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 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:

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

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

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:

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

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

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

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

1 Find the value of x which satisfies the equation

$$\log_2(5-x)-\log_2(x-2)=3-\log_2(1+x).$$

[6 *marks*]

2 Determine the solution set of the inequality

$$\frac{1}{2x-1}<\frac{1}{x+2}.$$

[6 *marks*]

3 Given $k+2$, $k-4$, $k-7$ are the first three terms of a geometric series. Determine the value of k. Hence, find the sum to infinity of the series.

[6 *marks*]

4 Given a complex number $z=1-\sqrt{3}i$. Determine the value of k if $\overline{z^2}=k\frac{1}{\bar{z}}$.

[7 *marks*]

5 (a) Matrix M is given as $\begin{bmatrix} 3 & -1 \\ -4 & 4 \end{bmatrix}$. Show that $M^2=7M-8I$, where I is the 2×2 identity matrix. Deduce that $M^{-1}=\frac{7}{8}I-\frac{1}{8}M$.

[5 *marks*]

(b) Given matrix $A=\begin{bmatrix} p+1 & -1 & 1 \\ 3 & 2 & 4 \\ -1 & 0 & p+2 \end{bmatrix}$ and $|A|=27$. Find the value of p, where p is an integer.

[5 *marks*]

6 The functions f and g are defined as $f(x)=\dfrac{3x+4}{x-2}$, $x\neq 2$ and $g(x)=3-x$.

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

[5 *marks*]

(b) Evaluate $\left(f\circ g^{-1}\right)(3)$.

[3 *marks*]

(c) If $(g\circ f^{-1})(k)=\dfrac{2}{3}$, find the value of k.

[4 *marks*]

7 (a) Solve $\left|x^2-x-3\right|=3$.

[5 *marks*]

(b) Find the solution set of the inequality $\dfrac{2x^2+9x-4}{x+2}<4$.

[7 *marks*]

8 The first four terms of a binomial expansion $(1+ax)^n$ is

$$1+x-\frac{1}{2}x^2+px^3+\ldots$$

Find

(a) the values of a and n where $n\neq 0$.

[6 *marks*]

(b) the value of p. Hence, by substituting $x=\frac{1}{4}$, show that $\sqrt{\frac{3}{2}}$ is approximately equal to $\frac{157}{128}$.

[7 *marks*]

9 Given $f(x)=\ln(2x+3)$ and $g(x)=\frac{e^x-3}{2}$.

(a) Show that $f(x)$ is a one-to-one function algebraically.

[3 *marks*]

(b) Find $(f\circ g)(x)$ and $(g\circ f)(x)$. Hence, state the conclusion about the results.

[5 *marks*]

(c) Sketch the graphs of $f(x)$ and $g(x)$ on the same axes. Hence, state the domain and range of $f(x)$.

[5 *marks*]

10 Given

$$A=\begin{bmatrix} 2 & 2 & 3 \\ 1 & 5 & 4 \\ 3 & 1 & 4 \end{bmatrix}.$$

(a) Find the determinant of matrix A.

[2 *marks*]

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

[5 *marks*]

(c) Given $A(\text{adjoint}(A)) = |A| I$ where I is 3×3 identity matrix, show that $A^{-1} = \frac{1}{|A|}\text{adjoint}(A)$. Hence, find A^{-1}.

[5 *marks*]

(d) By using A^{-1} in part (c), solve the following simultaneous equations.

$$\begin{aligned} 2x + 2y + 3z &= 49 \\ x + 5y + 4z &= 74 \\ 3x + y + 4z &= 49 \end{aligned}$$

[3 *marks*]

END OF QUESTION PAPER