UNIVERSITI SAINS MALAYSIA

Final Examination
Academic Session 2008/2009

April 2009

JIM 105 – Basic Mathematics
[Matematik Asas]

Duration: 3 hours
[Masa: 3 jam]

Please ensure that this examination paper contains SEVEN printed pages before you begin the examination.

Answer ALL questions. You may answer either in Bahasa Malaysia or in English.

Read the instructions carefully before answering.

Each question is worth 100 marks.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi TUJUH muka surat yang bercetak sebelum anda memulakan peperiksaan ini.

Jawab SEMUA soalan. Anda dibenarkan menjawab sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.

Baca arahan dengan teliti sebelum anda menjawab soalan.

Setiap soalan diperuntukkan 100 markah.]

1. The frequency distribution shows marks and grades for 50 students.

Marks	Grades	Frequency
1 – 20	E	2
21 – 40	D	7
41 – 60	C	13
61 – 80	B	18
81 – 100	A	10

(a) For the above data, construct

   (i)   histogram
   (ii) Ogive
   (iii) Pie chart.

(20 marks)

(b) For the above data, find

   (i)   mean
   (ii) modal class
   (iii) variance
   (iv) standard deviation.

(30 marks)

(c) If a student is selected at random from the 50 students, find the probability that he or she received

   (i)   grade A.
   (ii) grade D or E.
   (iii) grade C and above.

(25 marks)

(d) Box A contains the numbers 1, 2, 3 and 4. Box B contains the numbers 5, 6, 7 and 8. A number is first drawn from Box A at random, then another number from Box B at random.

   (i)   Draw a tree diagram for this experiment.
   (ii) What is the probability both numbers are even?

(25 marks)

2. (a) Find $\dfrac{dy}{dx}$, if

(i) $y = \dfrac{e^{2x}}{(x-2)^4}$

(ii) $y^2 + 4x^3 - xy = 0$.

(30 marks)

(b) Given the function $y = -x^3 + 3x - 1$. Find

(i)   minimum point
(ii)   maximum point
(iii) inflection point
(iv)   the interval where the function is concave up
(v)   the interval where the function is concave down.

Then, sketch the graph of the function showing the features above.

(50 marks)

(c) Given that $f(x) = \begin{cases} \dfrac{x^3 - 1}{x - 1}, & x \neq 1 \\ 3, & x = 1. \end{cases}$

Determine whether $f(x)$ is continuous at $x = 1$.

(20 marks)

3. (a) Compute

(i) $\displaystyle\int_0^1 3(3x-1)^4 \, dx$

(ii) $\displaystyle\int_0^2 \dfrac{x}{\sqrt{1+2x^2}} \, dx$.

(30 marks)

(b) Evaluate

(i) $\int 2e^{2x+1}dx$

(ii) $\int \left(\cos x + \dfrac{1}{x} - 4x^3 \right) dx$.

(30 marks)

(c) Find the area bounded by the curve $y = x^3$ and the line $y = 4x$ from $x = 0$ to $x = 2$.

(40 marks)

4. (a) Find the inverse of $\begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 2 \end{bmatrix}$.

(30 marks)

(b) Solve the following system of linear equations using matrices.

$$x + 2y = 1$$
$$y + z = 2$$
$$y + 2z = 3.$$

(40 marks)

(c) Let $A = \begin{bmatrix} -2 & 3 \\ 0 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 0 \\ -1 & 6 \end{bmatrix}$, $C = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$ and $D = \begin{bmatrix} 11 \\ -10 \end{bmatrix}$.

Compute X if, $AC - BX = D$.

(30 marks)

1. Jadual taburan frekuensi menunjukkan markah dan gred bagi 50 pelajar.

Markah	Gred	Frekuensi
1 – 20	E	2
21 – 40	D	7
41 – 60	C	13
61 – 80	B	18
81 – 100	A	10

(a) Bagi data di atas, bina

(i)   histogram
(ii) Ogif
(iii) Carta Pie.

(20 markah)

(b) Bagi data di atas, cari

(i)   min
(ii) kelas mod
(iii) varians
(iv) sisihan piawai.

(30 markah)

(c) Jika seorang pelajar dipilih secara rawak daripada 50 pelajar tersebut, cari kebarangkalian dia mendapat

(i)   gred A.
(ii) gred D atau E.
(iii) gred C dan ke atas.

(25 markah)

(d) Kotak A mengandungi nombor 1, 2, 3 dan 4. Kotak B mengandungi nombor 5, 6, 7 dan 8. Satu nombor dipilih dari Kotak A secara rawak, kemudian satu nombor dipilih dari Kotak B secara rawak.

(i)   Lukis gambarajah pokok untuk ujikaji ini.
(ii) Apakah kebarangkalian kedua-dua nombor adalah genap?

(25 markah)

2. (a) Cari $\dfrac{dy}{dx}$, jika

    (i) $y = \dfrac{e^{2x}}{(x-2)^4}$

    (ii) $y^2 + 4x^3 - xy = 0$.

    (30 markah)

    (b) Diberi fungsi $y = -x^3 + 3x - 1$. Dapatkan

    (i)   titik minimum
    (ii)   titik maksimum
    (iii) titik lengkok balas
    (iv)   selang di mana fungsi cekung ke atas
    (v)   selang di mana fungsi cekung ke bawah.

    Kemudian, lakar graf bagi fungsi tersebut yang menunjukkan ciri-ciri di atas.

    (50 markah)

    (c) Diberi $f(x) = \begin{cases} \dfrac{x^3 - 1}{x-1}, & x \neq 1 \\ 3, & x = 1. \end{cases}$

    Tentukan sama ada $f(x)$ selanjar atau tidak di titik $x = 1$.

    (20 markah)

3. (a) Hitung

    (i) $\displaystyle\int_0^1 3(3x-1)^4 \, dx$

    (ii) $\displaystyle\int_0^2 \dfrac{x}{\sqrt{1+2x^2}} \, dx$.

    (30 markah)

(b)   Selesaikan

   (i) $\int 2e^{2x+1} dx$

   (ii) $\int \left(\cos x + \dfrac{1}{x} - 4x^3 \right) dx.$

(30 markah)

(c)   Hitung luas yang di batasi oleh lengkung $y = x^3$ dan garis $y = 4x$ dari $x = 0$ ke $x = 2$.

(40 markah)

4.   (a)   Dapatkan songsang bagi $\begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 2 \end{bmatrix}$.

(30 markah)

(b)   Selesaikan sistem persamaan linear yang berikut dengan menggunakan matriks.

$$x + 2y = 1$$
$$y + z = 2$$
$$y + 2z = 3.$$

(40 markah)

(c)   Diberi $A = \begin{bmatrix} -2 & 3 \\ 0 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 0 \\ -1 & 6 \end{bmatrix}$, $C = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$ dan $D = \begin{bmatrix} 11 \\ -10 \end{bmatrix}$.

   Cari X, jika $AC - BX = D$.

(30 markah)

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