

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*

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**MATEMATIK**  
**Kertas 1**  
**2 jam**

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

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Kertas soalan ini mengandungi 11 halaman bercetak.

*This booklet consists of 11 printed pages.*

**KANG KOOI WEI**

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**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  $\pi$ ,  $e$ , 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:

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

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

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

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

- 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  $\alpha$  and  $\beta$  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