QS015/1
Mathematics
Paper 1
Semester I
Session 2012/2013
2 hours

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Matematik
Kertas 1
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2 jam

BAHAGIAN MATRIKULASI
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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.*

SHAMMAL

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 $\overline{z^2}=k\frac{1}{\overline{z}}$.

[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

$A^{-1} = \dfrac{1}{|A|}\text{adjoint}(A)$. 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