QS015/1
Mathematics
Paper 1
Semester I
Session 2014/2015
2 hours

QS015/1
Matematik
Kertas 1
Semester I
Sesi 2014/2015
2 jam

KEMENTERIAN PENDIDIKAN MALAYSIA

BAHAGIAN MATRIKULASI
MATRICULATION DIVISION

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:

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

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

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:

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

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

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

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

1 Solve the equation $3^x + 3^{(3-x)} = 12$.

[6 *marks*]

2 Solve the inequality $\frac{1}{6-x} < \frac{1}{x-1}$.

[6 *marks*]

3 Given matrices $\mathbf{A} = \begin{bmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ a & b & 1 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} 1 & 0 & 0 \\ z & 1 & 0 \\ x & y & 1 \end{bmatrix}$ where $\mathbf{B}$ is the inverse of $\mathbf{A}$.

Find x, y and z in terms of a and b.

[6 *marks*]

4 Using algebraic method, find the least value of n for which the sum of the first n terms of a geometric series

$$0.88 + (0.88)^2 + (0.88)^3 + (0.88)^4 + \cdots$$

is greater than half of its sum to infinity.

[7 *marks*]

5 (a) State the interval for x such that the expansion for $(4+3x)^{\frac{3}{2}}$ is valid.

[2 *marks*]

(b) Expand $(4+3x)^{\frac{3}{2}}$ in ascending power of x up to the term in x^3.

[4 *marks*]

(c) Hence, by substituting an appropriate value of x, evaluate $(5)^{\frac{3}{2}}$ correct to three decimal places.

[4 *marks*]

6 (a) Given $f(x) = 2x + 1$ and $g(x) = x^2 + 2x - 1$.

(i) Find $(f - g)(x)$.

[2 *marks*]

(ii) Evaluate $(3g - 2f)(1)$.

[4 *marks*]

(b) Given $f(x) = \sqrt{2x + \frac{1}{2}}$. State the domain and range of $f(x)$.

Hence, on the same axes, sketch the graph of $f(x)$ and $f^{-1}(x)$.

[6 *marks*]

7 Let $z = a + bi$ be a nonzero complex number.

(a) Show that $\frac{1}{z} = \frac{\bar{z}}{|z|^2}$.

[4 *marks*]

(b) Show that if $\bar{z} = -z$, then z is a complex number with only an imaginary part.

[3 *marks*]

(c) Find the value of a and b if $z(2 - i) = (\bar{z} + 1)(1 + i)$.

[5 *marks*]

8 (a) Solve the following equation $\left|6x^2+x-11\right|=4$.

[6 *marks*]

(b) Find the solution set for the inequality

$$2-\left(\frac{x+2}{x-4}\right)<5.$$

[7 *marks*]

9 Two companies P and Q decided to award prizes to their employees for three work ethical values, namely punctuality (x), creativity (y) and efficiency (z). Company P decided to award a total of RM3850 for the three values to 6, 2 and 3 employees respectively, while company Q decided to award RM3200 for the three values to 4, 1 and 5 employees respectively. The total amount for all the three prizes is RM1000.

(a) Construct a system of linear equations to represent the above situation.

[3 *marks*]

(b) By forming a matrix equation, solve this equation system using the elimination method.

[7 *marks*]

(c) With the same total amount of money spent by company P and Q, is it possible for company P to award 15 employees for their creativity instead of 2 employees? Give your reason.

[3 *marks*]

10 (a) Determine whether $f(x)=\frac{1}{x-4}$ and $g(x)=\frac{4x+1}{x}$ are inverse function of each other by computing their composite functions.

[5 *marks*]

(b) Given $f(x)=\ln(1-3x)$.

(i) Determine the domain and range of $f(x)$. Then sketch the graph of $f(x)$.

[6 *marks*]

(ii) Find $f^{-1}(x)$, if it exists. Hence, state the domain and range of $f^{-1}(x)$.

[4 *marks*]

END OF QUESTION PAPER