

SULIT

UNIVERSITI MALAYSIA PERLIS

Peperiksaan Akhir Semester Pertama
Sidang Akademik 2025/2026

Januari - Februari 2026

SMQ11103 – Mathematics for Engineering Technology 1 ,
[Matematik Untuk Teknologi Kejuruteraan 1]

Masa: 3 jam

Please make sure that this question paper has **TWELVE (12)** printed pages including this front page before you start the examination.

*[Sila pastikan kertas soalan ini mengandungi **DUA BELAS (12)** muka surat yang bercetak termasuk muka hadapan sebelum anda memulakan peperiksaan ini.]*

This question paper has **FIVE (5)** questions. Answer **ALL** questions. Each question contributes 20 marks.

*[Kertas soalan ini mengandungi **LIMA (5)** soalan. Jawab **SEMUA** soalan. Markah bagi tiap-tiap soalan adalah 20 markah.]*

(CO1, PO1, C3)

Question 1

[Soalan 1]

- (a) State whether the following statements are **TRUE** or **FALSE**.
[Nyatakan sama ada kenyataan berikut **BETUL** atau **SALAH**.]
- (i) Two parallel vectors must have the same magnitude.
[Dua vektor yang selari mesti mempunyai magnitud yang sama.] (1 Mark/ Markah)
- (ii) The dot product of two perpendicular vectors is zero.
[Hasil darab titik bagi dua vektor berserenjang adalah sifar.] (1 Mark/ Markah)
- (iii) The magnitude of a unit vector is 1.
[Magnitud bagi vektor unit adalah 1.] (1 Mark/ Markah)
- (iv) A quantity that has both magnitude and direction is called a scalar.
[Satu kuantiti yang mempunyai magnitud dan arah dikenali sebagai skalar.] (1 Mark/ Markah)
- (v) The vector $-\underline{u}$ has the opposite direction to \underline{u} .
[Vektor $-\underline{u}$ mempunyai arah yang bertentangan dengan \underline{u} .] (1 Mark/ Markah)
- (b) Given $\overline{CD} = \langle 4, -3 \rangle$ and $\overline{EF} = \langle 8, -6 \rangle$.
[Diberi bahawa $\overline{CD} = \langle 4, -3 \rangle$ dan $\overline{EF} = \langle 8, -6 \rangle$.]
- (i) Find the negative vector of \overline{CD} .
[Cari vektor negatif bagi \overline{CD} .] (1 Mark/ Markah)
- (ii) Determine whether vectors \overline{CD} and \overline{EF} are perpendicular or not.
[Tentukan sama ada vektor \overline{CD} dan \overline{EF} adalah berserenjang atau tidak.] (2 Marks/ Markah)
- (iii) Find $\overline{CD} + \overline{EF}$ and $\overline{CD} - \overline{EF}$.
[Cari $\overline{CD} + \overline{EF}$ dan $\overline{CD} - \overline{EF}$.] (4 Marks/ Markah)

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(c) Given $\underline{w} = 2\underline{i} + 3\underline{j} + \underline{k}$.
[Diberi $\underline{w} = 2\underline{i} + 3\underline{j} + \underline{k}$.]

(i) Multiply the vector \underline{w} by the scalar $k = 5$.
[Darabkan vektor \underline{w} dengan skalar $k = 5$.]

(2 Marks/ Markah)

(ii) Find the magnitude of \underline{w} .
[Cari magnitud bagi \underline{w} .]

(2 Marks/ Markah)

(iii) Find the unit vector in the direction of \underline{w} .
[Cari vektor unit dalam arah \underline{w} .]

(2 Marks/ Markah)

(iv) Prove that the magnitude of the unit vector in (c)(iii) is equal to 1.
[Buktikan bahawa magnitud vektor unit di (c)(iii) adalah 1.]

(2 Marks/ Markah)

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(CO1, PO1, C3)

Question 2*[Soalan 2]*

- (a) Given vector
- $\underline{p} = 3\underline{i} - 2\underline{j} + \underline{k}$
- and
- $\underline{q} = 2\underline{i} + \underline{j} + 2\underline{k}$
- . Determine

[Diberi vektor $\underline{p} = 3\underline{i} - 2\underline{j} + \underline{k}$ dan $\underline{q} = 2\underline{i} + \underline{j} + 2\underline{k}$. Tentukan]

(i) $\underline{p} \cdot \underline{q}$.
[$\underline{p} \cdot \underline{q}$.]

(2 Marks/ Markah)

- (ii) the angle between vectors
- \underline{p}
- and
- \underline{q}
- .

[sudut antara vektor \underline{p} dan \underline{q} .]

(5 Marks/ Markah)

- (b) Given that
- $A(2, -3, 1)$
- ,
- $B(-1, 1, 4)$
- , and
- $C(3, 2, -2)$
- are three points in
- \mathbb{R}^3
- .

[Diberi bahawa $A(2, -3, 1)$, $B(-1, 1, 4)$, dan $C(3, 2, -2)$ adalah tiga titik dalam \mathbb{R}^3 .]

(i) Find \overline{AB} and \overline{AC} .
[Cari \overline{AB} dan \overline{AC} .]

(3 Marks/ Markah)

(ii) Find $\overline{AB} \times \overline{AC}$.
[Cari $\overline{AB} \times \overline{AC}$.]

(3 Marks/ Markah)

- (iii) Determine the equation of the plane that passes through point
- A
- .

[Tentukan persamaan satah yang melalui titik A .]

(3 Marks/ Markah)

- (c) Show that the plane
- $2x + y - 3z + 5 = 0$
- is parallel to the plane
- $6x + 3y - 9z + 15 = 0$
- .

[Tunjukkan bahawa satah $2x + y - 3z + 5 = 0$ adalah selari dengan satah $6x + 3y - 9z + 15 = 0$.]

(4 Marks/ Markah)

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(CO2, PO1, C3)

Question 3*[Soalan 3]*

- (a) Find
- $\frac{dy}{dx}$
- for the following functions.

[Cari $\frac{dy}{dx}$ bagi fungsi-fungsi berikut.]

(i) $y = x^4 - 8x + 10$

(2 Marks/ Markah)

(ii) $y = 5x^{-1} + e^{2x}$

(3 Marks/ Markah)

(iii) $y = 6 - \cos x$

(2 Marks/ Markah)

- (b) Given
- $y = (2x^5)(\sin x)$
- , find
- $\frac{dy}{dx}$
- by using the product rule.

[Diberi $y = (2x^5)(\sin x)$, cari $\frac{dy}{dx}$ dengan menggunakan petua hasil darab.]

(5 Marks/ Markah)

- (c) Given
-
- [Diberi]*

$$y = \ln(x^3 - 2x + 9)$$

- (i) Find
- $\frac{dy}{dx}$
- by using the chain rule. [Hint: Let
- $u = x^3 - 2x + 9$
- .]

[Cari $\frac{dy}{dx}$ dengan menggunakan petua rantai. Petunjuk: Jadikan $u = x^3 - 2x + 9$.]

(6 Marks/ Markah)

- (ii) Based on question (c)(i), evaluate
- $\frac{dy}{dx}$
- at
- $x = 1$
- .

[Berdasarkan soalan (c)(i), nilaikan $\frac{dy}{dx}$ pada $x = 1$.]

(2 Marks/ Markah)

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(CO2, PO1, C3)

Question 4

[Soalan 4]

(a) Solve the following integrals.

[Selesaikan kamiran-kamiran berikut.]

(i) $\int (2x^3 - 5x + 4) dx$

(2 Marks/ Markah)

(ii) $\int_0^2 (12 + \cos x) dx$

(3 Marks/ Markah)

(b) Evaluate $\int x \sin(x^2) dx$ by using substitution method. [Hint: Let $u = x^2$.]*[Nilaiakan $\int x \sin(x^2) dx$ dengan menggunakan kaedah penggantian. Petunjuk: Jadikan $u = x^2$.]*

(4 Marks/ Markah)

(c) Solve $\int x^2 e^x dx$ by using the tabular method.*[Selesaikan $\int x^2 e^x dx$ dengan menggunakan kaedah tabular.]*

(4 Marks/ Markah)

(d) Find $\int \frac{5x+7}{(x-1)(x+2)} dx$ by using the partial fraction method.*[Cari $\int \frac{5x+7}{(x-1)(x+2)} dx$ dengan menggunakan kaedah pecahan separa.]*

(7 Marks/ Markah)

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(CO3, PO2, C4)

Question 5*[Soalan 5]*

- (a) A team of automotive engineers recorded the fuel consumption (in km/L) of two different engine designs (Engine X and Engine Y) over 10 standard road tests. **Table 5.1** shows the fuel consumption recorded for both engines.

[Satu kumpulan jurutera automotif merekodkan penggunaan bahan api (dalam km/L) bagi dua reka bentuk enjin yang berbeza (Enjin X dan Enjin Y) sepanjang 10 ujian jalan standard. Jadual 5.1 menunjukkan penggunaan bahan api yang direkodkan bagi kedua-dua enjin.]

Table 5.1: Fuel Consumption (in km/L)
[Jadual 5.1: Penggunaan Bahan Api (dalam km/L)]

Engine X	Engine Y
14.5	16.0
15.1	16.2
14.9	15.9
15.5	17.5
15.0	16.5
14.7	17.0
15.2	16.8
14.8	16.3
15.4	17.2
15.3	17.3

- (i) State the variable in this problem.
[Nyatakan pembolehubah dalam masalah ini.]
- (1 Mark/ Markah)
- (ii) Based on Table 5.1, calculate the mean, variance, and standard deviations for Engine X.
[Berdasarkan Jadual 5.1, kirakan min, varians dan sisihan piawai bagi Enjin X.]
- (6 Marks/ Markah)
- (iii) Given that the mean and standard deviation for engine Y are 17.3 and 0.570, respectively. Based on question (a)(ii), which engine is consistent in performance? Why?
[Diberi bahawa min dan sisihan piawai bagi Enjin Y masing-masing ialah 17.3 dan 0.570. Berdasarkan soalan (a)(ii), enjin manakah yang lebih konsisten dalam prestasinya? Mengapa?]

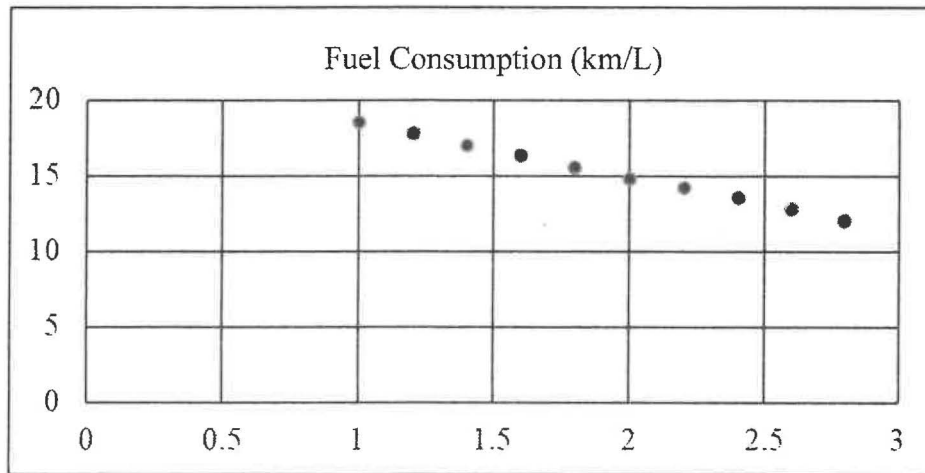
(2 Marks/ Markah)

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- (b) A study investigates the relationship between engine size (in liters) and fuel consumption (in km/L) for a sample of vehicles. The results of the analysis are shown in **Figure 5.1**.

[*Satu kajian menyiasat hubungan antara saiz enjin (dalam liter) dan penggunaan bahan api (dalam km/L) bagi sampel kenderaan. Hasil analisis ditunjukkan dalam **Rajah 5.1**.*]



<i>Regression Statistics</i>		<i>Coefficients</i>	
Multiple R	0.98	Intercept	22.05
R Square	0.96	Engine Size	-3.58
Observations	Z		

Figure 5.1: Excel Output Regression Analysis

[*Rajah 5.1: Output Excel Analisis Regresi*]

- (i) State the dependent and independent variables in this problem.
 [*Nyatakan pembolehubah bersandar dan tidak bersandar dalam masalah ini.*]
 (2 Marks/ *Markah*)
- (ii) Find the value of **Z**.
 [*Cari nilai Z.*]
 (1 Mark/ *Markah*)
- (iii) State the relationship between engine size and fuel consumption.
 [*Nyatakan hubungan antara saiz enjin dan penggunaan bahan api.*]
 (1 Mark/ *Markah*)
- (iv) State and interpret the coefficient of determination.
 [*Nyatakan dan tafsirkan nilai pekali penentuan.*]
 (2 Marks/ *Markah*)

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- (v) Write the simple linear regression equation.
[Tulis persamaan regresi linear mudah.]
(2 Marks/ Markah)
- (vi) Interpret the slope.
[Tafsirkan kecerunan.]
(1 Mark/ Markah)
- (vii) Predict the fuel consumption if the engine size is 2.5 liters.
[Anggarkan penggunaan bahan api jika saiz enjin adalah 2.5 liter.]
(2 Marks/ Markah)

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Appendix
 [Lampiran]
List of Formulas

Vector	
Vector \overline{PQ} : $\overline{PQ} = \overline{OQ} - \overline{OP} = \langle q_1 - p_1, q_2 - p_2, q_3 - p_3 \rangle$	
Parallel Vector: $\underline{u} = k\underline{v}$	
Perpendicular Vector: $\underline{u} \cdot \underline{v} = 0$	
Magnitude: $ \underline{u} = \sqrt{(u_1)^2 + (u_2)^2 + (u_3)^2}$	
Unit Vector: $\hat{u} = \frac{\underline{u}}{ \underline{u} }$	
Dot Product: $\underline{u} \cdot \underline{v} = u_1v_1 + u_2v_2 + u_3v_3$	
Cross Product: $\underline{u} \times \underline{v} = \begin{vmatrix} \underline{i} & \underline{j} & \underline{k} \\ u_1 & u_2 & u_3 \\ v_1 & v_2 & v_3 \end{vmatrix} = (u_2v_3 - u_3v_2)\underline{i} - (u_1v_3 - u_3v_1)\underline{j} + (u_1v_2 - u_2v_1)\underline{k}$	
Angle between Two Vectors: $\cos \theta = \frac{\underline{u} \cdot \underline{v}}{ \underline{u} \underline{v} }$	
Equation of Plane: $\underline{n} \cdot \overline{P_0Q} = 0$	
Standard form Equation of Plane: $ax + by + cz + d = 0$	
Differentiation and Integration	
Derivative Formula	Integral Formula
$\frac{d}{dx}[k] = 0$	$\int 0 dx = C$
$\frac{d}{dx}[x] = 1$	$\int 1 dx = x + C$
$\frac{d}{dx}[\ln x] = \frac{1}{x}$	$\int \frac{1}{x} dx = \ln x + C$
$\frac{d}{dx}[e^x] = e^x$	$\int e^x dx = e^x + C$
$\frac{d}{dx}[x^n] = nx^{n-1}$ where n is any real number.	$\int x^n dx = \frac{x^{n+1}}{n+1} + C$ where n is any real number.

$\frac{d}{dx}[\ln kx] = \frac{1}{x}$ where k is a constant.	$\int \frac{1}{kx} dx = \frac{1}{k} \ln x + C$ where k is a constant.
$\frac{d}{dx}[e^{kx}] = ke^{kx}$ where k is a constant.	$\int e^{kx} dx = \frac{1}{k} e^{kx} + C$ where k is a constant.
$\frac{d}{dx}[\sin(kx)] = k \cos(kx)$ where k is a constant	$\int \sin x dx = -\cos x + C$
$\frac{d}{dx}[\cos(kx)] = -k \sin(kx)$ where k is a constant.	$\int \cos x dx = \sin x + C$
$\frac{d}{dx}[\tan(kx)] = k \sec^2(kx)$ where k is a constant	$\int \tan x dx = \ln \sec x + C$

Integration by Partial Fraction	
Factor in Denominator, $Q(x)$	Term in Partial Fraction Decomposition
x	$\frac{A}{x}$
$ax + b$	$\frac{A}{ax + b}$
$(ax + b)^n$	$\frac{A_1}{(ax + b)^1} + \frac{A_2}{(ax + b)^2} + \dots + \frac{A_n}{(ax + b)^n}$
$ax^2 + bx + c$	$\frac{Ax + B}{ax^2 + bx + c}$

Chain Rule: $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$

Integration by Parts: $\int u dv = uv - \int v du$

Product Rule: $\frac{d}{dx}[u(x) \cdot v(x)] = u(x) \frac{d}{dx}[v(x)] + v(x) \frac{d}{dx}[u(x)]$

$$\text{Quotient Rule: } \frac{d}{dx} \left[\frac{u(x)}{v(x)} \right] = \frac{v(x) \frac{d}{dx} [u(x)] - u(x) \frac{d}{dx} [v(x)]}{[v(x)]^2}$$

Statistics and Simple Linear Regression

$$\text{Mean: } \bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

$$\text{Variance: } s^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}$$

$$\text{Standard Deviation: } s = \sqrt{s^2} = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$$

$$\text{Simple Linear Regression Model: } \hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$$

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