Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	CALCULUS
COURSE CODE	:	BWC 10303
PROGRAMME CODE	:	BWC
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **OPEN BOOK EXAMINATION**

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

Q1 (a) Consider the function

$$s(t)=\begin{cases}-Pt^2+Q, & t<2\\ 3, & t=2\\ Qt+P, & t>2\end{cases}$$

Given that $\lim_{t\to 2} s(t)$ is exist and equal to $s(2)$, determine the values of constant P and Q.

(6 marks)

(b) Find the following limits

(i) $\lim_{x\to 0}\dfrac{-5x+x^3}{x^3}$

(3 marks)

(ii) $\lim_{r\to\infty}\dfrac{5r^2+r+87}{4r^2-7r}$

(5 marks)

(iii) $\lim_{t\to 0}\dfrac{\cos(2t)-1}{\cos t-1}$

(6 marks)

(c) Investigate the continuity of the following function by considering any possible values of t.

$$g(t)=\frac{e^{\sin t}}{\left(-\sqrt{-9+t^2}\right)+4}$$

(5 marks)

Q2 (a) Determine the equation of perpendicular line to the graph of the function below

$$f(x)=\frac{1}{1+\tan(x)}.\tan(x) \text{ at } x=\frac{\pi}{4}$$

(9 marks)

(b) An expandable water toy has a rectangular shape with the rate of change for its length and width at 4 mm/hrs and 3 mm/hrs, respectively. Find

(i) the rate where the perimeter is changing.

(3 marks)

(ii) the rate where the area is changing when the length and width are 8 mm and 6 mm, respectively.

(4 marks)

(c) Referring to **Figure Q2(c)**, you suppose to walk through the paddy field before reaching at the resting hut that just beside the boundary at the opposite side of the field. The hut is 100 m from the point directly across the field from where you start the walk. If you can walk at the speed of 1 ms^{-1} and 3 ms^{-1} in the field and on the boundary respectively, calculate the traveling time.

(9 marks)

Q3 (a) Suppose that you want to construct a closed storage box with a square base and you only have 10 m^2 area of cardboard material. By assuming all the material is going to be used in the construction process, determine the maximum volume that the box can be made according to the optimization procedure.

(10 marks)

(b) Integrate each of the followings.

(i) $\int \left(4-s^2\right)\left(\sqrt[3]{s}+s\right) ds$

(2 marks)

(ii) $\int \frac{3-5\sin^2\phi}{\sin^2\phi}\, d\phi$

(2 marks)

(iii) $\int (8t-1)\, 3e^{4t^2-t}\, dt$

(2 marks)

(c) Determine the function of $f(x)$ with a known constant value, given that $f'(x) = 9 + 4x^3 + 7e^x + 2\sin x$ and $f(0)=15$.

(4 marks)

(d) Solve the following definite integral using the substitution method.

$$\int_{\frac{1}{50}}^{2} \frac{e^{\frac{2}{t}}}{t^2}\, dt$$

(5 marks)

Q4 (a) Calculate the area of region bounded by $y = 2x^2 + 10$, $y = 4x + 16$, $x = -2$ and $x = 5$ as the graph shown in **Figure Q4(a)**.

(6 marks)

(b) Apply the method of cylinder in finding the volume of solid obtained by rotating about the x-axis and the region bounded by $y = \sqrt[3]{x}$, $x = 8$ and x-axis.

(9 marks)

(c) Use Simpson's $\frac{1}{3}$ rule to approximate $\int_{2}^{0} \frac{1}{1+e^{x}}\,dx$ with $n = 8$.

(10 marks)

END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2020/2021
COURSE NAME : CALCULUS

PROGRAM CODE : BWC
COURSE CODE : BWC 10303

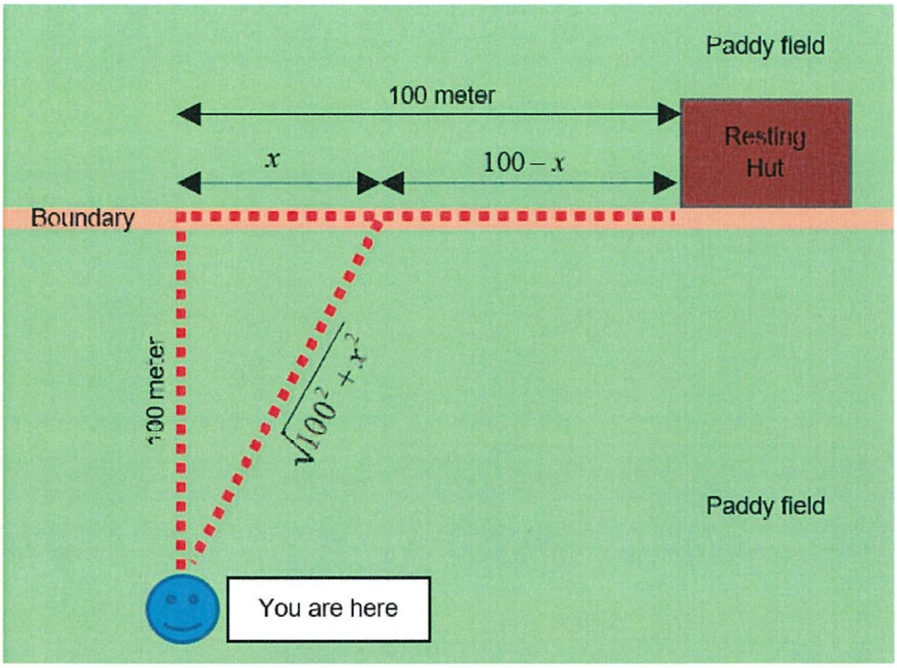

Figure Q2(c)

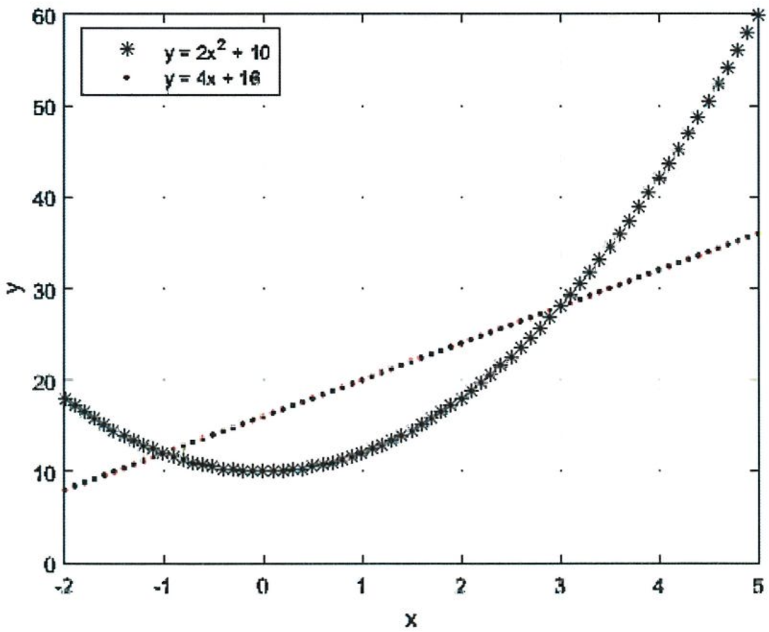

Figure Q4(a)