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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	CALCULUS
COURSE CODE	:	BFC15003
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

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Q1 (a) Find $\frac{d}{dx}[(1+x^5\cot x)^{-8}]$

(4 marks)

(b) Use implicit differentiation to find ${d^2y}/{dx^2}$ if $4x^2 - 2y^2 = 9$

(4 marks)

(c) Find the slope of the tangent line to the unit circle of $x = \cos t, y = \sin t, (0 \leq t \leq 2\pi)$ at the point where $t = \pi/6$ at **Figure Q1(c).**

(4 marks)

(d) **Figure Q1(d)** shows the increment Δy and the differential dy. The Δy represents the change in y that occurs when it starts at x and travel along the curve $y = f(x)$ until it moved $\Delta x\ (= dx)$ units in the x-direction, while dy represents the change in y that occurs if it starts at x and travel along the tangent line until it moved $dx(= \Delta x)$ units in the x-direction. Let $y = \sqrt{x}$

(i) Find formulas for Δy and dy

(ii) Evaluate Δy and dy at $x = 4$ with $dx = \Delta x = 3$. Then make a sketch of $y = \sqrt{x}$ showing the values of Δy and dy.

(8 marks)

Q2 (a) A garden is to be laid out in a rectangular area and protected by a chicken wire fence. What is the largest possible area of the garden if only 100 running meter of chicken wire is available for the fence?

(5 marks)

(b) Find the stationary points of the curve $y = 10x + x\sqrt{100 - x^2}$ for $0 < x \leq 10$. Hence determine whether the turning point is a maximum point or a minimum point.

(10marks)

(c) Find a point on the curve $y = x^2$ that is closet to the point (18, 0) by referring to **Figure 2(c).**

(5 marks)

Q3 (a) Evaluate $\int_2^5 (2x - 5)\ (x - 3)^9 dx$ using suitable integration method.

(5 marks)

(b) Evaluate $\int_0^{\pi/6} sin^2\ x\ cos^3 x\ dx$ by using integration by parts method

(5 marks)

(c) Evaluate $\int \frac{3x^4+4x^3+16x^2+20x+9}{(x+2)(x^2+3)^2} dx$

(10 marks)

Q4 (a) As illustrated in **Figure 4(a),** derive the formula for the volume of a pyramid whose altitude is h and whose base is a square with sides of length a.

(5 marks)

(b) Find the area of the surface that is generated by revolving the portion of the curve $y = x^3$ between $x = 0$ and $x = 1$. Sketch the curve and imagine revolving it about the x-axis.

(7 marks)

(c) Find the arc length of the curve $y = x^{3/2}$ from (1,1) to (2, 2√2) **Figure 4(c)** in two ways.

(8 marks)

Q5 (a) Solve the differential equation $\frac{dy}{dx} = -4xy^2$

(5 marks)

(b) Solve the initial-value problem $(4y - cosy)\frac{dy}{dx} - 3x^2 = 0, y\ (0) = 0$

(5 marks)

(c) At time $t = 0$, a tank contains 4kg of salt dissolved in 100 l of water. Suppose that brine containing 2 kg of salt per litre of brine is allowed to enter the tank at a rate of 5l/min and that the mixed solution is drained fro the tank at the same rate. Find the amount of salt in the tank after 10 minutes.

(10 marks)

– END OF QUESTIONS –

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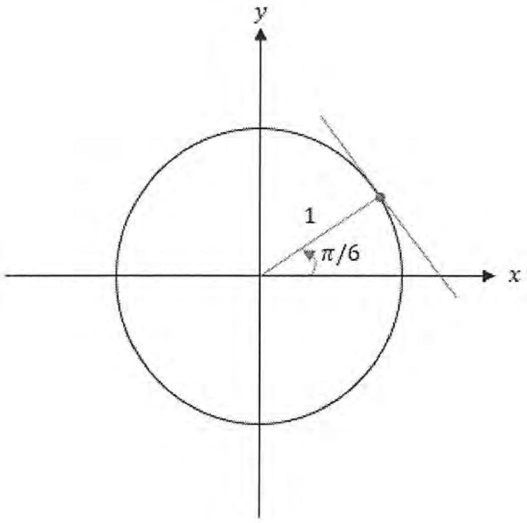

Figure Q1(c)

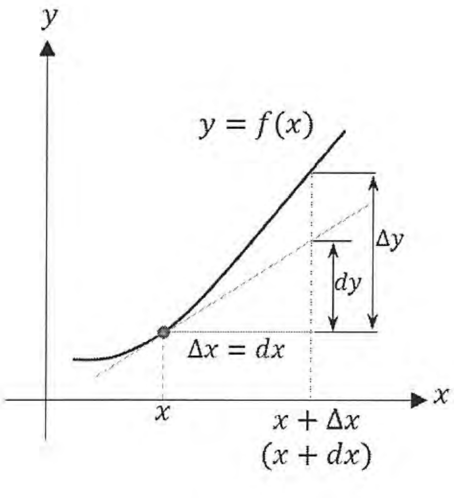

Figure Q1(d)

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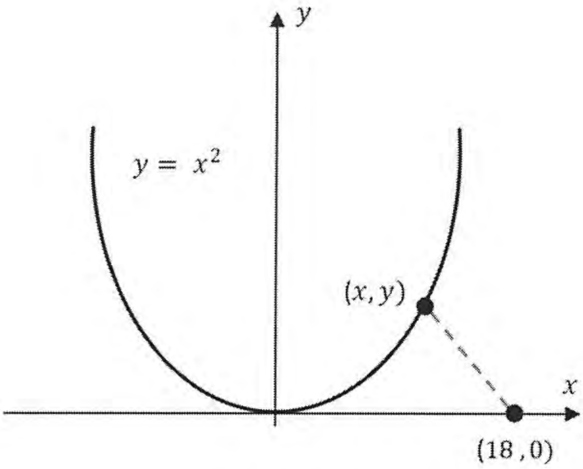

Figure 2(c)

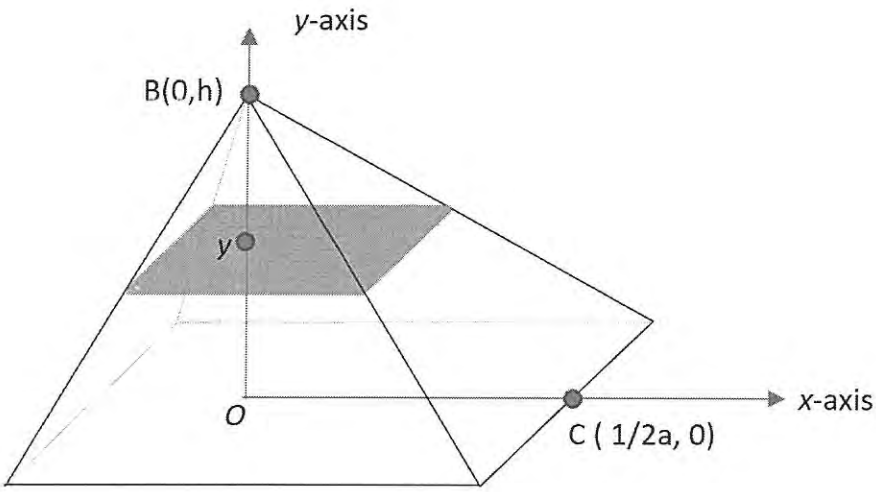

Figure 4(a)

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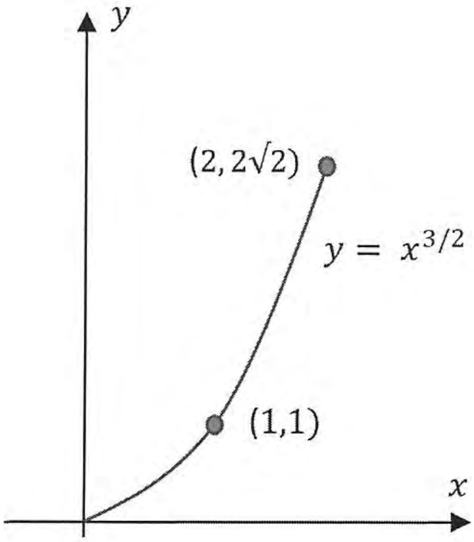

Figure 4(c)

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Formulae

Differentiation Rules	Indefinite Integrals
$\frac{d}{dx}[k]=0$	$\int k\,dx = kx + C$
$\frac{d}{dx}[x^n]=nx^{n-1}$	$\int x^n dx = \frac{x^{n+1}}{n+1}+C, \quad n \neq -1$
$\frac{d}{dx}[\ln\|x\|]=\frac{1}{x}$	$\int \frac{dx}{x} = \ln\|x\| + C$
$\frac{d}{dx}[\cos x]=-\sin x$	$\int \sin x\,dx = -\cos x + C$
$\frac{d}{dx}[\sin x]=\cos x$	$\int \cos x\,dx = \sin x + C$
$\frac{d}{dx}[\tan x]=\sec^2 x$	$\int \sec^2 x\,dx = \tan x + C$
$\frac{d}{dx}[\cot x]=-\text{cosec}^2 x$	$\int \text{cosec}^2 x\,dx = -\cot x + C$
$\frac{d}{dx}[\sec x]=\sec x \tan x$	$\int \sec x \tan x\,dx = \sec x + C$
$\frac{d}{dx}[\text{cosec}\,x]=-\text{cosec}\,x \cot x$	$\int \text{cosec}\,x \cot x\,dx = -\text{cosec}\,x + C$
$\frac{d}{dx}[e^x]=e^x$	$\int e^x\,dx = e^x + C$
$\frac{d}{dx}[\cosh x]=\sinh x$	$\int \sinh x\,dx = \cosh x + C$
$\frac{d}{dx}[\sinh x]=\cosh x$	$\int \cosh x\,dx = \sinh x + C$
$\frac{d}{dx}[\tanh x]=\text{sech}^2 x$	$\int \text{sech}^2 x\,dx = \tanh x + C$
$\frac{d}{dx}[\coth x]=-\text{cosech}^2 x$	$\int \text{cosech}^2 x\,dx = -\coth x + C$
$\frac{d}{dx}[\text{sech}\,x]=-\text{sech}\,x \tanh x$	$\int \text{sech}\,x \tanh x\,dx = -\text{sech}\,x + C$
$\frac{d}{dx}[\text{cosech}\,x]=-\text{cosech}\,x \coth x$	$\int \text{cosech}\,x \coth x\,dx = -\text{cosech}\,x + C$