

**SULIT**

**SM025/2**

*Mathematics 2*

*Paper 2*

*Semester II*

*Session 2018/2019*

*2 hours*

**SM025/2**

**Matematik 2**

**Kertas 2**

**Semester II**

**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 **16** halaman bercetak.

*This question paper consists of 16 printed pages.*

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**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**Trigonometry:****Trigonometri:**

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

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

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

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

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

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

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

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

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

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

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

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

$$\cos^2 x + \sin^2 x = 1$$

$$1 + \tan^2 x = \sec^2 x$$

$$\cot^2 x + 1 = \operatorname{cosec}^2 x$$

**LIST OF MATHEMATICAL FORMULAE**  
**SENARAI RUMUS MATEMATIK****Differentiation And Integration:**  
**Pembezaan Dan Pengamiran:**

$$\frac{d}{dx}(\sin x) = \cos x$$

$$\frac{d}{dx}(\cos x) = -\sin x$$

$$\frac{d}{dx}(\tan x) = \sec^2 x$$

$$\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x$$

$$\frac{d}{dx}(\sec x) = \sec x \tan x$$

$$\frac{d}{dx}(\operatorname{cosec} x) = -\operatorname{cosec} x \cot x$$

$$\int f'(x)e^{f(x)} dx = e^{f(x)} + c$$

$$\int \frac{f'(x)}{f(x)} dx = \ln |f(x)| + c$$

$$\int f'(x)[f(x)]^n dx = \frac{[f(x)]^{n+1}}{n+1} + c, n \neq -1$$

$$\int u dv = uv - \int v du$$

**Newton-Raphson Method:**  
**Kaedah Newton-Raphson:**

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}, n = 1, 2, 3, \dots$$

**Trapezoidal Rule:**  
**Petua Trapezium:**

$$\int_a^b f(x) dx \approx \frac{h}{2} [(y_0 + y_n) + 2(y_1 + y_2 + \dots + y_{n-1})], \quad h = \frac{b-a}{n}$$

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

**Circle:****Bulatan:**

$$(x-h)^2 + (y-k)^2 = r^2$$

$$x^2 + y^2 + 2gx + 2fy + c = 0$$

$$xx_1 + yy_1 + g(x+x_1) + f(y+y_1) + c = 0$$

$$r = \sqrt{f^2 + g^2 - c}$$

$$d = \frac{|ah + bk + c|}{\sqrt{a^2 + b^2}}$$

**Parabola:**

$$(x-h)^2 = 4p(y-k)$$

$$(y-k)^2 = 4p(x-h)$$

$$F(h+p, k)$$

$$F(h, k+p)$$

**Ellipse:****Elips:**

$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$$

$$F(h \pm c, k)$$

$$F(h, k \pm c)$$

**Line and Plane:****Garis dan Satah:**

$$\underline{r} = \underline{a} + t\underline{v}$$

$$\underline{r} \cdot \underline{n} = \underline{a} \cdot \underline{n}$$

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

**Grouped Data**  
**Data Terkumpul**

**Persentile:**  
**Persentil:**

$$P_k = L_k + \left[ \frac{\left(\frac{k}{100}\right)n - F_{k-1}}{f_k} \right] c$$

**Mode:**  
**Mod:**

$$M = L_M + \left[ \frac{d_1}{d_1 + d_2} \right] c$$

**Mean:**  
**Min:**

$$\bar{x} = \frac{\sum_{i=1}^n f_i x_i}{\sum_{i=1}^n f_i}$$

**Ungrouped Data**  
**Data Tak Terkumpul**

$$P_k = \begin{cases} \frac{x(s) + x(s+1)}{2}, & s \in \mathbb{Z} \\ x(s), & s \notin \mathbb{Z} \end{cases}$$

where  $s = \frac{n \times k}{100}$  and  $(s)$  = the least integer greater than  $s$ .

dengan  $s = \frac{n \times k}{100}$  dan  $(s)$  = integer terkecil lebih besar daripada  $s$ .

**Variance:**  
**Varians:**

$$s^2 = \frac{\sum_{i=1}^n f_i x_i^2 - \frac{1}{n} \left( \sum_{i=1}^n f_i x_i \right)^2}{n-1}$$

$$s^2 = \frac{\sum_{i=1}^n x_i^2 - \frac{1}{n} \left( \sum_{i=1}^n x_i \right)^2}{n-1}$$

**Pearson's Coefficient of Skewness:**  
**Pekali Kepencongan Pearson:**

$$S_k = \frac{3(\text{mean} - \text{median})}{\text{standard deviation}}$$

or

$$S_k = \frac{\text{mean} - \text{mode}}{\text{standard deviation}}$$

$$S_k = \frac{3(\text{min} - \text{median})}{\text{sisihan piawai}}$$

atau

$$S_k = \frac{\text{min} - \text{mod}}{\text{sisihan piawai}}$$

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

**Probability:****Kebarangkalian:**

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A') = 1 - P(A)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

**Binomial Distribution:****Taburan Binomial:**

$$X \sim B(n, p)$$

$$P(X = x) = {}^n C_x p^x (1-p)^{n-x}, \quad x = 0, 1, 2, 3, \dots, n$$

**Poisson Distribution:****Taburan Poisson:**

$$X \sim P_o(\lambda)$$

$$P(X = x) = \frac{e^{-\lambda} \lambda^x}{x!}, \quad x = 0, 1, 2, 3, \dots$$

**Normal Distribution:****Taburan Normal:**

$$X \sim N(\mu, \sigma^2)$$

$$Z \sim N(0, 1), \quad Z = \frac{X - \mu}{\sigma}$$

- 1 (a) Evaluate  $\int x(1-x)^8 dx$  by using a suitable substitution.

*Nilaiikan  $\int x(1-x)^8 dx$  menggunakan penggantian yang sesuai.*

[5 marks]

[5 markah]

- (b) Find the area of the region bounded by the curve  $y = x \cos x$  and  $x$ -axis between  $x = 0$  and  $x = \frac{\pi}{2}$ . Give your solution in term of  $\pi$ .

*Cari luas rantau yang dibatasi oleh lengkung  $y = x \cos x$  dan paksi- $x$  antara  $x = 0$  dan  $x = \frac{\pi}{2}$ . Beri penyelesaian anda dalam sebutan  $\pi$ .*

[8 marks]

[8 markah]

- 2 Solve  $\frac{dy}{dx} + 2(x+1)y^2 = 0$ , given that  $y=1$  when  $x=1$ . Express  $y$  in terms of  $x$ .

*Selesaikan  $\frac{dy}{dx} + 2(x+1)y^2 = 0$ , diberi bahawa  $y=1$  apabila  $x=1$ . Ungkap  $y$  dalam sebutan  $x$ .*

[6 marks]

[6 markah]

- 3 Use Newton-Raphson method to solve the equation  $e^x - x - 2 = 0$  correct to four decimal places by taking  $x_1 = 1$  as the first approximation.

*Gunakan kaedah Newton-Raphson untuk menyelesaikan persamaan  $e^x - x - 2 = 0$  betul kepada empat tempat perpuluhan dengan mengambil  $x_1 = 1$  sebagai penghampiran pertama.*

[5 marks]

[5 markah]



4 An ellipse  $Ax^2 + y^2 + Bx + Cy + 1 = 0$  passes through points  $(0,1)$ ,  $(1,-1)$  and  $(2,1)$ .

*Suatu elips  $Ax^2 + y^2 + Bx + Cy + 1 = 0$  melalui titik  $(0,1)$ ,  $(1,-1)$  dan  $(2,1)$ .*

- (a) Find the equation of the ellipse in the standard form. Hence, state the centre and vertices of the ellipse.

*Cari persamaan elips tersebut dalam bentuk piawai. Seterusnya, nyatakan pusat dan bucu bagi elips tersebut.*

[8 marks]

[8 markah]

- (b) Find the foci of the ellipse.

*Cari fokus bagi elips tersebut.*

[2 marks]

[2 markah]

- (c) Sketch the graph of the ellipse.

*Lakar graf elips tersebut.*

[2 marks]

[2 markah]

- 5 The line  $L_1$  and  $L_2$  passes through the point  $R(2, 4, -3)$  and  $S(8, -5, 9)$  in the direction of  $2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$  and  $\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ , respectively.

*Garis  $L_1$  dan  $L_2$  masing-masing melalui titik  $R(2, 4, -3)$  dan  $S(8, -5, 9)$  dalam arah  $2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$  dan  $\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ .*

- (a) State the equations for lines  $L_1$  and  $L_2$  in the vector form. Hence, calculate the acute angle between the lines  $L_1$  and  $L_2$ .

*Nyatakan persamaan garis  $L_1$  dan  $L_2$  dalam bentuk vektor. Seterusnya, hitung sudut tirus antara garis  $L_1$  dan  $L_2$ .*

[5 marks]

[5 markah]

- (b) Find the equation of plane containing the line  $L_1$  and the point  $(7, -3, 5)$  in the Cartesian form.

*Cari persamaan satah yang mengandungi garis  $L_1$  dan titik  $(7, -3, 5)$  dalam bentuk Cartesian.*

[5 marks]

[5 markah]

- (c) Determine whether the line  $L_2$  is parallel to the plane  $x + 5y + 3z = 5$ .

*Tentukan sama ada garis  $L_2$  adalah selari dengan satah  $x + 5y + 3z = 5$ .*

[4 marks]

[4 markah]

- 6 **TABLE 1** shows the frequency distribution of the diameter of 100 pebbles which are measured to the nearest millimeter (mm).

*JADUAL 1 menunjukkan taburan kekerapan bagi diameter 100 batu kerikil yang diukur dalam milimeter (mm) terdekat.*

**TABLE 1**  
**JADUAL 1**

Diameter (mm)	Frequency <i>Kekerapan</i>
10 – 14	22
15 – 19	20
20 – 24	25
25 – 29	15
30 – 34	18

Calculate the

*Hitung*

(a) mean.

*min.*

[2 marks]

[2 markah]

(b) mode.

*mod.*

[3 marks]

[3 markah]

(c) median.

[3 marks]

[3 markah]

- 7 A committee of 5 is to be selected from a group of 7 men and 6 women. How many different committees could be formed if

*Suatu jawatankuasa yang terdiri daripada 5 orang akan dipilih daripada sekumpulan 7 lelaki dan 6 wanita. Berapa banyak jawatankuasa yang berbeza boleh dibentuk jika*

- (a) there is no woman in the committee?

*tiada wanita dalam jawatankuasa tersebut?*

[2 marks]

[2 markah]

- (b) a particular man must be in the committee and the remaining has equal number of men and women?

*seorang lelaki tertentu mesti berada dalam jawatankuasa tersebut dan selebihnya mempunyai bilangan lelaki dan wanita yang sama?*

[3 marks]

[3 markah]

- (c) at least 3 men are in the committee?

*sekurang-kurangnya 3 lelaki dalam jawatankuasa tersebut?*

[4 marks]

[4 markah]

- 8 The probabilities of events  $X$  and  $Y$  are given as  $P(X) = \frac{3}{5}$ ,  $P(X'|Y) = \frac{31}{45}$   
and  $P(X \cap Y) = \frac{2}{25}$ .

*Kebarangkalian bagi peristiwa  $X$  dan  $Y$  adalah diberi sebagai  $P(X) = \frac{3}{5}$ ,*

$$P(X'|Y) = \frac{31}{45} \text{ dan } P(X \cap Y) = \frac{2}{25}.$$

- (a) Show that  $P(Y) = \frac{9}{35}$ .

*Tunjukkan bahawa  $P(Y) = \frac{9}{35}$ .*

[5 marks]

[5 markah]

- (b) Find  $P(X \cup Y')$ .

*Cari  $P(X \cup Y')$ .*

[3 marks]

[3 markah]

- 9 A discrete random variable  $X$  has the probability distribution function

*Suatu pembolehubah rawak diskrit  $X$  mempunyai fungsi taburan kebarangkalian*

$$f(x) = \begin{cases} \frac{x+1}{16}, & x = 2, 3, 4 \\ kx, & x = 6, 8 \\ 0, & \text{otherwise.} \\ & \text{selainnya.} \end{cases}$$

- (a) Show that  $k = \frac{1}{56}$ .

*Tunjukkan bahawa  $k = \frac{1}{56}$ .*

[3 marks]

[3 markah]

- (b) Hence, calculate  $P(3 \leq X < 8)$ .

*Seterusnya, hitung  $P(3 \leq X < 8)$ .*

[3 marks]

[3 markah]

- (c) Determine the values of  $E(X)$  and  $\text{Var}(X)$ . Thus, evaluate  $\text{Var}(\sqrt{3}X - 1)$ .

*Tentukan nilai  $E(X)$  dan  $\text{Var}(X)$ . Maka, nilaikan  $\text{Var}(\sqrt{3}X - 1)$ .*

[7 marks]

[7 markah]

- 10 The number of batteries sold at a service center on any particular day follows a Poisson distribution with mean  $\lambda$ .

*Bilangan bateri yang dijual di sebuah pusat servis pada suatu hari tertentu mengikut suatu taburan Poisson dengan min  $\lambda$ .*

- (a) If the probability of selling exactly 4 batteries divided by the probability of selling exactly 2 batteries is  $\frac{225}{12}$ , show that  $\lambda = 15$ .

*Jika kebarangkalian menjual tepat 4 bateri dibahagi dengan kebarangkalian menjual tepat 2 bateri ialah  $\frac{225}{12}$ , tunjukkan bahawa  $\lambda = 15$ .*

[3 marks]

[3 markah]

- (b) On any particular day, calculate the probability that the service center sells between 5 and 14 batteries.

*Pada suatu hari tertentu, hitung kebarangkalian bahawa pusat servis tersebut menjual di antara 5 dan 14 bateri.*

[3 marks]

[3 markah]

- (c) Given that the probability of selling less than  $k$  batteries on any particular day is 0.917, find the value of  $k$ .

*Diberi bahawa kebarangkalian menjual kurang daripada  $k$  bateri pada suatu hari tertentu ialah 0.917, cari nilai  $k$ .*

[3 marks]

[3 markah]

- (d) Find the probability that exactly 40 batteries are sold in 2 working days. Give your answer in four decimal places.

*Cari kebarangkalian bahawa tepat 40 bateri dijual dalam masa 2 hari bekerja. Beri jawapan anda dalam empat tempat perpuluhan.*

[3 marks]

[3 markah]

**END OF QUESTION PAPER**  
**KERTAS SOALAN TAMAT**

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