CONFIDENTIAL

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	BASIC CALCULUS
COURSE CODE	:	BBR33903
PROGRAMME CODE	:	BBR
EXAMINATION DATE	:	DECEMBER 2014 / JANUARY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE** QUESTIONS **ONLY**

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

Q1 (a) Sketch $y = -(x-5)^2 - 4$. State clearly the x- intercept and y- intercept.

(8 marks)

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

(6 marks)

(c) Sketch $y = e^x$, $y = e^{2x}$ and $y = 2e^x$ at the same graph. State clearly the y-intercept.

(6 marks)

Q2 (a) Find the one side limits for

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

(ii) $\lim\limits_{x \to 2^-} \dfrac{1}{x-2}$

Hence, or use other method, determine $\lim\limits_{x \to 2} \dfrac{1}{x-2}$.

(7 marks)

(b) Evaluate $\lim\limits_{x \to 6} \dfrac{x^2 - 2x - 24}{-6 + x}$ without using L' Hôpital's rule.

(6 marks)

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

$$f(x) = \begin{cases} x^2 + x + 4 & \text{if } x < 4 \\ 6x & \text{if } x > 4 \end{cases}$$

(7 marks)

Q3 (a) Find $\frac{dy}{dx}$ for the $y = (2 - x^2)(x^3 + x - 6)$.

(4 marks)

(b) Find $\frac{dy}{dx}$ for the following functions

(ii) $y = \frac{2x}{\sqrt{x} + 6}$

(iii) $y = \frac{\ln x}{e^x}$

(8 marks)

(c) Using the chain rule, differentiate

(i) $y = (2\ln x)^6$

(ii) $y = \frac{1}{\sqrt{4 - 6x}}$

(8 marks)

Q4 (a) Sand is poured onto a growing conical pile of sand, at the constant rate of $6\text{m}^3\text{s}^{-1}$. Suppose the side of the cone makes a 60 degree angle to cone's base. Given $V = \frac{1}{3}\pi r^2 h$.

(i) How fast is the height of the sand pile increasing when the volume of the cone is 180m^3?

(9 marks)

(ii) If the volume of the cone does not change, find the rate of change of its height, h with respect to its radius, r.

(4 marks)

(b) Given $f(x) = x^3 - 3x + 1$. Find all critical points of $f(x)$. Then use the Second Derivative Test to determine the properties of all the local extreme points.

(7 marks)

Q5 (a) Evaluate $\int_{-10}^{-5} 6\,dx$.

(4 marks)

(b) Evaluate $\int \cos^2 3x \sin 3x\,dx$ by using substitution method.

(7 marks)

(c) (i) Change $\frac{1}{x^2+x-6}$ into partial fraction.

(5 marks)

(ii) Thus, use the answer from Q5(c)(i) to evaluate $\int \frac{1}{x^2+x-6}\,dx$.

(4 marks)

Q6 (a) Find the area of $f(x) = x(x-3)$ for $0 \le x \le 5$.

(5 marks)

(b) Find the area of the region enclosed by $x = y^2$ and $y = x-2$, by integration with respect to y.

(7 marks)

(c) Find the volume of the solid generated when the region enclosed between $y = \sqrt{x}$, $x = 1$ and $x = 4$ is revolved about the $x-$axis.

(8 marks)

- END OF QUESTION -

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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 :

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

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

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

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

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

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

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

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

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

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

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

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

Area of region :

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

Volume cylindrical shells :

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

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