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CONFIDENTIAL

SET A

# UNIVERSITI KUALA LUMPUR
## Malaysia France Institute

## FINAL EXAMINATION
## JULY 2010 SESSION

| | | |
|---|---|---|
| SUBJECT CODE | : | FKB 14202 |
| SUBJECT TITLE | : | ENGINEERING MATHEMATICS 2 |
| LEVEL | : | BACHELOR |
| TIME / DURATION | : | 8.00 pm – 10.00 pm<br>( 2 HOURS ) |
| DATE | : | 13 NOVEMBER 2010 |

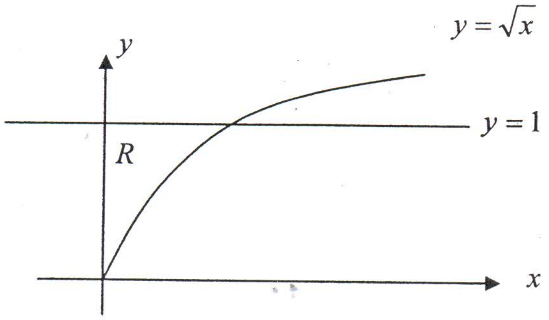
### INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of FIVE (5) questions. Answer FOUR (4) questions only.
6. Answer all questions in English.

THERE ARE 4 PAGES OF QUESTIONS AND 2 PAGES OF FORMULA , EXCLUDING THIS PAGE.

## Question 2

A solid bounded above by the surface of $z = \sin\left(\frac{y^3+1}{2}\right)$ and below by the plane region $R$ that is bounded by lines $y=\sqrt{x}$, $y=1$, $x=0$ (refer **Graph 1**). Given that the volume of the solid is $\int_0^1 \int_{\sqrt{x}}^1 \sin\left(\frac{y^3+1}{2}\right) dydx$.




**Graph 1**

(a) Reversed the order of integration for $\int_0^1 \int_{\sqrt{x}}^1 \sin\left(\frac{y^3+1}{2}\right) dydx$.

(3 marks)

(b) Hence, evaluate in **3 decimal places the reversed double integral** to get the volume of the solid.

(12 marks)

## Question 3

The daily output of a company is given by

$$f(x, y) = 500x + 800y + xy - 2x^2 - y^2,$$

where $x$ is the number of hours of labor per day and $y$ is the number of units of raw material used daily.

(a) How many hours of labor and how many units of material should be used to maximize the daily output ?

(13 marks)

(b) Determine the maximum daily output ?

(2 marks)

## Question 4

## Question 4

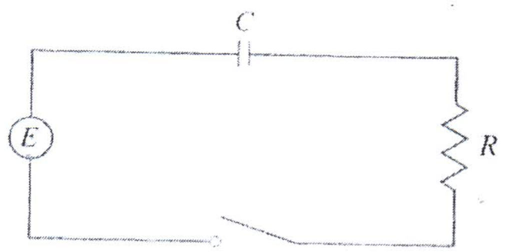


**Figure 1**

(a) The **Figure 1** above shows a circuit containing an electromotive force, a capacitor with a capacitance of ***C*** farads (***F***), and a resistor with a resistance of R ohms ($\Omega$). The voltage drop across the capacitor is $Q/C$, where $Q$ is the charge (in coulombs), so in this case Kirchhoff's Law gives :

$$R\frac{dQ}{dt}+\frac{1}{C}Q=E$$

Suppose that the resistance is $5\Omega$, the capacitance is 0.05 ***F***, and a battery gives a constant voltage of $E=60$ volts. Find **an expression for the charge** $Q$ at time $t$ for the initial-value $Q(0)=0$.

(10 marks)

(b) Fill in the missing value in 2 decimal places in **Table 1** given that $\frac{ds}{dt}=4e^{2t}$.

Assume that the rate of growth given by $\frac{ds}{dt}$ is approximately constant over each unit time interval.

| $t$ | 0 | 2 |
|---|---|---|
| $s$ | 6 | |

**Table 1**

(5 marks)

**Question 5**

Given the particular integral of differential equation :

$$\frac{d^2y}{dx^2} - y = xe^{3x}$$

is in the form of $f(x) \equiv e^{3x}(Ax+B)$.

(a) Find the value of A and B of the particular integral.

(11 marks)

(b) Hence, determine the general solution of the given differential equation :

$$\frac{d^2y}{dx^2} - y = xe^{3x}$$

(4 marks)

**END OF QUESTION**

# DIFFERENTIATION

## TRIGONOMETRIC FUNCTIONS

| STANDARD FORM | GENERALFORM |
|---|---|
| $\frac{d}{dx}(\sin x) = \cos x$ | $\frac{d}{dx}(\sin f(x)) = \cos f(x) f'(x)$ |
| $\frac{d}{dx}(\cos x) = -\sin x$ | $\frac{d}{dx}(\cos f(x)) = -\sin f(x) f'(x)$ |
| $\frac{d}{dx}(\tan x) = \sec^2 x$ | $\frac{d}{dx}(\tan f(x)) = \sec^2 f(x). f'(x)$ |
| $\frac{d}{dx}(\csc x) = -\csc x \cot x$ | $\frac{d}{dx}(\csc f(x)) = -\csc f(x) \cot f(x). f'(x)$ |
| $\frac{d}{dx}(\sec x) = \sec x \tan x$ | $\frac{d}{dx}(\sec f(x)) = \sec f(x) \tan f(x). f'(x)$ |
| $\frac{d}{dx}(\cot x) = -\csc^2 x$ | $\frac{d}{dx}(\cot f(x)) = -\csc^2 f(x). f'(x)$ |

## EXPONENTIAL FUNCTION

| STANDARD FORM | GENERALFORM |
|---|---|
| $\frac{d}{dx} e^x = e^x$ | $\frac{d}{dx} e^{f(x)} = e^{f(x)}. f'(x)$ |

## LOGARITHMIC FUNCTION

| STANDARD FORM | GENERALFORM |
|---|---|
| $\frac{d}{dx} \ln x = \frac{1}{x}$ | $\frac{d}{dx} \ln f(x) = \frac{f'(x)}{f(x)}$ |

# INTEGRATION - BASIC RULES

**( trigonometric functions , exponential functions , form 1/x )**

| STANDARD FORM trigonometric | GENERAL FORM Where : $f(x)=ax+b$ |
|---|---|
| $\int \cos x dx = \sin x + c$ | $\int \cos f(x) dx = \frac{\sin f(x)}{f'(x)} + c$ |
| $\int \sin x dx = -\cos x + c$ | $\int \sin f(x) dx = \frac{-\cos f(x)}{f'(x)} + c$ |
| $\int \sec^2 x dx = \tan x + c$ | $\int \sec^2 f(x) dx = \frac{\tan f(x)}{f'(x)} + c$ |
| $\int \sec x \tan x dx = \sec x + c$ | $\int \sec f(x) \tan f(x) dx = \frac{\sec f(x)}{f'(x)} + c$ |
| $\int \csc x \cot x dx = -\csc x + c$ | $\int \csc f(x) \cot f(x) dx = \frac{-\csc f(x)}{f'(x)} + c$ |
| $\int \csc^2 x dx = -\cot x + c$ | $\int \csc^2 f(x) dx = \frac{-\cot f(x)}{f'(x)} + c$ |

| STANDARD FORM exponential | GENERAL FORM Where : $f(x)=ax+b$ |
|---|---|
| $\int e^x dx = e^x + c$ | $\int e^{f(x)} dx = \frac{e^{f(x)}}{f'(x)} + c$ |

| STANDARD FORM Form 1/x | GENERAL FORM Where : $f(x)=ax+b$ |
|---|---|
| $\int \frac{1}{x} dx = \ln\|x\| + c$ | $\int \frac{1}{f(x)} dx = \frac{\ln\|f(x)\|}{f'(x)} + c$ |