Mathematics: MCM 109 Final Exam Date: 18 – 1 – 2012 Duration Time: 1 Hour	Modern University For Technology & Information Faculty of Pharmacy	Academic Year: 2011 – 2012 Semester: Autumn Examiner: Dr. Mohamed Eid
Answer All Questions		Marks

[1](a) Find $y`$ where:

(i) $y = 2x^4 + 4^x + 3$ (ii) $y = \sin x + \ln x + \log x$ (iii) $y = x^3 . \cos x$ **6**

(b) Find the integrals: (i) $\int (x^3 - 3^x + 2)dx$ (ii) $\int_0^1 (3x^2 + 2x + 1)dx$ **8**

(iii) $\int (\frac{1}{x} + \frac{1}{x^2} + \cos x)dx$ (iv) $\int \frac{x+3}{x^2 + 3x + 2} \, dx$

[2](a) If $A = \begin{bmatrix} 1 & 2 \\ 2 & 3 \\ 1 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 & 0 \\ 2 & 0 & 3 \\ 1 & 2 & -2 \end{bmatrix}$. Find, if possible, $A + B$, $A.B$, $A^t.B$ **4**

(b) If $A = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 3 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 3 \\ 0 & 2 \\ -2 & 1 \end{bmatrix}$. Find, if possible, $A + B$, $A + B^t$, $A.B$ **4**

(c) Solve the system of equations: **4**
$x + y - z = 3$, $x - y + z = 3$, $2x - y + 2z = 9$

[3](a) Find the eigenvalues and eigenvectors of the matrix $A = \begin{bmatrix} 0 & 1 \\ 4 & 0 \end{bmatrix}$ **5**

(b) A drug in the blood decreases according to equation $\sqrt{y_0} - \sqrt{y} = 10t$.   **4**

If the initial quantity $y_0 = 400$ units. Find

(i) The time at which 25 % of drug exists in the blood.
(ii) The time at which 50 % of drug exists in the blood.
(iii) The time.0 at which there is no drug in the blood.
(iv) The quantity of drug in the blood after 1 hour.

Good luck   *Dr. Mohamed Eid*

(1) Find the following limits:

(a) $\lim\limits_{x\to 1} \dfrac{x^2-1}{x-2}$ (b) $\lim\limits_{x\to 1} \dfrac{x^5-1}{x^2-1}$ (c) $\lim\limits_{x\to 0} \dfrac{\log(1+3x)}{x}$ (d) $\lim\limits_{x\to 0} \dfrac{\sin x}{2^x-1}$

(2) Find y` where: (a) $y = 2x^3 + 4^x$ (b) $y = x^2 \cos x + 3^x$

(c) $y = 8 + \tan x . \log x$ (d) $y = \dfrac{x^2}{\sin x}$

Answer

[1]Find y` where: (a) $y = x^3 \sin x$ (b) $y = 4^x + \log x$ (c) $y = 8 + x^{-3} + \tan x$

[2] Find the maximum, minimum and inflection points of the function:

  $f(x) = x^3 - 12x^2 + 3$

[3] Find the integrals: (a) $\int (x^2 + 3\cos x)\, dx$ (b) $\int (3^x + \dfrac{1}{x} + \dfrac{1}{x^3})\, dx$

(c) $\int (\dfrac{2x}{x^2+3} + \sin x)\, dx$ (d) $\int \dfrac{x-3}{x^2 - 3x + 2}\, dx$

Answer

[1] Find $y`$ where: (a) $y = 3x^4 + 4^x + \dfrac{1}{x^2}$ 　　　(b) $y = \cos x \,.\, \ln x$

　　　　　(c) $y = 3 + \log(x + \sin x)$ 　　　(d) $y = [x^2 + \cos x]^4$

[2] Find the integrals: (a) $\int (4^x + \cos x)dx$ 　　　(b) $\int x.\cos x\, dx$

　　　　　(c) $\int (3 + \dfrac{2x+3}{x^2 + 3x})\, dx$ 　　　(d) $\int_{1}^{2} (1 + x^2)^2 dx$

[3] Find the maximum, minimum and inflection points of the function:
$f(x) = x^3 - 6x^2 + 3$

[4] A drug in the blood decreases according to the equation $\sqrt{y_0} - \sqrt{y} = 6t$.

　If the initial quantity 225 units.

　Find (i) The time at which 40 % of drug exists in the blood.

　　　(ii) The time at which 60 % of drug exists in the blood.

　　　(iii) The time at which there is no drug in the blood.

　　　(iv) The quantity in the blood after 1 hour. 　　　　(time by hours)

Good luck 　　　　　　　　　　　　　　*Dr. Mohamed Eid*