UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2008/2009

SUBJECT	:	MATHEMATICS II
CODE	:	BSM 1253
COURSE	:	1 BBV
DATE	:	APRIL 2009
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS IN **PART A** AND **THREE (3)** QUESTIONS IN **PART B**.

THIS EXAMINATION PAPER CONSISTS OF 5 PAGES

PART A

Q1 (a) Find the area of the region bounded by the curve $y = 2x^2 + 10$ and the lines $y = 4x + 16$, $x = -2$ and $x = 5$.

(10 marks)

(b) Compute the surface area that is generated by revolving the portion of the curve $y = \sqrt{9 - x^2}$ over $-1 \le x \le 1$, about the x-axis.

(6 marks)

(c) Find the length of the curve $y = x + \dfrac{1}{x+1}$ from origin to $(2, 2\frac{1}{3})$. Write the answer in four decimal places.

(4 marks)

Q2 (a) Find a formula for the general term of the sequence below, starting with $n = 1$.

$$2, -\frac{4}{3}, \frac{6}{9}, -\frac{8}{27}, \ldots$$

(4 marks)

(b) Express the given repeating decimal

$$0.159159159\ldots$$

as a fraction.

(6 marks)

(c) Use the ratio test to determine whether these series converge or diverge.

(i) $\displaystyle\sum_{k=0}^{\infty} \frac{2^{k-1}}{3^k(k+1)}$.

(ii) $\displaystyle\sum_{k=1}^{\infty} \frac{k!}{k^2}$.

(10 marks)

PART B

Q3 (a) Given that $f(x) = 2x - 1$ and $g(x) = \sqrt{x}$.

   (i)   State the domain and range of the function $g(x)$.

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

   (iii) Evaluate $f\left(\dfrac{1}{a^2}\right)$ and $\dfrac{1}{\sqrt{g(a)}}$.

(10 marks)

(b) Given

$$f(x) = \begin{cases} x^2 + ax - 4, & -1 \leq x \\ 2^x + b, & -1 < x \leq 4 \\ \ln(x-3) + (x-1)^2, & x > 4 \end{cases}.$$

Find the values of a and b so that the function $f(x)$ is continuous for all x.

(10 marks)

Q4 (a) Compute the given limits.

   (i) $\displaystyle\lim_{h \to 0} \frac{\dfrac{1}{3+h} - \dfrac{1}{3}}{h}$.

   (ii) $\displaystyle\lim_{x \to +\infty} \frac{\sqrt[3]{x^6 - 2x}}{x^2 + 3}$.

(4 marks)

(b) Differentiate the following functions.

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

   (ii) $x^2 e^{2y} + \ln(y^2) = 5$.

   (iii) $x = \cos 2\theta, \quad y = \sin 2\theta$.

(8 marks)

(c) The perimeter of a rectangular garden is 100 m. Find the maximum area of the garden.

(8 marks)

Q5 (a) Find the value of x for $\int_1^x \dfrac{1}{\sqrt{t}}\, dt = 3$.

(3 marks)

(b) Evaluate the following integrals.

(i) $\displaystyle\int \dfrac{x \sin\sqrt{2x^2 - 5}}{\sqrt{2x^2 - 5}}\, dx$.

(ii) $\displaystyle\int \dfrac{4x - 15}{x^2(5 - 3x)}\, dx$.

(iii) $\displaystyle\int_0^1 3x^2 e^{3x}\, dx$.

(17 marks)

Q6 (a) Given the functions $x = 3y - y^2$ and $x + y = 3$.

(i) Sketch both functions in the same graph.
(ii) Hence, find the area of the region enclosed by $x = 3y - y^2$ and $x + y = 3$.

(10 marks)

(b) Determine the volume of the solid obtained by rotating the region bounded by $y = x^2 - 4x + 5$, $x = 1$, $x = 4$ and the x-axis about the x-axis.

(10 marks)

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Formulae

Arc length (L)

(i) $L = \int_{x_1}^{x_2} \sqrt{1 + \left(\dfrac{dy}{dx}\right)^2}\, dx$ or

(ii) $L = \int_{y_1}^{y_2} \sqrt{1 + \left(\dfrac{dx}{dy}\right)^2}\, dy$

Area of the surface of revolution (S)

i) $S = \int_{x_1}^{x_2} 2\pi y \sqrt{1 + \left(\dfrac{dy}{dx}\right)^2}\, dx$ or

ii) $S = \int_{y_1}^{y_2} 2\pi x \sqrt{1 + \left(\dfrac{dx}{dy}\right)^2}\, dy$