

**SULIT**  
**SM015/2**  
*Mathematics 1*  
*Paper 2*  
*Semester I*  
*Session 2018/2019*  
*2 hours*

**SM015/2**  
**Matematik 1**  
**Kertas 2**  
**Semester I**  
**Sesi 2018/2019**  
**2 jam**



**KEMENTERIAN  
PENDIDIKAN  
MALAYSIA**

**BAHAGIAN MATRIKULASI**  
*MATRICULATION DIVISION*

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**PEPERIKSAAN SEMESTER PROGRAM MATRIKULASI**  
*MATRICULATION PROGRAMME EXAMINATION*

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

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Kertas soalan ini mengandungi **12** halaman bercetak.

*This question paper consists of 12 printed pages.*

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**SULIT**

**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  $\pi$ ,  $e$ , surd, fractions or up to three significant figures, where appropriate, unless stated otherwise in the question.

**ARAHAN KEPADA CALON:**

*Kertas soalan ini mengandungi 10 soalan.*

*Jawab semua soalan.*

*Semua jawapan hendaklah ditulis pada buku jawapan yang disediakan. Gunakan muka surat baharu bagi nombor soalan yang berbeza.*

*Markah penuh yang diperuntukkan bagi setiap soalan atau bahagian soalan ditunjukkan dalam kurungan pada penghujung soalan atau bahagian soalan.*

*Semua langkah kerja hendaklah ditunjukkan dengan jelas.*

*Kalkulator saintifik yang tidak boleh diprogramkan sahaja yang boleh digunakan.*

*Jawapan berangka boleh diberi dalam bentuk  $\pi$ ,  $e$ , surd, pecahan atau sehingga tiga angka bererti, di mana-mana yang sesuai, kecuali jika dinyatakan dalam soalan.*

**LIST OF MATHEMATICAL FORMULAE**  
**SENARAI RUMUS MATEMATIK**

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

**Persamaan kuadrat**  $ax^2 + bx + c = 0$ :

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

**Arithmetic series:**

**Siri aritmetik:**

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

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

**Geometric series:**

**Siri geometri:**

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

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

**Sum to infinity:**

**Hasil tambah infiniti:**

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

**Binomial expansion:**

**Kembangan binomial:**

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

$${}^nC_r = \binom{n}{r} = \frac{n!}{(n-r)!r!}$$

$$(1+ax)^n = 1 + n(ax) + \frac{n(n-1)}{2!}(ax)^2 + \frac{n(n-1)(n-2)}{3!}(ax)^3 + \dots, |x| < \frac{1}{|a|}$$

**LIST OF MATHEMATICAL FORMULAE**  
**SENARAI RUMUS MATEMATIK**

**Trigonometry**  
**Trigonometri**

$$\sin (A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos (A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan (A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\sin A + \sin B = 2 \sin \frac{A+B}{2} \cos \frac{A-B}{2}$$

$$\sin A - \sin B = 2 \cos \frac{A+B}{2} \sin \frac{A-B}{2}$$

$$\cos A + \cos B = 2 \cos \frac{A+B}{2} \cos \frac{A-B}{2}$$

$$\cos A - \cos B = -2 \sin \frac{A+B}{2} \sin \frac{A-B}{2}$$

$$\sin 2A = 2 \sin A \cos A$$

$$\begin{aligned} \cos 2A &= \cos^2 A - \sin^2 A \\ &= 2 \cos^2 A - 1 \\ &= 1 - 2 \sin^2 A \end{aligned}$$

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

$$\sin^2 A = \frac{1 - \cos 2A}{2}$$

$$\cos^2 A = \frac{1 + \cos 2A}{2}$$

**LIST OF MATHEMATICAL FORMULAE**  
**SENARAI RUMUS MATEMATIK**

**Differentiation**  
**Pembezaan**

$f(x)$	$f'(x)$
$\cot x$	$-\operatorname{cosec}^2 x$
$\sec x$	$\sec x \tan x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$

$$\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$$

**Sphere**  
**Sfera**

$$V = \frac{4}{3} \pi r^3 \qquad S = 4 \pi r^2$$

**Right circular cone**  
**Kon membulat tegak**

$$V = \frac{1}{3} \pi r^2 h \qquad S = \pi r^2 + \pi r h$$

**Right circular cylinder**  
**Silinder membulat tegak**

$$V = \pi r^2 h \qquad S = 2\pi r^2 + 2\pi r h$$

- 1 Given  $z_1 = 2 + 3i$  and  $z_2 = 4 - 4i$ .

Express  $\frac{(z_2)}{(z_1)} + \left[ \left( \frac{i^3}{-z_2} \right) \right]$  in Cartesian form.

Diberi  $z_1 = 2 + 3i$  dan  $z_2 = 4 - 4i$ .

Ungkapkan  $\frac{(z_2)}{(z_1)} + \left[ \left( \frac{i^3}{-z_2} \right) \right]$  dalam bentuk Cartesian.

[8 marks]

[8 markah]

- 2 Solve

Selesaikan

(a)  $\left( \frac{27}{125} \right)^2 \times \left( \frac{25}{9} \right)^{4x} = \left( \frac{9}{25} \right)^{x-3} \times \left( \frac{625}{81} \right)^2$ .

[6 marks]

[6 markah]

(b)  $\frac{1}{4-2x} \geq \frac{8}{x}$ .

[6 marks]

[6 markah]

- 3 (a) The first three terms of a geometric series are  $\left(3c - \frac{7}{2}\right)$ ,  $(3c - 2)$  and 6.

Determine the value of  $c$ . Hence, find the seventh term of this series.

*Tiga sebutan pertama suatu siri geometri adalah  $\left(3c - \frac{7}{2}\right)$ ,  $(3c - 2)$  dan 6.*

*Tentukan nilai  $c$ . Seterusnya, cari sebutan yang ketujuh bagi siri ini.*

[8 marks]

[8 markah]

- (b) Expand

*Kembangkan*

$$\left(\frac{3}{2}x^2 - 1\right)^3.$$

[4 marks]

[4 markah]

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KOLEJ MATRIKULASI KEDAH

4 (a) Given the matrix  $\begin{bmatrix} 1 & 3 & 4 \\ a+2b & 3 & 2 \\ 4 & a+b & 9 \end{bmatrix}$  such that  $M_{11} = 7$  and  $C_{12} = -1$ ,

calculate the values of  $a$  and  $b$ .

Diberi matriks  $\begin{bmatrix} 1 & 3 & 4 \\ a+2b & 3 & 2 \\ 4 & a+b & 9 \end{bmatrix}$  supaya  $M_{11} = 7$  dan  $C_{12} = -1$ ,

hitung nilai  $a$  dan  $b$ .

[5 marks]

[5 markah]

(b) Let  $A = \begin{bmatrix} 1 & 3 & 4 \\ 1 & 3 & 2 \\ 4 & 10 & 9 \end{bmatrix}$ ,  $B = \begin{bmatrix} 7 & 13 & -6 \\ -1 & -7 & 2 \\ -2 & 2 & 0 \end{bmatrix}$  and  $C = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$ .

Katakan  $A = \begin{bmatrix} 1 & 3 & 4 \\ 1 & 3 & 2 \\ 4 & 10 & 9 \end{bmatrix}$ ,  $B = \begin{bmatrix} 7 & 13 & -6 \\ -1 & -7 & 2 \\ -2 & 2 & 0 \end{bmatrix}$  dan  $C = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$ .

(i) Find determinant of  $A$  by expanding first column.

Cari penentu bagi  $A$  dengan pengembangan lajur pertama.

(ii) Evaluate  $(A^2 - B^T)C$ .

Nilaikan  $(A^2 - B^T)C$ .

[9 marks]

[9 markah]



5 (a) Given  $f(x) = \left(\frac{5x+1}{4x}\right)$  and  $g(x) = \frac{\sqrt{x+1}-2}{x^2-4}$ . Find

*Diberi  $f(x) = \left(\frac{5x+1}{4x}\right)$  dan  $g(x) = \frac{\sqrt{x+1}-2}{x^2-4}$ . Cari*

(i) the domain of  $g(x)$ .

*domain bagi  $g(x)$ .*

(ii)  $h(x)$ , if  $(f \circ h)(x) = x$ .

*$h(x)$ , jika  $(f \circ h)(x) = x$ .*

[8 marks]

[8 markah]

(b) Given  $p(x) = \ln(3x+6)$  and  $q(x) = \frac{e^x}{3} - 2$ .

Show that  $p(x)$  and  $q(x)$  are inverses of each other.

*Diberi  $p(x) = \ln(3x+6)$  dan  $q(x) = \frac{e^x}{3} - 2$ .*

*Tunjukkan  $p(x)$  dan  $q(x)$  adalah songsangan antara satu sama lain.*

[6 marks]

[6 markah]

- 6 The polynomial  $P(x) = x^4 + ax^3 - 7x^2 - 4ax + b$  has a factor  $(x+3)$  and remainder 60 when divided by  $(x-3)$ . Find the values of  $a$  and  $b$ .

Hence, factorise  $P(x)$  completely.

*Polinomial  $P(x) = x^4 + ax^3 - 7x^2 - 4ax + b$  mempunyai faktor  $(x+3)$  dan baki 60 apabila dibahagi dengan  $(x-3)$ . Cari nilai  $a$  dan  $b$ .*

*Seterusnya, faktorkan  $P(x)$  selengkapnya.*

[8 marks]

[8 markah]

- 7 (a) Express  $12 \cos \theta + 7 \sin \theta$  in the form of  $R \cos(\theta - \alpha)$ , where  $R > 0$  and  $0^\circ \leq \alpha \leq 90^\circ$ .

*Ungkapkan  $12 \cos \theta + 7 \sin \theta$  dalam bentuk  $R \cos(\theta - \alpha)$ , dengan  $R > 0$  dan  $0^\circ \leq \alpha \leq 90^\circ$ .*

[6 marks]

[6 markah]

- (b) Hence, show that the maximum value of  $\frac{1}{12 \cos \theta + 7 \sin \theta + 15}$  is

$$\frac{1}{32}(15 + \sqrt{193}).$$

*Seterusnya, tunjukkan bahawa nilai maksimum bagi  $\frac{1}{12 \cos \theta + 7 \sin \theta + 15}$*

$$\text{adalah } \frac{1}{32}(15 + \sqrt{193}).$$

[2 marks]

[2 markah]

- 8 The function  $g(x)$  is defined by

*Fungsi  $g(x)$  ditakrifkan sebagai*

$$g(x) = \begin{cases} 2, & x \leq 2, \\ \frac{x-2}{\sqrt{2x-2}}, & 2 < x \leq 8, \\ \frac{|8-x|}{x-8}, & x > 8. \end{cases}$$

Find

*Cari*

(a)  $\lim_{x \rightarrow 2^+} g(x)$ .

[5 marks]

[5 markah]

(b)  $\lim_{x \rightarrow 8^+} g(x)$ .

[3 marks]

[3 markah]

- 9 (a) Find the derivative of  $f(x) = \frac{6}{\sqrt{x}}$  using the first principle.

*Cari terbitan bagi  $f(x) = \frac{6}{\sqrt{x}}$  dengan menggunakan prinsip pertama.*

[5 marks]

[5 markah]

- (b) Find the value of  $\frac{dy}{dx}$  when  $x = 0$  for each of the following:

*Cari nilai  $\frac{dy}{dx}$  apabila  $x = 0$  bagi setiap yang berikut:*

(i)  $y = \ln(9 - 2x)$ .

[3 marks]

[3 markah]

(ii)  $y = \frac{e^{-3x}}{\sqrt{3x+1}}$ .

[3 marks]

[3 markah]

- 10 Given  $f(x) = \frac{3x}{x^2+9}$ , where  $x > 0$ . Find the coordinates of the stationary point and state its nature.

*Diberi  $f(x) = \frac{3x}{x^2+9}$ , dengan  $x > 0$ . Cari koordinat titik pegun dan nyatakan jenisnya.*

[5 marks]

[5 markah]

**END OF QUESTION PAPER**

**KERTAS SOALAN TAMAT**