

QS015/1
Mathematics
Paper 1
Semester I
Session 2013/2014
2 hours

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Matematik
Kertas 1
Semester I
Sesi 2013/2014
2 jam

BAHAGIAN MATRIKULASI
KEMENTERIAN PENDIDIKAN 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 QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Kertas soalan ini mengandungi **13** halaman bercetak.

This question paper consists of 13 printed pages.

INSTRUCTIONS TO CANDIDATE:

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

Answer **all** questions.

All answers must be written in the answer booklet provided. Use a new page for each question.

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

Quadratic equation $ax^2 + bx + c = 0$:

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

Arithmetic series:

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

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

Geometric series:

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

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

Sum to infinity:

$$S_\infty = \frac{a}{1-r}, |r| < 1$$

Binomial expansion:

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

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

$$(1+ax)^n = 1 + n(ax) + \frac{n(n-1)}{2!}(ax)^2 + \frac{n(n-1)(n-2)}{3!}(ax)^3 + \dots$$

$$|ax| < 1 \text{ where } n \in \mathbb{Z}^- \text{ or } n \in \mathbb{Q}$$

- 1 Given matrices $A = \begin{bmatrix} 5 & 3 & 0 \\ 3 & -1 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} c & 3 & 0 \\ 3 & d & 0 \\ 0 & 0 & e \end{bmatrix}$. Find the values of c , d and e

such that $AB = 14I$, where I is the identity matrix. Hence, determine A^{-1} .

[6 marks]

- 2 Consider the function $f(x) = 1 + \ln x$, $x \geq 1$. Determine $f^{-1}(x)$ and state its range.
Hence, evaluate $f^{-1}(3)$.

[6 marks]

- 3 Find the value of x which satisfies the equation

$$\log_9 x = (\log_3 x)^2, \quad x > 1.$$

[7 marks]

- 4 Solve the equation $2^{2x-2} - 2^{x+1} = 2^x - 2^3$.

[7 marks]

- 5 Given $g(x) = \frac{kx+8}{4x-5}$, $x \neq \frac{5}{4}$ where k is a constant.

(a) Find the value of k if $(g \circ g)(x) = x$.

[5 marks]

(b) Find the value of k so that $g(x)$ is not a one-to-one function.

[5 marks]

6 Given $f(x) = e^{3x} + 4$, $x \in R$.

(a) Find $f^{-1}(x)$.

[5 marks]

(b) On the same axes, sketch the graphs of $f(x)$ and $f^{-1}(x)$. State the domain of $f(x)$ and $f^{-1}(x)$.

[6 marks]

7 (a) Find the values of p and q if $\frac{p}{4-2i} + \frac{q}{4+2i} = 1 + \frac{5}{2}i$.

[6 marks]

(b) Given $\log_{10} 2 = m$ and $\log_{10} 7 = n$. Express x in terms of m and n if

$$(14^{3x+1})(8^{2x+3}) = 7.$$

[6 marks]

- 8 An osteoporosis patient was advised by a doctor to take enough magnesium, vitamin D and calcium to improve bone density. In a week, the patient has to take 8 units magnesium, 11 units vitamin D and 17 units calcium. The following are three types of capsule that contains the three essential nutrients for the bone:

Capsule of type P : 2 units magnesium, 1 unit vitamin D and 1 unit calcium.

Capsule of type Q : 1 unit magnesium, 2 units vitamin D and 3 units calcium.

Capsule of type R : 4 units magnesium, 6 units vitamin D and 10 units calcium.

Let x, y and z represent the number of capsule of types P, Q and R respectively that the patient has to take in a week.

- (a) Obtain a system of linear equation to represent the given information and write

the system in the form of matrix equation $AX = B$, where $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$.

[3 marks]

- (b) Find the inverse of matrix A from part (a) by using the adjoint method. Hence, find the values of x, y and z .

[8 marks]

- (c) The cost for each capsule of type P, Q and R are RM10, RM15 and RM17 respectively. How much will the expenses be for 4 weeks if the patient follows the doctor's advice?

[2 marks]

- 9 (a) In an arithmetic progression, the sum of the first four terms is 46 and the seventh term exceeds twice of the second term by 5. Obtain the first term and the common difference for the progression. Hence, calculate the sum of the first ten even terms of the progression.

[6 marks]

- (b) A ball is dropped from a height of 2 m. Each time the ball hits the floor, it bounces vertically to a height that is $\frac{3}{4}$ of its previous height.

- (i) Find the height of the ball at the tenth bounce.

[2 marks]

- (ii) Find the total distance that the ball will travel before the eleventh bounce.

[5 marks]

- 10 (a) Find the solution set of $|2 - 3x| < |x + 3|$.

[8 marks]

- (b) If $x + 1 < 0$, show that

- (i) $2x - 1 < 0$.

[3 marks]

- (ii) $\frac{2x - 1}{x + 1} > 2$.

[4 marks]

END OF QUESTION PAPER