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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	BASIC CALCULUS
COURSE CODE	:	BBR 33903
PROGRAMME	:	3 BBR
EXAMINATION DATE	:	DECEMBER 2013/JANUARY 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

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Q1 (a) Sketch $y = -(x+3)^2 + 4$. State clearly the x- intercept and y- intercept.

(8 marks)

(b) Sketch $y = \dfrac{1}{(x+2)^2} - 2$.

(6 marks)

(c) Sketch both $y = e^x$ and $y = \ln x$ on the same graph. State clearly the x- intercept and y- intercept.

(6 marks)

Q2 (a) Find one-sided limits for the following:

(i) $\lim\limits_{x \to 4^+} \dfrac{1}{x-4}$

(ii) $\lim\limits_{x \to 4^-} \dfrac{1}{x-4}$

Hence determine $\lim\limits_{x \to 4} \dfrac{1}{x-4}$.

(6 marks)

(b) Evaluate $\lim\limits_{x \to 1} \dfrac{2x^2 + x - 3}{1-x}$

(i) without using L' Hôpital's rule.

(ii) using L' Hôpital's rule.

(9 marks)

(c) Find the $\lim\limits_{x \to 4} f(x)$ where

$$f(x) = \begin{cases} x^2 - 2x & \text{if } x < 4 \\ 2x & \text{if } x > 4 \end{cases}$$

(5 marks)

Q3 (a) Find the first derivatives for the following functions

(i) $y = e^{0.2\sin(2x)}$

(ii) $y = x^3 \ln(5x)$

(10 marks)

(b) Find $f'(x)$ for function, $f(x) = g(x) + 0.25h(x)$, where $g(x) = \ln\left[x(x+1)^2\right]$ and $h(x) = e^{4x}$.

(4 marks)

(c) Suppose that $f(x) = A(\sin x)^2 + B\cos(2x)$ with A and B are constants. Determine the values of A and B, given that $f\left(\frac{\pi}{2}\right) = -2$ and $f'\left(\frac{\pi}{4}\right) = -5.$

(6 marks)

Q4 (a) Your team need to solve problems in the yearly fair which have balloons. Air is being pumped into a spherical balloon at rate of 4.5 cubic inches per minute.

(i) Find $\frac{dV}{dt}$.

(ii) Since $V = \frac{4}{3}\pi r^3$, find $\frac{dV}{dr}$.

Hence, find $\frac{dr}{dt}$ when $r = 2$.

(10 marks)

(b) Your team need to do the practical in an airport. An airplane is flying on a path that will take it directly over a radar tracking station. Given the distance, $s = 10$ miles when the height, $h = 6$ miles.

(i) Using $s^2 = x^2 + h^2$, sketch the diagram.

(ii) Find $\frac{ds}{dx}$ whenever $s^2 = x^2 + h^2$ and $h = 6$ miles.

(iii) Find $\frac{ds}{dx}$ whenever $x = 8$.

(iv) If x is decreasing at rate of 400 miles per hour when $s = 10$ miles and the height, $h = 6$ miles. what is the speed of the plane?

(10 marks)

Q5 (a) Integrate the following

(i) $\int \frac{2+x-x^3}{x^2}\, dx$

(ii) $\int_0^1 x(1+x^3)\, dx$

(6 marks)

(b) Evaluate $\int \cos x\sqrt{\sin x}\, dx$ by using substitution method.

(3 marks)

(c) Evaluate $\int \frac{x}{x^2+2}\, dx$ by using substitution method. Hence, evaluate

$$\int \frac{3x^2+4}{x(x^2+2)}\, dx$$

by using the method of partial fraction decomposition.

(11 marks)

Q6 (a) Given two curves $y=-x^2+4$ and $y=x+2$. Sketch the region that enclosed by both curves. Include all intersection points. Hence, calculate the area of the bounded region

(12 marks)

(b) Find the volume of the solid generated when the region enclosed between curves $y=x^2$ and $y=\sqrt{x}$, is revolved about the *y*-axis.

(8 marks)

- END OF QUESTION -

FINAL EXAMINATION

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FORMULAS

Differentiation :

$$\frac{d}{dx}[c]=0$$

$$\frac{d}{dx}[x^n]=nx^{n-1}$$

$$\frac{d}{dx}[c\,f(x)]=c\frac{d}{dx}[f(x)]$$

$$\frac{d}{dx}[f(x)\pm g(x)]=\frac{d}{dx}[f(x)]\pm\frac{d}{dx}[g(x)]$$

$$\frac{d}{dx}[f(x)g(x)]=f(x)\cdot\frac{d}{dx}[g(x)]+g(x)\cdot\frac{d}{dx}[f(x)]$$

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right]=\frac{g(x)\cdot\frac{d}{dx}[f(x)]-f(x)\cdot\frac{d}{dx}[g(x)]}{[g(x)]^2}$$

$$\frac{d}{dx}[\sin x]=\cos x$$

$$\frac{d}{dx}[\cos x]=-\sin x$$

$$\frac{d}{dx}[\tan x]=\sec^2 x$$

$$\frac{d}{dx}[\sec x]=\sec x\tan x$$

$$\frac{d}{dx}[\cot x]=-\csc^2 x$$

$$\frac{d}{dx}[\csc x]=-\csc x\cot x$$

$$\frac{d}{dx}[\sin^{-1}x]=\frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}[\cos^{-1}x]=\frac{-1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}[\tan^{-1}x]=\frac{1}{1+x^2}$$

$$\frac{d}{dx}[\sec^{-1}x]=\frac{1}{|x|\sqrt{x^2-1}}$$

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Integration :

$$\int c\, f(x)dx = c\, F(x) + C$$

$$\int [f(x) \pm g(x)]\, dx = F(x) \pm G(x) + C$$

$$\int x^r\, dx = \frac{x^{r+1}}{r+1} + C\,, (r \neq -1)$$

$$\int \cos x\, dx = \sin x + C$$

$$\int \sin x\, dx = -\cos x + C$$

$$\int \csc x\, dx = -\ln\left|\csc x + \cot x\right| + C$$

$$\int \tan x\, dx = \ln\left|\sec x\right| + C$$

$$\int \sec^2 x\, dx = \tan x + C$$

$$\int \csc^2 x\, dx = -\cot x + C$$

$$\int \sec x \tan x\, dx = \sec x + C$$

$$\int \csc x \cot x\, dx = -\csc x + C$$

$$\int \sec x\, dx = \ln\left|\sec x + \tan x\right| + C$$

Area of region :

$$A = \int_a^b [f(x) - g(x)]\, dx \quad \textbf{or} \quad A = \int_c^d [w(y) - v(y)]\, dy$$

Volume cylindrical shells :

$$V = \int_a^b 2\pi x\, f(x)\, dx$$

$$V = \int_c^d 2\pi y\, f(y)\, dy$$