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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : MATHEMATICS 2
COURSE CODE : BBM 10403
PROGRAMME CODE : BBF
EXAMINATION DATE : DECEMBER 2019 / JANUARY 2020
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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Q1 (a) Given a piecewise-defined function:

$$f(x) = \begin{cases} x^2 - 1, & x \leq 0 \\ x - 1, & 0 < x \leq 4 \\ 3 & x > 4 \end{cases}$$

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

[3 marks]

(ii) State the domain and range of $f(x)$

[2 marks]

(b) Given a piecewise-defined function:

$$f(x) = \begin{cases} -x, & x < -2 \\ x^2, & x \geq -2 \end{cases}$$

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

[3 marks]

(ii) What is happening at the transition point?

[1 marks]

(c) Solve the following:

(i) For $f(x) = 5 + \sqrt[3]{-4 - 3x}$, find $f(-4)$

[2 marks]

(ii) Given that $f(x) = \sqrt{9 - x^2}$ and $g(x) = \sqrt{x - 1}$. Find $(f \circ g)(x)$. Hence, find $(f \circ g)(3)$

[3 marks]

(d) Show that $f(x) = 3x - 2$ is the inverse of $g(x) = \frac{x + 2}{3}$

[2 marks]

(e) Given the functions $f(x) = 2 - x$ and $g(x) = a + bx^2$. If $(g \circ f)(x) = 3x^2 - 12x + 13$, find the values of a and b .

[4 marks]

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Q2 (a) Compute the following:

(i) $\lim_{x \rightarrow 1} \frac{(1+x)^2 - 3}{x}$

[2 marks]

(ii) $\lim_{x \rightarrow -\infty} \frac{x^2 + 1}{x - 2}$

[2 marks]

(iii) $\lim_{t \rightarrow 0} \frac{\sqrt{t+9} - 3}{t}$

[3 marks]

(b) By using L' Hospital rule, evaluate:

(i) $\lim_{x \rightarrow \infty} \frac{e^x}{x^2}$

[2 marks]

(ii) $\lim_{x \rightarrow 1} \frac{5x^4 - 4x^2 - 1}{10 - x - 9x^3}$

[3 marks]

(c) From the graph in **DIAGRAM Q2(c)**, evaluate whether the limit is exist or not at $x = 0$.

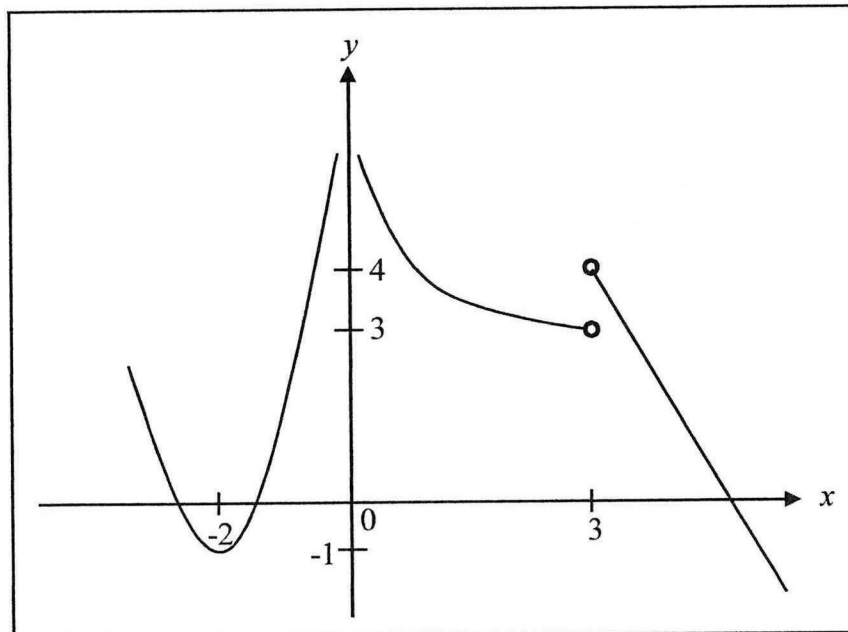


DIAGRAM Q2(c)

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(d) Given the function

$$f(x) = \begin{cases} x-1, & x < 3 \\ 12-x^2, & x \geq 3 \end{cases}$$

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

[2 marks]

(ii) Hence, determine the continuity of $f(x)$ at $x = 3$

[3 marks]

Q3 (a) Differentiate the following functions:

(i) $y = x - \frac{1}{x^2}$

[2 marks]

(ii) $f(x) = \frac{2}{\sqrt{x+3}}$

[3 marks]

(iii) $f(x) = \frac{1}{4}(x^7 - 5)$

[2 marks]

(iv) $3y^2 - 2x^2 = 2xy$

[3 marks]

(b) By using chain rule, solve the following functions:

(i) $y = \cos(x^3 - 5x^2 + 2)$

[3 marks]

(ii) $y = \sqrt{3x^2 - 5x + 1}$

[3 marks]

(c) The radius, r , of a spherical balloon at time t is given by $r = t^2 + t$.

(i) Express the volume of the balloon, $V \text{ cm}^3$ in terms of t . (Use

$$V_{\text{spherical}} = \frac{4}{3}\pi r^3)$$

[1 marks]

(ii) Hence, find the rate of change of the volume at $t = 4$.

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[3 marks]

Q4 (a) Integrate the following:

(i) $\int \left(\frac{1}{x^3} - \frac{1}{x^4} \right) dx$

[3 marks]

(ii) $\int_{-2}^0 (x^2 + 3)^2 dx$

[3 marks]

(b) Integrate $\int e^x (e^x - 1)^3 dx$ by using substitution method.

[3 marks]

(c) Integrate $\int_1^3 x^2 \ln x dx$ by using by parts method.

[5 marks]

(d) Find the area bounded by the line $y = -x$ and $y = 6 - x^2$.

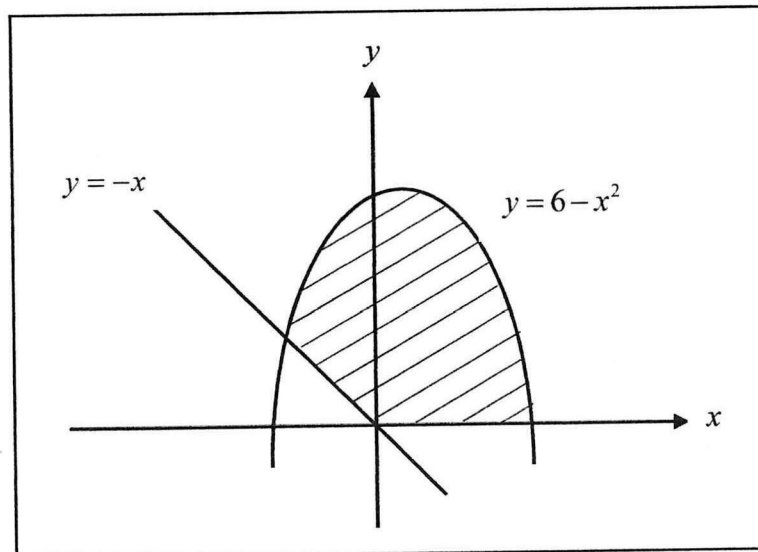


DIAGRAM Q4(d)

[6 marks]

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- Q5** (a) Solve the following:
- (i) Given an arithmetic sequence is $-6, -12, 4, 9, \dots$. Find the n -th term of the sequence. [2 marks]
- (ii) If T_1 and T_{50} of an arithmetic sequence are -5 and 93 respectively, find the T_{73} of the sequence. [3 marks]
- (b) Given a series $3, 7, 11, 15, \dots$
- (i) Find an expression for the sum of the first n terms. [2 marks]
- (ii) Hence, find the value of n if the sum of the series is equal to 465 . [2 marks]
- (c) Solve the following:
- (i) The 2nd term and the 5th term of a geometric series are 3 and 81 respectively. Find the sum from the 5th term to the 10th term of this series. [3 marks]
- (ii) Show that $-1, 3, -9, 27$ is a geometric series. [2 marks]
- (d) A 16-team bowling league has RM8000 to be awarded as prize money. If the last place team is awarded RM275 in prize money, and the award increase by the same amount for each successive finishing place,
- (i) How much will the first place receive? [4 marks]
- (ii) What is the difference of amount of the prize money received by each team? [2 marks]

-END OF QUESTIONS-

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