QM016/1
Mathematics
Paper 1
Semester I
2009/2010
2 hours

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Matematik
Kertas 1
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BAHAGIAN MATRIKULASI
KEMENTERIAN PELAJARAN MALAYSIA
MATRICULATION DIVISION
MINISTRY OF EDUCATION MALAYSIA

PEPERIKSAAN SEMESTER PROGRAM MATRIKULASI
MATRICULATION PROGRAMME EXAMINATION

MATEMATIK
Kertas 1
2 jam

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU.
DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Kertas soalan ini mengandungi **11** halaman bercetak.
This booklet consists of **11** *printed pages.*

INSTRUCTIONS TO CANDIDATE:

This question booklet consists of **10** questions.

Answer **all** questions.

The full marks for each question or section are shown in the bracket at the end of the question or section.

All steps must be shown clearly.

Only non-programmable scientific calculators can be used.

Numerical answers may be given in the form of π, e, surd, fractions or up to three significant figures, where appropriate, unless stated otherwise in the question.

LIST OF MATHEMATICAL FORMULAE

For the quadratic equation $ax^2 + bx + c = 0$**:**

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

For an arithmetic series:

$$T_n = a + (n-1)d$$

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

For a geometric series:

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r}, \quad r \neq 1$$

Binomial expansion:

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where $n \in N$ and $\binom{n}{r} = \frac{n!}{(n-r)!\,r!}$.

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \cdots + \frac{n(n-1)\cdots(n-r+1)}{r!}x^r + \cdots \text{ for } |x| < 1$$

1 Solve the equation $3^{2x} - 10(3^{x-1}) + 1 = 0$.

[6 *marks*]

2 Determine the solution set for $2x + \frac{3}{x} \leq 5$.

[7 *marks*]

3 Express $\frac{4x-3}{(x-2)(x^2+2x+2)}$ in partial fractions.

[6 *marks*]

4 The first term and common difference of an arithmetic progression are a and -2, respectively. The sum of the first n terms is equal to the sum of the first $3n$ terms. Express a in terms of n. Hence, show that $n = 7$ if $a = 27$.

[6 *marks*]

5 (a) Solve $2|5+x| > |x|$.

[4 *marks*]

(b) If α and β are the roots of the quadratic equation $2x^2 + x + 4 = 0$, form an equation whose roots are $\alpha + 2\beta$ and $2\alpha + \beta$.

[7 *marks*]

6 Given a complex number $z = a + bi$ which satisfy the equation $z^2 = 8 + 6i$.

(a) Find all the possible values of z.

[6 *marks*]

(b) Hence, express z in polar form.

[6 *marks*]

7 Matrix A is given as $\begin{bmatrix} 3 & x & 2x \\ 0 & x & 4 \\ 0 & 0 & x-10 \end{bmatrix}$ and $|A| = -75$. Find

(a) the value of x.

[4 *marks*]

(b) the cofactor and the adjoint matrix of A. Hence, determine the inverse of A.

[8 *marks*]

8 Given a polynomial $P(x) = 2x^3 + ax^2 + bx - 30$ has factors $(x+2)$ and $(x-5)$.

(a) Find the value of the constants a and b.

[6 *marks*]

(b) Factorize $P(x)$ completely.

[3 *marks*]

(c) Obtain the solution set for $P(x) < 0$.

[3 *marks*]

9 (a) Expand $(4-x)^{\frac{1}{2}}$ and $(1+3x)^{-\frac{1}{2}}$ in ascending powers of x up to the term x^2.

[5 *marks*]

(b) Find the expansion of $(4-x)^{\frac{1}{2}}(1+3x)^{-\frac{1}{2}}$ up to the term x^2 and determine the range of x such that this expansion is valid. Hence, by substituting $x = \frac{1}{13}$, approximate the value of $\sqrt{51}$ correct to four significant figures.

[8 *marks*]

10 The following table shows the quantities in kilogram (kg) and the amount paid (RM) for three types of fruits bought from three stalls at a night market.

Fruit / Stall	Mango (kg)	Durian (kg)	Rambutan (kg)	Amount paid (RM)
P	5	3	2	34.00
Q	3	4	4	37.00
R	2	3	4	29.00

The price in RM per kilogram (kg) for mango, durian and rambutan are x, y and z respectively.

(a) Form a system of linear equations which represent the total expenditure per stall calculated based on the weight bought and price per kilogram. Hence, write the system in the form of a matrix equation $AX = B$.

[3 *marks*]

(b) Find the determinant, minor and adjoint of matrix A.

[6 *marks*]

(c) Based on part (b) above, find A^{-1}. Hence, solve the matrix equation.

[4 *marks*]

(d) Suppose the price per kilogram for mango, durian and rambutan has increased by RM2, RM2 and RM1, respectively. Obtain a new matrix representing the amount spent on each type of fruit to be bought.

[2 *marks*]

END OF QUESTION BOOKLET