UNIVERSITI UTARA MALAYSIA

FINAL EXAMINATION
SECOND SEMESTER SESSION 2008/2009

CODE/COURSE NAME: TQM1203 / MATHEMATICS FOR INFORMATION TECHNOLOGY

DATE: 18 APRIL 2009 (SATURDAY)
TIME: 12.30 – 3.00 PM
VENUE: DP4(1), DP4(3), DSB K. MAS, KIA, KN and KYM

INSTRUCTIONS:
1. This exam paper contains FOURTEEN (14) questions in TEN (10) printed pages excluding the cover page.
2. Answer ALL the questions in the space provided.
3. You are NOT ALLOWED to remove the exam paper from the examination hall.

MATRIC NO. ____________________________ (in words) (in numbers)

IDENTIFICATION NO.: ____________________________

LECTURER: ____________________________

GROUP: ____________________________ TABLE NO: ____________________________

DO NOT OPEN UNTIL INSTRUCTED

CONFIDENTIAL
1. Given $A = \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$, find
   a) $4B - 2A$  
   (2 marks)

   b) $(A + B)^T$  
   (2 marks)

   c) $AB$  
   (2 marks)

2. Given $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 4 & 7 \\ -2 & -5 & -2 \end{bmatrix}$ and $|A| = 3$
   a) If $A_{\text{minor}} = \begin{bmatrix} b & 2 & -1 \\ 6 & 3 & c \end{bmatrix}$, find $a$, $b$ and $c$  
   (4 marks)
b) Based on answer from (a), find $A^{-1}$
3. Solve the equation below by using Elementary Row Operation.
\[ x + y + z = 4 \]
\[ x - 2y - z = -3 \]
\[ 2x - y + 2z = 5 \] (9 marks)

4. Given \( u = (4, 2, 1) \) and \( v = (1, 8, 0) \), find
   a) \( 2u - v \) (2 marks)
b) $u \cdot v$  

(2 marks)

c) Compute the magnitude of $u$ and the magnitude of $v$.  

(4 marks)

d) The angle $\theta$ between vector $u$ and $v$.  

(3 marks)

e) Cross product of $u$ and $v$.  

(4 marks)
5. Find the straight line equation that passes through (2,3) and perpendicular to the line whose equation is $y - 4x + 2 = 0$.

(4 marks)

6. Given the quadratic function $y = x^2 - 2x + 5$

   a) Find the vertex point.

   (3 marks)

   b) Find the y-intercept

   (2 marks)

   c) Find the x-intercept

   (3 marks)
d) Sketch the graph for the above function  

7. Solve the following equations:

   a) $5^x = \frac{1}{125}$  

   b) $e^{(3x+1)} = 2$
8. Find \( \frac{dy}{dx} \) for the following function:

a) \( y = 2x^5 + 4x^4 + 5x^3 - 6x + 10 \)  

b) \( y = x^2 e^{3x} \)  

c) \( y = \frac{\ln(2x+3)}{x^3} \)  

(2 marks)  
(3 marks)  
(3 marks)

9. Find the two stationary points on the curve \( y = 2x^3 - 9x^2 + 12x + 10 \) and determine the maximum or minimum of the points.  

(6 marks)
10. Given \( f(x,y) = 5x^4y + 3y^5x - 8xy + 5x - 6y + 20 \). Find

\( \text{a) } f_x(x,y) \) \hspace{5cm} (2 marks)

\( \text{b) } f_y(x,y) \) \hspace{5cm} (2 marks)

11. Evaluate the following integrals:

\( \text{a) } \int (5x^2 + 3x + 14) \, dx \) \hspace{5cm} (2 marks)

\( \text{b) } \int_0^1 (4 - 2x^2 - 2x) \, dx \) \hspace{5cm} (3 marks)
12. By using substitution method, determine the value of $\int_0^2 4x(2x^2 + 1)dx$

(4 marks)

13. If $\frac{dy}{dx} = x + 3$ and $y = 10$ when $x = 3$, find the equation of the curve.

(4 marks)
14. a) Sketch and shade the region bounded by the curves \( y = x^2 + 2x - 4 \), \( y = -x^2 \) and y-axis and determine the interception point for \( x > 0 \).

\( \text{(7 marks)} \)

b) Find the area of the region bounded by the curves \( y = x^2 + 2x - 4 \), \( y = -x^2 \) and y-axis.

\( \text{(4 marks)} \)
### Logarithmic Rules

If \( N = a^x \), \( x \) is said to be a logarithm of \( N \) and noted as \( \log_a N = x \)

1. \( a^{\log_a N} = N \)
2. \( \log_a a = 1 \)
3. \( \log_a 1 = 0 \)
4. \( \log_a (MN) = \log_a M + \log_a N \)
5. \( \log_a \left( \frac{M}{N} \right) = \log_a M - \log_a N \)
6. \( \log_a M^p = p \log_a M \)
7. \( \log_b x = \frac{\log_a x}{\log_a b} \)
8. If \( \log_a x = \log_a y \) then \( x = y \)

### Exponential Rules

1. \( x^m \cdot x^n = x^{m+n} \)
2. \( \frac{x^m}{x^n} = x^{m-n} \)
3. \( (x^m)^n = x^{mn} \)
4. \( (xy)^n = x^n \cdot y^n \)
5. \( x^0 = 1 \)
6. \( x^{-n} = \frac{1}{x^n} \)
7. \( x^0 = 1 \)
8. \( x^n = (x^m)^n = (x^m)^{\frac{1}{n}} \)
9. If \( a^x = a^y \) then \( x = y \)

### Differentiation Rules

1. \( y = x^n, \frac{dy}{dx} = nx^{n-1} \)
2. \( y = u(x) + v(x), \frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx} \)
3. \( y = uv, \frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx} \)
4. \( y = \frac{u}{v}, \frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2} \)
5. \( y = u^n, \frac{dy}{dx} = n u^{n-1} \frac{du}{dx} \)
6. \( y = e^u, \frac{dy}{dx} = e^u \frac{du}{dx} \)
7. \( y = \ln u, \frac{dy}{dx} = \frac{1}{u} \frac{du}{dx} \)
8. \( \frac{dy}{dx} = \frac{du}{dx} \cdot \frac{udx}{dx} \)

### Integration Rules

1. \( \int dx = x + c \)
2. \( \int kdx = k \int dx \)
3. \( \int (du + dv) = \int du + \int dv \)
4. \( \int x^n dx = \frac{x^{n+1}}{n+1} + c, n \neq -1 \)
5. \( \int u^n du = \frac{u^{n+1}}{n+1} + c, n \neq -1 \)
6. \( \int e^x dx = e^x + c \)
7. \( \int e^{ax} dx = \frac{1}{a} e^{ax} + c \)
8. \( \int dx = \ln |x| + c \)
9. \( \int \frac{1}{ax + b} dx = \frac{1}{a} \ln |ax + b| + c \)
10. \( \int u v' dx = uv - \int v du \)

### Quadratic Functions

\( f(x) = ax^2 + bx + c \)

\[
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\]