Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	CALCULUS
COURSE CODE	:	DAS 20803
PROGRAMME	:	DAU
EXAMINATION DATE	:	JUNE / JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN **SECTION A** AND ANSWER **THREE (3)** QUESTIONS ONLY IN **SECTION B**.

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

SECTION A

Q1 (a) Solve the following integrals.

(i) $\int \frac{2x^6+1}{x^3}dx$.

(2 marks)

(ii) $\int_1^8 \sqrt[3]{x} - \frac{1}{\sqrt[3]{x}}dx$.

(3 marks)

(b) Solve the given integrals.

(i) $\int \frac{x}{1-4x^2}dx$ by using substitution.

(4 marks)

(ii) $\int \frac{3x+11}{x^2-3x-10}dx$ by using partial fraction.

(4 marks)

(c) Evaluate $\int_1^4 \left(\frac{x^2}{\sqrt{x+1}}\right)dx$ using Simpson's Rule with n = 6. Give the answer to four decimal places.

(7 marks)

Q2 (a) Find the area of the region bounded above by $y = 2 + x - x^2$, bounded below by $y + x + 1 = 0$.

(7 marks)

(b) Region R bounded by curve $y = 2x^2 + 10$ and $y = 4x + 16$ that intersect at point P and Q.

(i) Determine points P and Q.

(4 marks)

(ii) Find the area enclosed by the curve and the line.

(5 marks)

(c) Determine the length of the curve $y = \frac{(x^2 + 2)^{\frac{2}{3}}}{3}$ from $x = 3$ to $x = 4$.

(4 marks)

SECTION B

Q3 (a) Sketch the graph and determine the domain and range.

(i) $y = x^2 - 2$.

(4 marks)

(ii) $y = -x^3 + 1$.

(4 marks)

(iii) $y = -\frac{1}{x} + 3$.

(4 marks)

(b) Given $f(x) = \frac{1}{x^2} + 1$ and $g(x) = x + 4$. Find

(i) $g \circ f(x)$.

(3 marks)

(ii) $f \circ g^{-1}(x)$.

(5 marks)

Q4 (a) Evaluate the following limit, if it exists.

(i) $\lim_{x \to 3} \left(\frac{2 - x}{x^2 + 5x - 7} \right)$.

(3 marks)

(ii) $\lim_{x \to -2} \left(\frac{x + 2}{x^2 - x - 6} \right)$.

(3 marks)

(iii) $\lim_{x \to 2} \left(\frac{2x - 3}{x^2 + 3x - 4} \right)$.

(3 marks)

(b) Sketch the graph and find the limit, if it exists.

(i) $\lim_{x\to -2^+}\left(\frac{1}{x+2}\right)$.

(ii) $\lim_{x\to -2^-}\left(\frac{1}{x+2}\right)$.

(iii) $\lim_{x\to -2}\left(\frac{1}{x+2}\right)$.

(6 marks)

(c)

$$f(x)=\begin{cases}3x & , \quad x\le 1\\ r\sqrt{x}+s & , \quad 1<x\le 4\\ x+3 & , \quad x>4\end{cases}$$

If $f(x)$ is a continuous function, find the value of r and s.

(5 marks)

Q5 (a) Find $\frac{dy}{dx}$ of the given functions.

(i) $y=x^{-2}-\frac{\cos x}{5}+\frac{1}{2}\ln x$.

(3 marks)

(ii) $y=\frac{e^x+3}{2}+\ln x^2$.

(2 marks)

(b) Differentiate the following functions by using technique of differentiation.

(i) $y=4e^x\sin x$

(5 marks)

(ii) $y=\frac{x^3}{2\ln x+1}$.

(5 marks)

(iii) $y = \sqrt{3x^4 - 6\cos x}$

(5 marks)

Q6 (a) Given $f(x) = 2x^3 + 3x^2 - 36x$, find the extrema, point of inflection, the interval where the function is increasing, the intervals where the function is decreasing, the intervals where the function is concave up and where it is concave down. Hence, fill the blanks of the **Table Q6** below.

Table Q6

Value Type	Test Value	Critical Value	Test Value	Inflection point	Test value	Critical Value	Test Value
x	$x=$	$x=$	$x=$	$x=$	$x=$	$x=$	$x=$
$f(x)$							
$f'(x)$							
$f''(x)$							
Graph Characteristics							

(8 marks)

(b) The area of a drop of blood A cm^2 expands by the formula $A = 4t^2 + t$ after t second. Find the rate of change of the area of the ink when $t = 3$.

(3 marks)

(c) A spherical balloon is being blown up such that its volume increases at the constant rate of $15.3\pi cm^3 / s$. Find the radius of the balloon at the instant when the radius is increasing at the rate of $0.1 cm / s$.

(5 marks)

(d) Using L'Hospital's Rule, find $\lim_{x \to +\infty} f(x) = \dfrac{2 + 7x^2 - 4x}{6x - 5x^4}$.

(4 marks)

Q7 (a) By using Trapezoidal rule, solve the following integral by taking step $h = 0.5$ with three decimal places.

$$y = \int_{2}^{5} \frac{e^{x}}{\sqrt[3]{x^{2}+2}}\,dx.$$

(8 marks)

(b) By using substitution method, evaluate $\int_{0}^{1} \frac{4x+6}{x^{2}+3x+7}\,dx$.

(6 marks)

(c) Solve $\int (e^{2x} \sin 3x)\,dx$.

(6 marks)

- END OF QUESTIONS –

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FORMULAE

Differentiations

$$\frac{d}{dx}(ax^n) = nax^{n-1}$$

$$\frac{d}{dx}(\sin u) = \cos\ u.\frac{du}{dx}$$

$$\frac{d}{dx}(u^n) = nu^{n-1}.\frac{du}{dx}$$

$$\frac{d}{dx}(\cos u) = -\sin\ u.\frac{du}{dx}$$

$$\frac{d}{dx}\left(\frac{1}{\sqrt{u}}\right) = \frac{1}{2\sqrt{u}}.\frac{du}{dx}$$

$$\frac{d}{dx}(\tan u) = sec^2\ u.\frac{du}{dx}$$

$$\frac{d}{dx}(e^u) = e^u.\frac{du}{dx}$$

$$\frac{d}{dx}(\sec\ u) = \sec\ u.\ tan\, u.\frac{du}{dx}$$

$$\frac{d}{dx}(\ln u) = \frac{1}{u}.\frac{du}{dx}$$

$$\frac{d}{dx}(uv) = uv' + vu'$$

$$\frac{d}{dx}(\mathrm{k}u) = k.\frac{du}{dx}$$

$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{vu' - uv'}{v^2}$$

Basic Integration

$$\int kdx = kx + C$$

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C$$

$$\int sinx dx = -cosx + C$$

$$\int cosx dx = sinx + C$$

Integration By Parts

$$\int udv = uv - \int vdu$$

Arch Length

$$\int_a^b \sqrt{1 + \left(\frac{dx}{dy}\right)^2}\, dy$$

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Area of bounded Region

$\int_c^d [u(y) - v(y)]\, dy$

Volume of solid generation

$V = \pi \int_c^d [(y_2)^2 - (y_1)^2]\, dx$