UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	ENGINEERING MATHEMATICS I
COURSE CODE	:	DAS 10203
PROGRAMME CODE	:	DAA / DAM
EXAMINATION DATE	:	JUNE / JULY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN SECTION A AND **THREE (3)** QUESTIONS IN SECTION B

TERBUKA

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

SECTION A

Q1 (a) Solve the following integrals.

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

(2 marks)

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

(3 marks)

(b) Solve the given integrals.

(i) $\int \frac{x}{1-4x^2}\,dx$; [substitution].

(4 marks)

(ii) $\int \frac{3x+11}{x^2-3x-10}\,dx$, [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) **Figure Q2 (a)** shows the region R bounded by curve $y = 2x^2 + 10$ and line $y = 4x + 16$ that intersect at points A and B.

(i) Determine points A and B.

(4 marks)

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

(5 marks)

(b) Use cylindrical shells to find the volume that results when the bounded region of $x + y = 2$, $x-$axis, $y-$axis is revolved about $x-$axis.

(7 marks)

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

(4 marks)

SECTION B

Q3 (a) The piecewise function $f(x)$ is given by

$$f(x)=\begin{cases} 0; & -5\le x<-2 \\ -x^2+4; & -2\le x\le 1 \\ -x+3; & 2<x\le 5 \end{cases}.$$

(i) Sketch the graph of $f(x)$.

(6 marks)

(ii) Write the domain and range for $f(x)$.

(2 marks)

(b) Given the functions $f(x)=6-x^2$, $h(x)=\sqrt{x+4}$, and $g(x)=\dfrac{1}{3x}$. Find

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

(2 marks)

(ii) $(f\circ g\circ h)(x)$.

(4 marks)

(iii) $(h^{-1}\circ f^{-1})(x)$.

(6 marks)

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

(i) $\lim\limits_{x\to 3}\left(\dfrac{1+3x}{1+4x^2+3x^4}\right)^3$.

(3 marks)

(ii) $\lim\limits_{h\to 0}\left(\dfrac{\sqrt{1+h}-1}{h}\right)$.

(4 marks)

(b) The function $f(x)$ is defined by $f(x)=\begin{cases} 4 & , & x\le -1 \\ 3x+7 & , & -1<x<1. \\ 9-3x & , & x\ge 1 \end{cases}$

Determine whether $f(x)$ is continuous at $x=-1$ and $x=1$.

(9 marks)

(c) Given $f(x)=\begin{cases} 3x & , \quad x\le 1 \\ a\sqrt{x}+c & , \quad 1<x\le 4. \\ x+3 & , \quad x>4 \end{cases}$

If $f(x)$ is a continuous function, find the values of a and c.

(4 marks)

Q5 (a) Differentiate the following functions by using technique of differentiation.

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

(5 marks)

(ii) $y=\dfrac{\cos x}{2+3\sin x}$.

(5 marks)

(b) Find derivative of function $y=5x^2y^3$ by implicit differentiation.

(5 marks)

(c) A curve is given by the equation $p=r^3-3r$ and $q=r^4-4r$. Hence, evaluate $\dfrac{dp}{dq}$ when $r=\dfrac{1}{2}$.

(5 marks)

Q6 (a) By using L'Hospital's Rule , find

(i) $\lim\limits_{x\to\infty}\dfrac{2+7x^2-4x^5}{6x-5x^4}$.

(4 marks)

(ii) $\lim\limits_{x\to 0}\dfrac{-\dfrac{1}{2x^2}}{\ln x}$.

(3 marks)

(iii) $\lim\limits_{x\to\infty}\dfrac{2e^x}{x^2}$.

(3 marks)

(b) Given $f(x)=\frac{x^3}{3}-\frac{3x^2}{2}-4x+2$, 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(b)**.

(10 marks)

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

$$y=\int_2^5 \frac{e^x}{\sqrt[3]{x^2+2}}.$$

(8 marks)

(b) By using substitution method, evaluate $\int_0^1 \frac{4x+6}{\left(x^2+3x+7\right)^4}dx$.

(6 marks)

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

(6 marks)

-END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER / SESSION: II/ 2017/2018 PROGRAMME : DAA / DAM

COURSE : ENGINEERING MATHEMATICS I COURSE CODE : DAS 10203

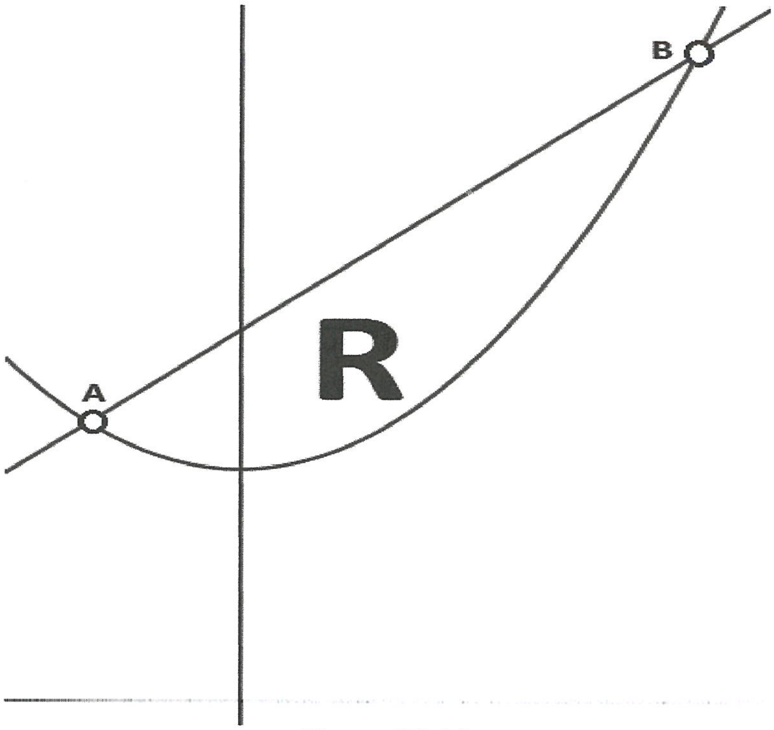

Figure Q2 (a)

Table Q6(b)

Value Type	Test Value	Critical Value	Test Value	Inflection point, $f''(x)=0$	Test value	Critical Value	Test Value
x	$x=$	$x=$	$x=$	$x=$	$x=$	$x=$	$x=$
$f(x)$							
$f'(x)$							
$f''(x)$							
Graph Characteristics							

FINAL EXAMINATION

SEMESTER / SESSION: II/ 2017/2018 PROGRAMME : DAA / DAM

COURSE : ENGINEERING MATHEMATICS I COURSE CODE : DAS 10203

Table 1 : Differentiation

$\frac{d}{dx}[c]=0$	$\frac{d}{dx}[\sin u]=\cos u\left(\frac{du}{dx}\right)$
$\frac{d}{dx}[x^n]=nx^{n-1}$	$\frac{d}{dx}[\cos u]=-\sin u\left(\frac{du}{dx}\right)$
$\frac{d}{dx}[cu]=c\frac{du}{dx}$	$\frac{d}{dx}[\ln\|u\|]=\frac{1}{u}\left(\frac{du}{dx}\right)$
$\frac{d}{dx}[u\pm v]=\frac{du}{dx}\pm\frac{dv}{dx}$	$\frac{d}{dx}\left[e^u\right]=e^u\left(\frac{du}{dx}\right)$
$\frac{d}{dx}[uv]=u\frac{dv}{dx}+v\frac{du}{dx}$	$\frac{d}{dx}[\tan u]=\sec^2 u\left(\frac{du}{dx}\right)$
$\frac{d}{dx}\left[\frac{u}{v}\right]=\frac{v\frac{du}{dx}-u\frac{dv}{dx}}{v^2}$	$\frac{d}{dx}[\sec u]=\sec u\tan u\left(\frac{du}{dx}\right)$
Chain Rule: $\frac{dy}{dx}=\frac{dy}{du}.\frac{du}{dx}$	Parametric Differentiation: $\frac{dy}{dx}=\left(\frac{dy}{dt}\Big/\frac{dx}{dt}\right)=\frac{dy}{dt}.\frac{dt}{dx}$

TERBUKA

FINAL EXAMINATION

SEMESTER / SESSION: II/ 2017/2018 PROGRAMME : DAA / DAM

COURSE : ENGINEERING MATHEMATICS I COURSE CODE : DAS 10203

Table 2 : Integration

$\int a\,dx = ax + C$	$\int \sin nx\,dx = -\frac{1}{n}(\cos nx) + C$
$\int x^n\,dx - \frac{x^{n+1}}{n+1} + C, (n \neq -1)$	$\int \cos nx\,dx = \frac{1}{n}(\sin nx) + C$
$\int \frac{1}{nx+b}\,dx = \frac{1}{n}\ln\lvert nx+b\rvert + C$	$\int \tan x\,dx = \ln\lvert \sec x \rvert + C$
$\int \frac{1}{b-nx}\,dx = -\frac{1}{n}\ln\lvert b-nx\rvert + C$	$\int \sec^2 x\,dx = \tan x + C$
$\int e^{nx}\,dx = \frac{1}{n}\left(e^{nx}\right) + C$	$\int \csc^2 x\,dx = -\cot x + C$
Integration part by part: $\int u\,dv = uv - \int v\,du$	
Improper Integral: $\int_a^{\infty} f(x)dx = \lim_{b\to\infty}\int_a^b f(x)dx$	

Area of Region

$$A = \int_a^b [f(x) - g(x)]\,dx \quad \text{or} \quad A = \int_c^d [w(y) - v(y)]\,dy$$

Volume Cylindrical Shells

$$V = \int_a^b 2\pi x\, f(x)\,dx \quad \text{or} \quad V = \int_c^d 2\pi y\, f(y)\,dy$$

Arc Length

$$L = \int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\,dx \quad \text{or} \quad L = \int_c^d \sqrt{1 + \left(\frac{dx}{dy}\right)^2}\,dy$$

FINAL EXAMINATION

SEMESTER / SESSION: II/ 2017/2018 PROGRAMME : DAA / DAM

COURSE : ENGINEERING MATHEMATICS I COURSE CODE : DAS 10203

Partial Fraction

$$\frac{a}{x^2-1}=\frac{A}{x+1}+\frac{B}{x-1}$$

Simpson's Rule

$$\int_a^b f(x)\,dx \approx \frac{h}{3}\left[(f_0+f_n)+4\sum_{\substack{i=1 \\ i \text{ odd}}}^{n-1} f_i + 2\sum_{\substack{i=2 \\ i \text{ even}}}^{n-2} f_i\right] \quad ; \quad n=\frac{b-a}{h}$$

Trapezoidal Rule

$$\int_a^b f(x)\,dx \approx \frac{h}{2}\left[(f_0+f_n)+2\sum_{i=1}^{n-1} f_i\right] \quad ; \quad n=\frac{b-a}{h}$$