

QM016
Mathematics
Semester I
2007/2008
1 hour



BAHAGIAN MATRIKULASI
KEMENTERIAN PELAJARAN MALAYSIA
MATRICULATION DIVISION
MINISTRY OF EDUCATION MALAYSIA

QM016
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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.

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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:

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

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

Binomial expansion:

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

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

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

1. The sum of the first n terms of an arithmetic progression is $S_n = 7n - n^2$.
Find the first term and the common difference. [4 marks]
2. The difference between the roots of the equation $x^2 - px + 12 = 0$ is 4. Find the possible values of p . [5 marks]
3. Solve the inequality $|x + 3| + 2x \geq 5$. [6 marks]
4. (a) Simplify $\frac{1 + \sqrt{3}}{2 - \sqrt{3}}$ in the form of $a + b\sqrt{c}$ where $a, b, c \in \mathbb{R}$. [2 marks]
- (b) Solve the equation

$$3 \log_{10} x^3 - 2 \log_{10} \sqrt{x} - 2 \log_{10} x^2 = 8$$
 [4 marks]
5. Given the complex number $z = \frac{4}{i - \sqrt{3}}$. Find the modulus and argument of z . Express z in the form of $r(\cos \theta + i \sin \theta)$. [6 marks]
6. Expand $(1 + 2x)^{\frac{1}{2}}$ and $(1 - x)^{-\frac{1}{2}}$ in ascending powers of x up to the term in x^3 . Hence, obtain the expansion of $\sqrt{\frac{1 + 2x}{1 - x}}$ in ascending powers of x up to the term in x^3 . State the range of x where the expansion is valid.
By substituting $x = \frac{1}{10}$ into the expansion, find the approximate value of $\sqrt{3}$ correct to 3 decimal places. [11 marks]
7. The polynomial $P(x)$ is defined by $P(x) = 2x^3 + ax^2 - 4x + b$.
- (a) If $(x + 2)$ is a factor of $P(x)$, and 4 is the remainder when $P(x)$ is divided by $(x + 1)$, find the values of a and b . [4 marks]
- (b) Find all the factors of $P(x)$. [2 marks]
- (c) Express $\frac{x + 1}{P(x)}$ as partial fractions. [6 marks]