# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER I
## SESSION 2015/2016

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|---|---|---|
| COURSE NAME | : | BASIC CALCULUS |
| COURSE CODE | : | BBR33903 |
| PROGRAMME | : | BACHELOR OF EDUCATION (PRIMARY SCHOOL) |
| EXAMINATION DATE | : | DECEMBER 2015 / JANUARY 2016 |
| DURATION | : | 3 HOURS |
| INSTRUCTION | : | ANSWER **FIVE** QUESTIONS ONLY |

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

**Q1** (a) Sketch $y=-(x+6)^2+2$. State clearly the *x*- intercept and *y*- intercept.

(8 marks)

(b) Sketch $y=\dfrac{1}{x^2-3^2}+2$ .

(6 marks)

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

(6 marks)

**Q2** (a) Evaluate $\lim\limits_{x\to -2} f(x)$ and $\lim\limits_{x\to 2} f(x)$ where $f(x)=\begin{cases} x^2-13 & \text{if } x<-2 \\ 5x+1 & \text{if } x\geq -2 \end{cases}$.

(7 marks)

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

(i) without using L' Hôpital's rule.

(ii) with using L' Hôpital's rule.

(8 marks)

(c) Find the one side limits for

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

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

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

(5 marks)

**Q3** (a) Find $\frac{dy}{dx}$ for the $y=(5x-x^3)(2x^5+x^2-3x)$.

(4 marks)

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

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

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

(8 marks)

(c) Using the chain rule, differentiate

(i) $y=(7\ln x)^5$

(ii) $y=\sqrt[3]{\sin^3 x^2}$

(8 marks)

**Q4** (a) Sand is poured onto a growing conical pile of sand, at the constant rate of $6m^3s^{-1}$. 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 $180\text{m}^3$?

(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 $f(x)=x^2-6x+\frac{82}{x}+\frac{45}{x^2}$, $x\neq 0$. 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 $\int_{1}^{4}\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)dx$.

(4 marks)

(b) Evaluate $\int_{0}^{\pi/8}\sin^5 2x\cos 2x\, dx$ by using substitution method.

(7 marks)

(c) (i) Change $\frac{3x^2-7x-2}{x^2-x}$ into partial fraction.

(5 marks)

(ii) Thus, use the answer from Q5(c)(i) to evaluate $\int\frac{3x^2-7x-2}{x^2-x}dx$.

(4 marks)

**Q6** (a) Find the area of $f(x)=4x(x^2+x)$ for $0\le x\le 5$.

(5 marks)

(b) Find the area of the region enclosed by $\sqrt{y}=x$ and $y=x+6$, by integration with respect to $x$.

(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 :**

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

**Volume cylindrical shells :**

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

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