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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(TAKE HOME)  
SEMESTER I  
SESSION 2020/2021**

COURSE NAME : CALCULUS  
COURSE CODE : BWD 11003  
PROGRAMME CODE : BWD  
EXAMINATION DATE : JANUARY/FEBRUARY 2021  
DURATION : 4 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS  
OPEN BOOK EXAMINATION

**TERBUKA**

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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**Q1** Evaluate

(a)  $\lim_{x \rightarrow \infty} \frac{-2x}{3}$  (2 marks)

(b)  $\lim_{h \rightarrow 3} \frac{h^2 + 2h - 4}{(h+3)}$  (2 marks)

(c)  $\lim_{x \rightarrow 3} \frac{x^2 + 2x - 15}{x^2 - 9}$  (2 marks)

(d)  $\lim_{n \rightarrow 2} \frac{\frac{1}{n} - 1}{n-2}$  (2 marks)

**Q2** (a) Consider a function [Figure Q2(a)] Find

(i)  $\lim_{x \rightarrow -1^+} f(x)$  (1 marks)

(ii)  $\lim_{x \rightarrow 1^+} f(x)$  (2 marks)

(iii)  $\lim_{x \rightarrow 1^-} f(x)$  (2 marks)

(iv) Does  $\lim_{x \rightarrow 0.5} f(x)$  exist? (1 marks)

(b) (i) Sketch the graph of

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

(6 marks)

(ii) Find  $\lim_{x \rightarrow 0} f(x)$  (2 marks)

(iii) Does the  $f(x)$  continue at  $x = 0$ ? Justify your answer. (3 marks)

**Q3** (a) Differentiate the following functions with respect to  $x$ .

(i)  $e^{3x} + 5y^4 + 1 = 0$  (5 marks)

(ii)  $\frac{2}{3}x^2 - \ln y = 2 \sin x$  (5 marks)



(iii)  $y = (4x^{-2} - 3\cos x)^7$  (5 marks)

(b) (i) If  $x = 3$  is chosen as an initial approximation of the equation  $f(x) = x^3 - 4x^2 + 2x + 2 = 0$ , find a better approximation. (6 marks)

(ii) The efficiency of an engine, E is given  $E = 125(1 - r^{-\frac{1}{5}})$  where r is its compression ratio. Use differentiation to determine the approximate change in efficiency due to a change in compression ratio from 3125 to 3050. (14 marks)

**Q4**

(a) Determine the dimension that will minimize the cost of metal to manufacture a cylindrical can that able to store 0.25L of carbonated drinks. (4 marks)

(b)  $k$  number of workers are required to produce  $q$  units of banana muffins. The relationship between  $k$  and  $q$  is given by  $q = 16k^2$ . If the current production is 160,000 units per year and increases at a rate of 32,000 units per year, calculate the rate increase in the number of workers. (4 marks)

(c) A hemispherical glass bowl has radius of 10cm and the depth of creamy mushroom soup in the bowl is  $h$  cm. The formula of the volume of mushroom soup is

$$V = \frac{\pi h^2}{3}(30 - h).$$

Mushroom soup is poured into the bowl at the rate of  $2 \text{ cm}^3/\text{s}$ .

(i) If the radius of the mushroom soup surface is  $r$  cm, state  $r$  in terms of  $h$ . (3 marks)

(ii) When  $h = 4$  cm, determine the rates of change in the height and the radius of the mushroom soup surface. Determine the new rate of mushroom soup pouring into the bowl when  $h = 4$ . (9 marks)

**Q5**

(a) Evaluate these integrals.

(i)  $\int_2^4 \left(\frac{x^2+5}{\sqrt{x}}\right) dx$  (4 marks)

(ii)  $\int_{-2}^1 (e^{2x} - x + 5) dx$  (5 marks)

(iii)  $\int_0^{\frac{\pi}{4}} (\cos(x) + \cos(-2x)) dx$  (6 marks)

(b) Find the area of the region bounded by curve  $y = x^2 - 3$ , the  $x$  - axis and the lines  $x = 1$  and  $x = 2$  [Figure Q5(b)]. (5 marks)

- END OF QUESTIONS -



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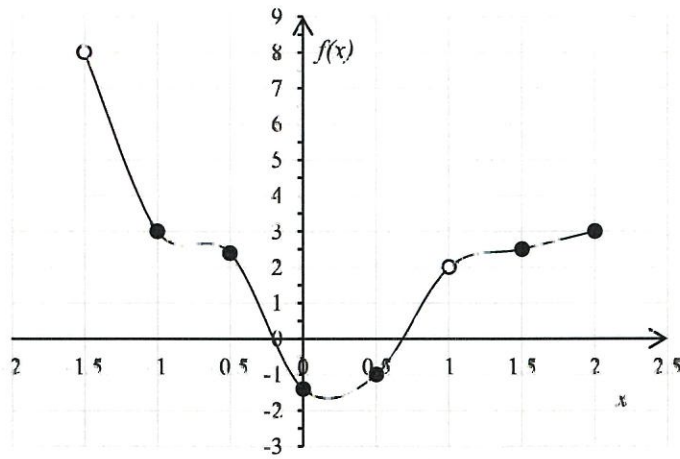


Figure Q2(a)

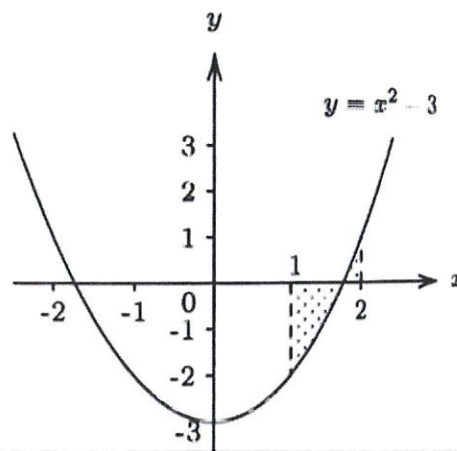


Figure Q5(b)

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