UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	CALCULUS
COURSE CODE	:	DAS 20803
PROGRAMME	:	DAU
EXAMINATION DATE	:	JUNE 2017
DURATION	:	3 HOURS
INSTRUCTION	:	**SECTION A)** ANSWER **ALL** QUESTIONS.
		SECTION B) ANSWER **THREE (3)** QUESTIONS ONLY.

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

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SECTION A

Q1 (a) Find the following integrals.

(i) $\int\left(5x^2-\sqrt{x}+\frac{2}{x^2}\right)dx$

(ii) $\int\left(2e^x-\sin x+\cos x\right)dx$

(3 marks)

(3 marks)

(b) Calculate $\int_1^4\left(4x^3-\sqrt{x}\right)dx$.

(3 marks)

(c) Evaluate the integral using the given technique.

(i) $\int 4x^3\left(x^4-12\right)dx$ [substitution]

(3 marks)

(ii) $\int 3x\cos x dx$ [by parts]

(3 marks)

(iii) $\int\frac{x+1}{x^2+x-2}dx$ [partial fraction]

(5 marks)

Q2 (a) Determine the area of the region bounded by the following curve.

(i) $y=x^2$ and $y=\sqrt{x}$.

(ii) $y=3x$ and $y=x^2+2$.

(7 marks)

(7 marks)

(b) Find the area of the surface that is generated by revolving the portion of $y=3x^3$ between $x=0$ and $x=2$ about the x - axis.

(6 marks)

SECTION B

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

(i) $y = x^2 + x - 6$

(4 marks)

(ii) $y = -\sqrt{3x+9}$

(4 marks)

(iii) $y = \dfrac{1}{(x+3)^2} - 2$

(4 marks)

(b) Given two functions, $f(x) = 2x^2 + 3$ and $g(x) = 2 - x - x^2$.

(i) Calculate $f(x).g(x)$.

(2 marks)

(ii) Find the inverse function, $f^{-1}(x)$.

(3 marks)

(iii) Find the composite function, $f \circ g(x)$.

(3 marks)

Q4 (a) Calculate the following limits.

(i) $\lim\limits_{x \to 2} \dfrac{2x-3}{x^2+3x-4}$ (2 marks)

(ii) $\lim\limits_{x \to 2} \dfrac{2x-4}{x^2-4}$

(2 marks)

(iii) $\lim\limits_{x \to 1} \dfrac{\sqrt{x+3}}{x-2}$

(2 marks)

(b) Let $f(x)=\begin{cases}-2 & x<0\\ x+3 & 0\le x\le 2\\ x^2 & x>2\end{cases}$. Find

(i) $f(2), f(-3)$ and $f(6)$.

(3 marks)

(ii) $\lim_{x\to 2^+} f(x)$, $\lim_{x\to 2^-} f(x)$ and $\lim_{x\to 2} f(x)$.

(3 marks)

(c) Find $\lim_{x\to 0}\dfrac{x}{\sqrt{x+1}-1}$ by multiply the numerator and denominator with the conjugate.

(8 marks)

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

(i) $y=\tan x-2x+4e^x$

(3 marks)

(ii) $y=\dfrac{1}{\sqrt{x}}+\sqrt{2x}+\cos x$

(3 marks)

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

(i) $y=\dfrac{1}{\left(x^3-2x+5\right)^3}$

(4 marks)

(ii) $y=\left(4x^3-5\right)\left(3-x^3\right)$

(5 marks)

(iii) $y=\dfrac{\cos x}{1-\cos x}$

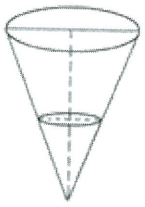
(5 marks)

Q6 (a) Given $f(x) = \frac{1}{3}x^3 - \frac{5}{2}x^2 + 6x$, find the extrema, 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. Fill in blanks of the table below. Hence, sketch the graph.

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							

(10 marks)

(b) The figure shows a cone container. The base radius and the height of cone are 3cm and 12cm respectively. Water is poured into the cone at constant rate $2\,cm^3/s$. Determine the rate of change of height with respect to time, when the depth of water is 6cm. (Hint: $V = \frac{1}{3}\pi r^2 h$)



(7 marks)

(c) Using L'Hospital's Rule, find $\lim_{x \to 2} f(x) = \frac{x^2 - 4}{x - 2}$.

(3 marks)

Q7 (a) Solve the integral $\int_0^1 \sqrt{\frac{x}{1+x}}dx$ by using Simpson's rule, using $h = 0.125$. Write the answer to 3 decimal places.

(10 marks)

(b) Find the approximate value for $\int_1^4 \frac{x}{\sqrt{x+1}}dx$ using trapezoidal rule by taking $n = 12$ subintervals. Do the calculation in 3 decimal places.

(10 marks)

- END OF QUESTIONS –

FINAL EXAMINATION

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FORMULAE

Differentiations

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

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

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

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

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

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

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

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

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

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

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

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

Basic Integration

$$\int kdx = kx + C$$

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

$$\int sinxdx = -cosx + C$$

$$\int cosxdx = sinx + C$$

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

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