Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	ENGINEERING MATHEMATICS I
COURSE CODE	:	DAS10203
PROGRAMME	:	3 DAI
EXAMINATION DATE	:	DECEMBER 2013/JANUARY 2014
DURATION	:	3 HOURS
INSTRUCTION	:	A) ANSWER **ALL** QUESTIONS IN SECTION A B) ANSWER **TWO (2)** QUESTIONS IN SECTION B

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

SECTION A

Q1 (a) Given two curve $y_1 = 4x + 16$ and $y_2 = 2x^2 + 10$.

(i) Sketch both curve and show the region bounded between both curves.

(3 marks)

(ii) Find two (2) intersects point of both curves.

(5 marks)

(iii) Thus, calculate the area bounded between both curves.

(5 marks)

(b) The region R is bounded by the graph of $f(x) = x^2 + 1$, $y = 0$, $x = 0$ and $x = 1$.

(i) Sketch the graph of $f(x) = x^2 + 1$.

(1 mark)

(ii) Show the radius (r) and height (h) of the solid generated when region R is revolved about the y-axis.

(5 marks)

(iii) Find the volume of the generated solid by cylindrical method.

(6 marks)

SECTION B

Q2 (a) Evaluate

(i) $\int\left(3x^2+3\sqrt[4]{x}-\frac{4}{x^3}\right)dx$

(3 marks)

(ii) $\int\left(\frac{x+3x^2}{x}\right)dx$

(2 marks)

(iii) $\int\left((x+1)(3x+2)\right)dx$

(3 marks)

(iv) $\int_0^2\left(x(1+x^2)\right)dx$

(5 marks)

(b) By using substitution technique, evaluate $\int\left(\frac{2x}{(x^2+1)^2}\right)dx$.

(6 marks)

(c) Solve $\int\left(2x^2\cos x\right)dx$ by using integration by tabular method.

(6 marks)

Q3 (a) By referring to the **Figure Q3 (a)**, find

(i) $\lim_{x \to -1} f(x)$

(4 marks)

(ii) $\lim_{x \to 2} f(x)$

(4 marks)

(b) Compute the limit

(i) $\lim_{x \to 3} \frac{x^2 - 6x + 8}{x^2 - 4}$

(2 marks)

(ii) $\lim_{x \to \infty} 3x^4 - x^2 + x + 2$

(2 marks)

(iii) $\lim_{x \to \infty} \frac{7 + 4x^2}{x^3 + 2x}$

(4 marks)

(c) Given $f(x) = \begin{cases} \dfrac{x^2 - 4x + 3}{x - 3} & , x \neq 3 \\ 2 & , x = 3 \end{cases}$

Find:

(i) $\lim_{x \to 3} f(x)$

(6 marks)

(ii) $f(3)$

(1 mark)

(ii) Thus, determine whether $f(x)$ is continue at $x = 3$

(2 marks)

Q4 (a) Find the derivatives of the following

(i) $y = 4\sqrt{x} + \frac{1}{4}x^4 + x + 1$

(3 marks)

(ii) $y = 2x - e^{2x}$

(4 marks)

(iii) $y = 2x\sin x - 4x^3$

(5 marks)

(iv) $y = \ln(\sin 3x)^2$

(6 marks)

(b) Find $\frac{dy}{dx}$ of the implicit equation of $3x^2 + 5xy = 7 - y^3$.

(7 marks)

Q5 (a) Air is being pumped into a spherical balloon at a rate of 4.5 m^3/ min. Find the rate of change of the radius when the radius is 2m.

(Volume of sphere = $\frac{4}{3}\pi r^3$)

(8 marks)

(b) Given the function of a curve is $f(x) = x^3 - 3x$.

(i) Find all the critical value of the function.

(7 marks)

(ii) Fill up the **Table 1**

Table 1: Analysis table Q6 (b) (ii) *(redraw this table into your answer booklet)

	Test value	Critical value	Test value	Critical value	Test value	Critical value	Test value
Value of x							
Value of $f(x)$							
Sign of $f'(x)$							
Gradient (increase/decrease)							
Sign of $f''(x)$							
Concave up/ concave down							
Shape of curve							

(6 marks)

(iii) Sketch the graph of the curve and locate minima, maxima and inflection point.

(4 marks)

- END OF QUESTION -

FINAL EXAMINATION

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COURSE : ENGINEERING MATHEMATIC I COURSE CODE: DAS 10203

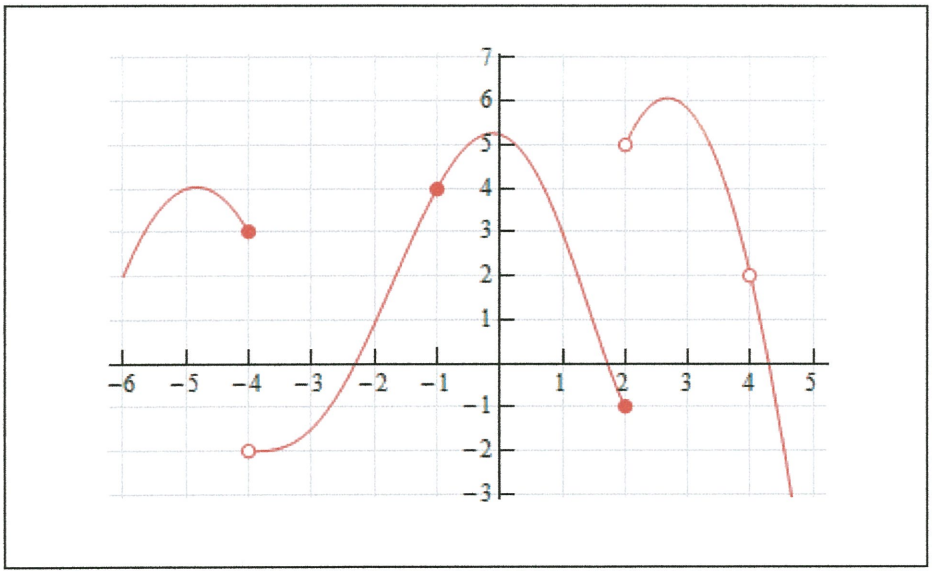

Figure Q3 (a)

Differentiation:

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

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

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{(g(x))^2}$$

$$\frac{d}{dx}\ln u = \frac{1}{u}\cdot\frac{du}{dx}$$

$$\frac{d}{dx}e^u = e^u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\sin u = \cos u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\cos u = -\sin u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\tan u = \sec^2 u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\cot u = -\csc^2 u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\sec u = \sec u\tan u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\csc u = -\csc u\cot u\cdot\frac{du}{dx}$$

Integration :

$$\int k\,dx = kx + C \qquad \int e^x\,dx = e^x + C$$

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C\,,(n \neq -1) \qquad \int \frac{1}{x}\,dx = \ln|x| + C$$

$$\int \sin x\,dx = -\cos x + C \qquad \int \cos x\,dx = \sin x + C$$

Area of region :

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

Volume cylindrical shells :

$$V = \int_a^b 2\pi x\, f(x)\,dx$$

$$V = \int_c^d 2\pi y\, f(y)\,dy$$