

ii. $y = \sqrt{(2x^2 + 9)}$

(4 marks)

b. Apply the quotient rule to find $\frac{dy}{dx}$ for

$$y = \frac{3e^{7x}}{5x^2 - 2}$$

(6 marks)

c. Let $y = 2x^2 - 3x + 7$,

i. determine the slope, m at $x = -3$

(3 marks)

ii. find the equation of the tangent line at the point $x = -3$

(4 marks)

d. Let the function f be defined by $f(x) = 2x^3 + 6x^2 - 5$ on the interval $[-4,2]$.

i. Find $f'(x)$

(2 marks)

ii. Find the critical points of f.

(3 marks)

iii. Evaluate $f(x)$ at all endpoints to find the absolute maximum and minimum of the function f.

(5 marks)

(Total: 30 marks)

QUESTION 3

a. Let

$$f(x) = (30x - 21)(5x^2 - 7x + 2)^4$$

Evaluate the integral using substitution technique.

(7 marks)

b. Find the second derivative for $f(x) = 5x^4 + 3x$

(3 marks)

(Total: 10 marks)

QUESTION 4

a. Find the integration of

i. $\int -3x^5 \, dx$

(2 marks)

ii. $\int (3x^3 - 4x^2 - 3x) \, dx$

(3 marks)

iii. $\int \frac{3}{7x + 6} \, dx$

(4 marks)

b. Evaluate

$$\int \left(3 - 2e^{9x} + \frac{3}{5}x\right) \, dx$$

(4 marks)

c. Evaluate

$$\int_2^4 (6x(x^2 + 7)) \, dx$$

(5 marks)

d. Use integration by parts to integrate

$$\int 4xe^{-8x} \, dx$$

(6 marks)

e. i. Find the value of A and B from the given partial fraction:

$$\int \frac{2x-6}{(x-4)(x+9)}dx = \int \frac{A}{(x-4)} + \frac{B}{(x+9)}dx$$

(6 marks)

ii. Solve the following integration:

$$\int \frac{2x-6}{(x-4)(x+9)}dx = \int \frac{A}{(x-4)} + \frac{B}{(x+9)}dx$$

(5 marks)

(Total: 35 marks)

(TOTAL: 100 MARKS)

END OF QUESTION PAPER

APPENDIX 1 (1)

LIMITS AND CONTINUITY

a. Basic properties and rules of limits

1. $\lim_{x\to a} kf(x) = k\lim_{x\to a} f(x) = kL$
2. $\lim_{x\to a}[f(x) \pm g(x)] = \lim_{x\to a} f(x) \pm \lim_{x\to a} g(x) = L + M$
3. $\lim_{x\to a}[f(x)\cdot g(x)] = \lim_{x\to a} f(x)\cdot \lim_{x\to a} g(x) = LM$
4. $\lim_{x\to a}[\frac{f(x)}{g(x)}] = \frac{\lim_{x\to a} f(x)}{\lim_{x\to a} g(x)} = \frac{L}{M},\ M \neq 0$
5. $\lim_{x\to a} \sqrt[n]{f(x)} = \sqrt[n]{\lim_{x\to a} f(x)} = \sqrt[n]{L}$, provided $L > 0$ if n is even
6. $\lim_{x\to a}[f(x)]^n = \left[\lim_{x\to a} f(x)\right]^n = L^n$

b. A function f is said to be continuous at $x = c$ provided the following conditions are satisfied.

1. $\lim_{x\to c} f(x)$ exists
2. $f(c)$ exists
3. $\lim_{x\to c} f(x) = f(c)$

APPENDIX 1 (2)

THE DERIVATIVES OF A FUNCTION

a. Derivatives of functions

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

2. $\frac{d}{dx}[f(x)]^n = n[f(x)]^{n-1} \cdot f'(x)$

3. $\frac{d}{dx}\left(e^{f(x)}\right) = e^{f(x)} \cdot f'(x)$

4. $\frac{d}{dx}\ln\left(f(x)\right) = \frac{1}{f(x)} \cdot f'(x)$

b. Techniques of differentiation

1. Derivatives of sum and difference

$$\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}f(x) \pm \frac{d}{dx}g(x)$$

2. The Product Rule

$$\frac{dy}{dx} = uv' + vu'$$

3. The Quotient Rule

$$\frac{dy}{dx} = \frac{vu' - uv'}{v^2}$$

4. The Chain Rule

$$f'(x) = n.[f(x)]^{n-1}.f'(x)$$

APPENDIX 1 (3)

THE INTEGRATION OF A FUNCTION

a. The Indefinite Integral of functions

1. $\int x^n dx = \frac{x^{n+1}}{n+1} + c$
2. $\int k dx = kx + c$
3. $\int [f(x) \pm g(x)] = \int f(x)dx \pm \int g(x)dx$
4. $\int e^{f(x)}\ dx = \frac{e^{f(x)}}{f'(x)} + c$
5. $\int \frac{1}{ax+b} dx = \frac{ln|ax+b|}{a} + c$

b. The Definite Integral of function

$\int_a^b f(x)dx = F(b) - F(a)$

c. Integration by parts

$$\int (u \,.\, dv)dx = uv - \int (v \,.\, du)$$