UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	ENGINEERING MATHEMATICS 1
COURSE CODE	:	BDA 14003
PROGRAMME	:	BDD
EXAMINATION DATE	:	JUNE/JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	A) ANSWER **ALL** QUESTION FROM SECTION A B) ANSWER **TWO(2)** QUESTIONS ONLY FROM SECTION B

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

SECTION A

Q1 (a) Find the function $q(x)$ for which $q''(x) = x - 1$, $q(0) = 2$ and $q(1) = -1/3$.

(4 marks)

(b) Find $\int 3a^2\,(a^3 + 1)da$.

(2 marks)

(c) If you are given that $\int_1^2 (px + q)dx = 0$ and $\int_2^{-1} (px + q)dx = 6$ where $k, l \in \mathbb{R}$ then find the function $f(x)$.

(6 marks)

(d) Find anti-derivative of function $f(t) = \int t^3 e^{2t} dt$ by using tabular method.

(8 marks)

Q2 (a) A designer of a box making company wants to produce an open box from a piece of card 16 cm width and 20 cm in length. The box is made by cutting the same size of squares at the corners. The sides of the paper are folded up to form the box. Find the measurements of the cutting square so that the volume of the box is maximum and the measurements of the box. Construct your answer by figure, labels, and equations.

(14 marks)

(b) Find the absolute maximum and minimum values of function $f(x) = 2x^3 - 15x^2 + 36x$ on the interval [1, 5] and determine where the values occur.

(6 marks)

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Q3 A closed cylindrical can is to hold 1 liter (1000 cm^3) liquid. We want to minimize the amount of material needed for the can manufacturing.

(a) Drawn an appropriate figure and label the quantities relevant to the problem.

(5 marks)

(b) Find a formula for quantity to be minimized.

(8 marks)

(c) How should we close the height and radius to minimize the amount of material needed to manufacture the can?

(7 marks)

SECTION B

Q4 (a) At different altitudes in Earth's atmosphere, sound travels at different speeds. The speed sound $S(x)$ (in meters per second) can be modelled by,

$$S(x) = \begin{cases} -4x + 341, & 0 \leq x < 11.5 \\ 295, & 11.5 \leq x < 22 \\ \frac{3}{4}x + 278.5, & 22 \leq x < 32 \\ \frac{3}{2}x + 254.5, & 32 \leq x < 50 \\ -\frac{3}{2}x + 404.5, & 50 \leq x < 80 \end{cases}$$

where x is the altitude in kilometers. What is the average of speed of sound over the interval [0, 80]?

(12 marks)

(b) Find the area of the region bounded by the curves $y = 4 - x^2$ and $y = x^2 - 2x$.

(8 marks)

Q5 (a) Determine the length of the curve $y = x^{3/2}$ from 0 to 1 and 0 to 4.

(10 marks)

(b) A particle is moving along line so that its velocity is

$$v(t) = t^3 - 10t^2 + 29t - 20,$$

feet per second at time t. What is the displacement of the particle on the time interval $1 \leq t \leq 5$?. What is the total distance travelled by particle on the time interval $1 \leq t \leq 5$?

(10 marks)

Q6 (a) Express $\frac{2(z+1)}{(z-1)(2z-1)}$ in the form of partial fractions and prove that

$$\int_2^5 \frac{2(z+1)}{(z-1)(2z-1)}\, dz = \ln\left(\frac{256}{27}\right)$$

(12 marks)

(b) A company determines that its marginal cost function is given by

$$C'(x) = 4x\sqrt{x+3}.$$

Find the total cost given that $C(13) =$ RM 1126.40.

(8 marks)

- END OF QUESTION -

FINAL EXAMINATION

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Formulae:

Arc length function: $s(x) = \int_a^b \sqrt{1 + f'(x)^2}$.

Arc length function: $s = L = \int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$.

$A(x) = \int A'(x)dx$.

$\int \frac{ax+b}{(cx+d)(px+q)}\, dx = \int \frac{A}{cx+d} dx + \int \frac{B}{px+q} dx$.

$\frac{1}{(b-a)} \int_a^b f(x)dx$.

$S = 2\pi r^2 + 2\pi rh$.