QM016
Mathematics
Semester I
2008/2009
1 hour

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

UJIAN PERTENGAHAN SEMESTER PROGRAM MATRIKULASI
MID-SEMESTER EXAMINATION

MATEMATIK
1 jam

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

ARAHAN KEPADA CALON:

Kertas soalan ini mengandungi **7** soalan.

Jawab **semua** soalan.

Markah penuh yang diperuntukkan bagi tiap-tiap soalan atau bahagian soalan ditunjukkan dalam kurungan pada penghujung soalan atau bahagian soalan.

Semua langkah kerja hendaklah ditunjukkan dengan jelas.

Kalkulator saintifik yang tidak boleh diprogramkan sahaja boleh digunakan.

Jawapan berangka boleh diberi dalam bentuk π, e, surd, pecahan atau sehingga tiga angka bererti, di mana-mana yang sesuai, kecuali jika dinyatakan dalam soalan.

INSTRUCTIONS TO CANDIDATE:

This question booklet consists of **7** questions.

Answer **all** questions.

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

All steps must be shown clearly.

Only non-programmable scientific calculators can be used.

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

Kertas soalan ini mengandungi **5** halaman bercetak.
*This booklet consists of **5** printed pages.*

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:

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

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

For a geometric series:

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

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

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. Given that $z = \dfrac{i}{\sqrt{3} - i}$, where $i = \sqrt{-1}$.

   Express z in the form of $a + bi$, where a and b are real numbers.

   Hence, find $|z|$ and the argument of z.

   [6 marks]

2. Solve $3x \le 2 + \dfrac{1}{x}$.

   [5 marks]

3. Determine the integers p and q such that $x^3 - x^2 + 4x - 4 = (x^2 + p)(x + q)$.

   Hence, express $\dfrac{5x^2}{x^3 - x^2 + 4x - 4}$ in the form of partial fractions.

   [7 marks]

4. The sum of the first n terms of an arithmetic sequence is $S_n = 5n^2 + n$.
   Find the first term and the common difference. Find the 15th term.

   [6 marks]

5. Solve $2\log_x 3 - \log_3 \sqrt{x} = \dfrac{3}{2}$.

   [6 marks]

6. Given $(x - 1)$ is a factor of the polynomial $P(x) = 2x^3 + ax^2 - 2x + b$.

   When $P(x)$ is divided by $(x - 2)$, the remainder is -6. Find the values of a and b.

   Hence,

   (a) factorise $P(x)$ completely.

   (b) find the solution set of $P(x) \ge 0$.

   [10 marks]

7. Find the first four terms in the expansion of $(1 + 3x)^{\frac{1}{3}}$ in ascending powers of x.
   State the range of x for which the expansion is valid.
   Hence, evaluate $\sqrt[3]{8.24}$ correct to four decimal places.

   [10 marks]

END OF BOOKLET