UNIVERSITI MALAYSIA TERENGGANU

FINAL EXAMINATION
PEPERIKSAAN AKHIR

SEMESTER I SESSION 2025/2026 (STEM FOUNDATION)
SEMESTER I SESI 2025/2026 (ASASI STEM)

COURSE ***KURSUS***	**:**	**MATHEMATICS I** ***MATEMATIK I***
COURSE CODE ***KOD KURSUS***	**:**	**AMM1114**
DURATION ***TEMPOH***	**:**	**3 HOURS** ***3 JAM***

MATRIC NO. ***NO. MATRIK***	**:**	______________________
PROGRAMME ***NAMA PROGRAM***	**:**	______________________
SEAT NO. ***NO. MEJA***	**:**	______________________

INSTRUCTIONS TO CANDIDATES
ARAHAN KEPADA CALON

i. Answer all questions.
Sila jawab semua soalan.

ii. All answers must be written in answer booklet provided.
Semua jawapan hendaklah ditulis dalam buku jawapan yang disediakan.

DO NOT OPEN THE QUESTION PAPER UNTIL INSTRUCTED
JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

THIS QUESTION PAPER CONSISTS OF THIRTEEN (20) PRINTED PAGES
KERTAS SOALAN INI MENGANDUNGI TIGA BELAS (20) MUKA SURAT BERCETAK

PART A / ***BAHAGIAN A*** **(40 Marks/** ***40 Markah*****)**

Please choose the most appropriate answer for each question in this part.
Sila pilih jawapan yang paling tepat bagi setiap soalan dalam bahagian ini.

1. Find the value of $\left(25\sqrt{x}\right)^{\frac{1}{2}}$. (1 Mark)
Cari nilai bagi $\left(25\sqrt{x}\right)^{\frac{1}{2}}$. *(1 Markah)*

A. $5x$
B. $5x^{\frac{1}{4}}$
C. $25x$
D. $25x^{\frac{1}{4}}$

2. Find $\log_a x + \log_a y - 1$ in a single logarithm. (1 Mark)
Cari $log_a x + log_a y - 1$ *dalam sebutan logarithma tunggal. (1 Markah)*

A. $\log_a \frac{xy}{a}$
B. $\log_a xy - 1$
C. $-\log_a xy$
D. $\log_a xy$

3. State the number of columns of a matrix $D = \begin{pmatrix} 3 & 5 & 0 & 1 & 1 \\ 0 & 0 & 1 & 5 & 2 \\ 6 & 3 & -2 & 1 & -1 \end{pmatrix}$. (1 Mark)

Nyatakan bilangan lajur bagi matrik $D = \begin{pmatrix} 3 & 5 & 0 & 1 & 1 \\ 0 & 0 & 1 & 5 & 2 \\ 6 & 3 & -2 & 1 & -1 \end{pmatrix}$. *(1 Markah)*

A. 0
B. 3
C. 5
D. 15

4. Select which of the following is an identity matrix. (1 Mark)
Pilih antara berikut yang manakah merupakan matriks identiti. (1 Markah)

A. $\begin{pmatrix} 1 & 1 \end{pmatrix}$

B. $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

C. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

D. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$

5. Given the order of matrix C is 3×4, and the order of D is 4×2. Find the order of matrix $(CD)^T$. (1 Mark)
Diberi saiz matriks C adalah 3×4, dan saiz matriks D adalah 4×2. Cari saiz matriks $(CD)^T$. (1 Markah)

A. 3×4
B. 4×3
C. 3×2
D. 2×3

6. Select the **wrong** statement about the vector. (1 Mark)
*Pilih pernyataan yang **salah** tentang vektor. (1 Markah)*

A. A vector is a quantity which has both magnitude and direction.
Vektor adalah kuantiti yang mempunyai magnitud dan arah.
B. A position vector starts from the origin.
Vektor kedudukan bermula dari asalan
C. A free vector does not start from the origin.
Vektor bebas tidak bermula dari titik asalan.
D. Magnitude is the velocity of the vector.
Magnitud adalah halaju vektor.

For question 7 and 8, refer to the following information and Figure 1.
Untuk soalan 7 dan 8, rujuk maklumat dan Rajah 1 berikut.

Given that $\overrightarrow{PT} = 3\boldsymbol{a}$, $\overrightarrow{PR} = 8\boldsymbol{b}$ and $\overrightarrow{PQ} = 4\overrightarrow{PT}$.
Diberi bahawa $\overrightarrow{PT} = 3\boldsymbol{a}$, $\overrightarrow{PR} = 8\boldsymbol{b}$ dan $\overrightarrow{PQ} = 4\overrightarrow{PT}$.

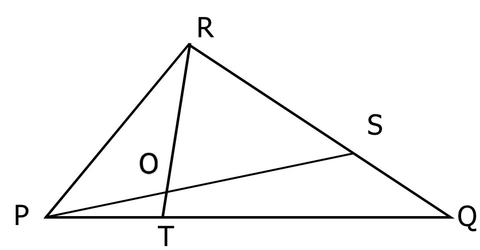


Figure 1
Rajah 1

7. Find the expression for $\overrightarrow{TR}$ in Figure 1. (1 Mark)
Cari ungkapan bagi $\overrightarrow{TR}$ dalam Rajah 1. (1 Markah)

A. $3\boldsymbol{a} + 8\boldsymbol{b}$
B. $4\boldsymbol{a} + 8\boldsymbol{b}$
C. $8\boldsymbol{b} - 3\boldsymbol{a}$
D. $3\boldsymbol{b} - 4\boldsymbol{a}$

8. Find the expression for $\overrightarrow{RQ}$ in Figure 1. (1 Mark)
Cari ungkapan bagi $\overrightarrow{RQ}$ *dalam Rajah 1. (1 Markah)*

A. $\boldsymbol{a} + 8\boldsymbol{b}$
B. $3\boldsymbol{a} - 8\boldsymbol{b}$
C. $7\boldsymbol{a} + 8\boldsymbol{b}$
D. $12\boldsymbol{a} - 8\boldsymbol{b}$

9. Find the principal value of $\tan\theta = -\frac{2}{5}$. (1 Mark)
Cari nilai utama bagi $tan\,\theta = -\frac{2}{5}$. *(1 Markah)*

A. $0.4°$
B. $-0.4°$
C. $21.8°$
D. $-21.8°$

10. State how many solution(s) are there for $\sec x - 1 = 0$ for $0° \leq x \leq 270°$. (1 Mark)
Nyatakan bilangan penyelesaian bagi $sec\,x - 1 = 0$ *bagi* $0° \leq x \leq 270°$. *(1 Markah)*

A. 1
B. 2
C. 3
D. No solution
Tiada penyelesaian

11. State the amplitude of the trigonometric function $f(x) = -\sqrt{7}\sin(x - 35°)$. (1 Mark)
Nyatakan amplitud bagi fungsi trigonometri $f(x) = -\sqrt{7}\,sin(x - 35°)$. *(1 Markah)*

A. $-\sqrt{7}$
B. $\sqrt{7}$
C. 35
D. -35

12. Select the **wrong** differentiation of the following functions. (1 Mark)
*Pilih pembezaan yang **salah** bagi fungsi berikut. (1 Markah)*

A. $\frac{d}{dx}\left(\sin\left(3x+2\right)\right) = 3\left(\cos(3x+2)\right)$
B. $\frac{d}{dx}\left(\sin 5x\right) = 5\cos 5x$
C. $\frac{d}{dx}\left(\cos\left(2-3x\right)\right) = 3\sin\left(2-3x\right)$
D. $\frac{d}{dx}\left(\cos 5x\right) = 5\sin x$

13. Find the derivative $-2x^3 + 3y^3 = 7$. (1 Mark)
Cari pembezaan bagi $-2x^3 + 3y^3 = 7$. *(1 Markah)*

A. $\frac{2x^3}{9y^3}$
B. $\frac{2x^2}{3y^2}$
C. $\frac{2x^2}{y^2}$
D. $-\frac{3y^2}{2x^2}$

14. Given that $x = 3t^2 - 1$ and $y = t^3 - 2t$. Select the **correct** differentiation for this parametric equation. (1 Mark)
Diberikan bahawa $x = 3t^2 - 1$ *dan* $y = t^3 - 2t$. *Pilih pembezaan yang* ***betul*** *bagi persamaan berparameter ini. (1 Markah)*

A. $\frac{dy}{dx} = \frac{t^3-2t}{3t^2-1}$
B. $\frac{dy}{dx} = \frac{3t^2-2}{6t}$
C. $\frac{dy}{dx} = (3t^2 - 2)(6t)$
D. $\frac{dy}{dx} = \frac{6t}{3t^2-2}$

15. Select the **wrong** statement about the differentiation. (1 Mark)
Pilih pernyataan yang ***salah*** *tentang pembezaan. (1 markah)*

A. Differentiation allows us to find rates of change.
Pembezaan membenarkan kita untuk mencari kadar perubahan.
B. Differentiation allows us to find the gradients of function.
Pembezaan membenarkan kita untuk mencari kecerunan sesuatu fungsi.
C. Derivative of any constant is zero.
Terbitan bagi sesuatu pemalar adalah sifar.
D. Second derivative of function is denoted by $\left(\frac{dy}{dx}\right)^2$.
Terbitan kedua bagi sesuatu fungsi diwakilkan oleh $\left(\frac{dy}{dx}\right)^2$.

16. Select the **correct** statement about the stationary point. (1 Mark)
*Pilih pernyataan yang **benar** tentang titik pegun. (1 Markah)*

A. The nature of stationary point is a minimum when $\frac{d^2y}{dx^2} < 0$.
Sifat bagi titik pegun adalah minimum apabila $\frac{d^2y}{dx^2} < 0$.

B. The nature of stationary point is a maximum when $\frac{d^2y}{dx^2} > 0$.
Sifat bagi titik pegun adalah maksimum apabila $\frac{d^2y}{dx^2} > 0$.

C. Stationary points are also known as the maximum and minimum points.
Titik pegun juga dikenali sebagai titik maksimum dan minimum.

D. Stationary point can be found when $\frac{d^2y}{dx^2} = 0$.
Titik pegun boleh didapati apabila $\frac{d^2y}{dx^2} = 0$.

17. Given that a curve $f(x) = 4x^3 + 9x^2 - 12x + 20$ and its derivative $f'(x) = 12x^2 + 18x - 12$. Find the **correct** stationary point for the curve. (1 Mark)
Diberikan bahawa lengkung $f(x) = 4x^3 + 9x^2 - 12x + 20$ *dan terbitannya* $f'(x) = 12x^2 + 18x - 12$. *Cari titik pegun yang **betul** bagi lengkung tersebut. (1 Markah)*

A. $(-2, 48)$
B. $(-2, 0)$
C. $\left(-\frac{1}{2}, 0\right)$
D. $\left(-\frac{1}{2}, -\frac{67}{4}\right)$

18. Find $\int e^{3x} dx$. (1 Mark)
Cari $\int e^{3x} dx$. *(1 Markah)*

A. $3e^{3x} + C$
B. $e^{3x} + C$
C. $\frac{e^{3x}}{3} + C$
D. $\frac{e^{x}}{3} + C$

19. Figure 2 shows the shaded area which bounded by straight line $y = 2x$ and $y = x^2$, from $x = 0$ until $x = 2$. (1 Mark)
Rajah 2 menunjukkan kawasan berlorek yang dibataskan di antara garis lurus $y = 2x$ dan $y = x^2$, dari $x = 0$ hingga $x = 2$. (1 Markah)

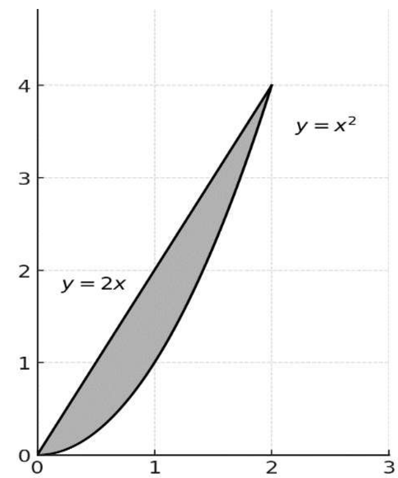


Figure 2
Rajah 2

Select the **correct** integral setup in finding the shaded area. (1 Mark)
*Pilih penyediaan kamiran yang **betul** untuk mencari luas kawasan berlorek. (1 Markah)*

A. $\int_0^2 2x - x^2\, dx$
B. $\int_0^2 x^2 - 2x\, dx$
C. $\int_0^4 2x - x^2\, dx$
D. $\int_0^4 x^2 - 2x\, dx$

20. Select the correct integral setup in finding the volume of solid formed by rotating the region under $y = \sqrt{x}$ from $x = 0$ until $x = 5$. (1 Mark)
Pilih penyediaan kamiran yang betul bagi mencari isipadu bungkah yang terhasil dengan memutarkan kawasan di bawah $y = \sqrt{x}$ dari $x = 0$ hingga $x = 5$. (1 Markah)

A. $\int_0^5 \sqrt{x}\, dx$
B. $\int_0^5 (\sqrt{x})^2\, dx$
C. $\pi \int_0^5 \sqrt{x}\, dx$
D. $\pi \int_0^5 (\sqrt{x})^2\, dx$

21. Given that $log_2 x = 3$. Find the value of $log_2 \sqrt{x}$. (2 Marks)
Diberikan bahawa $log_2 x = 3$*. Cari nilai bagi* $log_2 \sqrt{x}$*. (2 Markah)*

A. 6
B. $\frac{3}{2}$
C. $\sqrt{3}$
D. $\sqrt{2}$

22. Given that $D = \begin{pmatrix} a & -b & 2c \\ -d & 0 & f \\ g & 2h & i \end{pmatrix}$. If $|D| = -8$, find $\begin{vmatrix} -2d & 0 & 2f \\ a & -b & 2c \\ 3g & 6h & 3i \end{vmatrix}$. (2 Marks)
Diberi bahawa $D = \begin{pmatrix} a & -b & 2c \\ -d & 0 & f \\ g & 2h & i \end{pmatrix}$*. Jika* $|D| = -8$*, cari* $\begin{vmatrix} -2d & 0 & 2f \\ a & -b & 2c \\ 3g & 6h & 3i \end{vmatrix}$*. (2 Markah)*

A. -8
B. 6
C. -48
D. 48

23. Given $A = \begin{pmatrix} 2 & 1 & 0 \\ 0 & 2 & 3 \\ 1 & 3 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 0 & 1 & 2 \\ 3 & 1 & 2 \\ 2 & 1 & 0 \end{pmatrix}$. Find $B^T A^T$. (2 Marks)
Diberi $A = \begin{pmatrix} 2 & 1 & 0 \\ 0 & 2 & 3 \\ 1 & 3 & 0 \end{pmatrix}$ *dan* $B = \begin{pmatrix} 0 & 1 & 2 \\ 3 & 1 & 2 \\ 2 & 1 & 0 \end{pmatrix}$*. Cari* $B^T A^T$*. (2 Markah)*

A. $\begin{pmatrix} 3 & 3 & 6 \\ 9 & 4 & 8 \\ 12 & 5 & 4 \end{pmatrix}$

B. $\begin{pmatrix} 3 & 12 & 9 \\ 3 & 5 & 4 \\ 6 & 4 & 8 \end{pmatrix}$

C. $\begin{pmatrix} 3 & 9 & 12 \\ 3 & 4 & 5 \\ 6 & 8 & 4 \end{pmatrix}$

D. $\begin{pmatrix} 3 & 3 & 6 \\ 12 & 5 & 4 \\ 9 & 4 & 8 \end{pmatrix}$

24. Given that the vector $\boldsymbol{u} = 3\boldsymbol{i} + 4\boldsymbol{j} + \boldsymbol{k}$ and $\boldsymbol{v} = 11\boldsymbol{i} - 2\boldsymbol{j} - \boldsymbol{k}$. Find the magnitude of the vector $\boldsymbol{u} + \boldsymbol{v}$. (2 Marks)
Diberikan bahawa vektor $\boldsymbol{u} = 3\boldsymbol{i} + 4\boldsymbol{j} + \boldsymbol{k}$ *dan* $v = 11\boldsymbol{i} - 2\boldsymbol{j} - \boldsymbol{k}$. *Cari magnitud vektor* $\boldsymbol{u} + \boldsymbol{v}$. *(2 Markah)*

A. 10
B. 200
C. $2\sqrt{6}$
D. $10\sqrt{2}$

25. Find $gf(2)$, if $f(x) = x - 3$ and $g(x) = \frac{5}{x+5}$. (2 Marks)
Cari $gf(2)$, *jika* $f(x) = x - 3$ *dan* $g(x) = \frac{5}{x+5}$. *(2 Markah)*

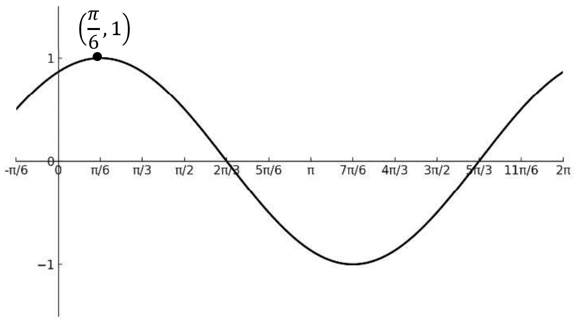
A. -1
B. 1
C. 2
D. -2

26. Find the number of solution(s) for $\operatorname{cosec} x = \frac{5}{6}$ for $0° \leq x \leq 360°$. (2 Marks)
Cari bilangan penyelesaian bagi $\text{kosek}\, x = \frac{5}{6}$ *bagi* $0° \leq x \leq 360°$. *(2 Marks)*

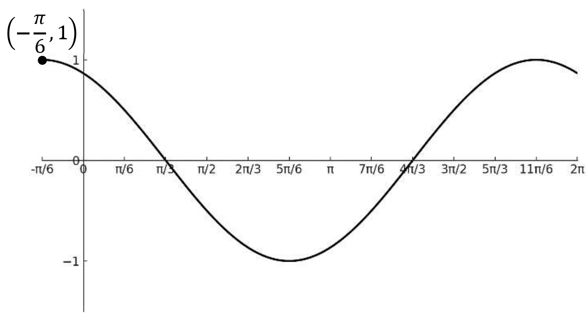
A. 1
B. 2
C. 3
D. No solution
Tiada penyelesaian

27. Given that $\sqrt{3}\cos x - \sin x = 2\cos\left(x - \frac{\pi}{6}\right)$ for $0° \leq x \leq 360°$. Hence, find the **correct** graph of $y = \sqrt{3}\cos x - \sin x$. (2 Marks)
Diberikan bahawa $\sqrt{3}\,kos\,x - sin\,x = 2\,kos\left(x - \frac{\pi}{6}\right)$ *untuk* $0° \leq x \leq 360°$. *Maka, cari graf yang **betul** bagi* $y = \sqrt{3}\,kos\,x - sin\,x$. *(2 Markah)*

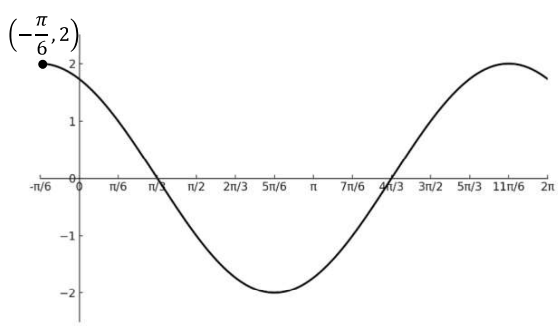
A.



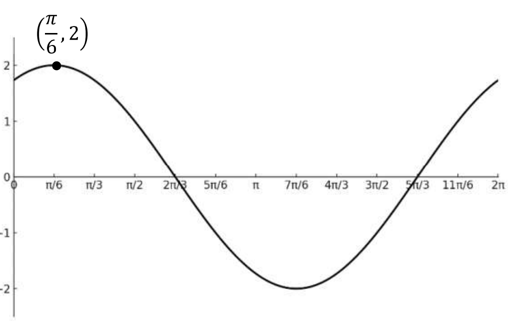
B.



C.



D.



28. Given that $y = (-2x^4 + 5x)(3x - 1)$. Find $\frac{dy}{dx}$ when $x = 1$. (2 Marks)
Diberikan bahawa $y = (-2x^4 + 5x)(3x - 1)$*. Cari* $\frac{dy}{dx}$ *apabila* $x = 1$*. (2 Markah)*

A. 3
B. 6
C. -15
D. -9

29. Given that the derivative of $f(x)$ is $f'(x) = -6x^2 - 6x + 12$. Find the stationary points of $f(x)$. (2 Marks)
Diberi pembezaan bagi $f(x)$ adalah $f'(x) = -6x^2 - 6x + 12$. *Cari titik pegun bagi* $f(x)$.
(2 Markah)

A. $(-1, -9);(2,0)$
B. $(1, 11);(-2, -16)$
C. $(1, -16)$; $(-2,11)$
D. $(-1, 0)$; $(2, -9)$

30. Find $\int \cos 2x \, dx$. (2 Marks)
Cari $\int kos\, 2x \, dx$. *(2 Markah)*

A. $\sin 2x + C$
B. $2 \sin 2x + C$
C. $\frac{1}{2} \sin 2x + C$
D. $-\frac{1}{2} \sin 2x + C$

PART B/ *BAHAGIAN B* (60 Marks/ 60 Markah)

Please answer all questions.
Sila jawab semua soalan.

1. Given that the complex number z is defined by $z = \frac{-5+2i}{2+3i}$.
Diberikan bahawa nombor kompleks z ditakrifkah oleh $z = \frac{-5+2i}{2+3i}$.

   a. Change z in the form $x + yi$, where x and y are real. (3 Marks)
   Tukarkan z dalam bentuk $x + yi$, yang mana x dan y adalah nyata. (3 Markah)

   b. Hence, compute the argument of z. (2 marks)
   Maka, kirakan hujah bagi z. (2 markah)

2. Given that $\log_m 5 = p$ and $\log_m 2 = r$, then solve the value of $log_m \frac{25m}{4}$ in terms of p and r. (4 Marks)
Diberikan bahawa $log_m 5 = p$ dan $log_m 2 = r$, maka cari nilai bagi $log_m \frac{25m}{4}$ dalam sebutan p dan r. (4 Markah)

3. A system of linear equation is given as follows:
Satu sistem persamaan linear diberikan seperti berikut:

$$x + 3y + z = 10$$
$$x - 2y - z = -6$$
$$2x + y + 2z = 10$$

   a. Express the system of linear equations in the form of a matrix equation $AX = B$. (1 mark)
   Ungkapkan sistem persamaan linear dalam bentuk persamaan matriks $AX = B$. (1 markah)

   b. Hence, find $A^T B$. (2 Marks)
   Maka, cari $A^T B$. (2 *Markah*)

   c. By using Gauss-Jordan Elimination method, compute the value x, y and z. (5 Marks)
   Dengan menggunakan kaedah Penyingkiran Gauss-Jordan, kirakan nilai x, y dan z. (5 *Markah*)

4. Lines l_1 and l_2 are given by the following equations:
Garis l_1 *dan* l_2 *diberi oleh persamaan berikut:*

$$l_1 : \ \boldsymbol{r} = (9\boldsymbol{i} + 13\boldsymbol{j} - 3\boldsymbol{k}) + \alpha(\boldsymbol{i} + 4\boldsymbol{j} - 2\boldsymbol{k})$$
$$l_2 : \ \boldsymbol{r} = (2\boldsymbol{i} - \boldsymbol{j} + \boldsymbol{k}) + \mu(2\boldsymbol{i} + \boldsymbol{j} + \boldsymbol{k})$$

where α and μ are scalar parameter.
yang mana α *dan* μ *adalah pemalar skalar*.

a. If the lines l_1 and l_2 meet, find the point of intersection. (5 Marks)
Jika garis l_1 *dan* l_2 *bertemu, cari titik persilangan tersebut. (5 Markah)*

b. By using scalar product, compute the angle between l_1 and l_2. (3 Marks)
Dengan menggunakan hasil darab skalar, hitung sudut di antara l_1 *and* l_2*.*
(3 Markah)

5. Given that $f(x) = x^2 - 4x + 5$ for $x \geq k$, where k is a constant.
Diberi bahawa $f(x) = x^2 - 4x + 5$ *untuk untuk* $x \geq k$*, di mana* k *adalah pemalar.*

a. Express $x^2 - 4x + 5$ in the form $(x + a)^2 + b$, where a and b are constants to be found. (2 Marks)
Nyatakan $x^2 - 4x + 5$ *dalam bentuk* $(x + a)^2 + b$*, di mana* a *dan* b *ialah pemalar yang boleh ditemui. (2 markah)*

b. Find the least value of k for which the function f^{-1} exists. (1 Mark)
Cari nilai terkecil bagi k *yang mana fungsi* f^{-1} *wujud. (1 Markah)*

c. Compute inverse function, $f^{-1}(x)$. (3 Marks)
Kirakan fungsi songsangan, $f^{-1}(x)$*. (3 Markah)*

d. State the range of $f^{-1}(x)$. (1 Mark)
Nyatakan julat bagi $f^{-1}(x)$*. (1 Markah)*

6. Given that a trigonometric function $\sin 2x = \cos x$ where $0° < x \leq 270°$.
Diberi fungsi trigonometri $\sin 2x = \cos x$ *yang mana* $0° < x \leq 270°$.

a. Show that $\sin 2x = \cos x$ can be written as $\cos x\,(2\sin x - 1) = 0$. (2 Marks)
Tunjukkan bahawa $\sin 2x = \mathrm{kos}\, x$ *boleh ditulis sebagai* $\mathrm{kos}\, x\,(2\sin x - 1) = 0$*.*
(2 Markah)

b. Solve $\sin 2x = \cos x$ for $0° < x \leq 270°$. (4 Marks)
Selesaikan $\sin 2x = \mathrm{kos}\, x$ *untuk* $0° < x \leq 270°$*. (4 Markah)*

7. a. Compute $\frac{dy}{dx}$ for the implicit function $2xy + \sin 3x = x^3y^3$. (4 Marks)
Kirakan $\frac{dy}{dx}$ *bagi fungsi tersirat* $2xy + \sin 3x = x^3y^3$. *(4 Markah)*

b. Compute the gradient of the curve at the points where $x = \pi$ and $y = 0$. (3 Marks)
Kirakan kecerunan lengkung tersebut pada titik di mana $x = \pi$ *dan* $y = 0$. *(3 Markah)*

8. A curve $y = f(x)$ has a stationary point at the point $(2, -15)$. It is given that $f'(x) = 2x^2 + px - 12$, where p is a constant.
Sebuah lengkung $y = f(x)$ *mempunyai satu titik pegun pada titik* $(2, -15)$. *Diberikan bahawa* $f'(x) = 2x^2 + px - 12$ *, di mana* p *adalah pemalar.*

a. Find the value of p. (3 Marks)
Cari nilai bagi p. *(3 Markah)*

b. Hence, give the x-coordinate of the other stationary point on the curve. (1 Mark)
Seterusnya, berikan koordinat-x bagi titik pegun yang lain pada lengkung tersebut. (1 Markah)

c. Compute $f''(x)$ and determine the nature of each of the stationary points on $y = f(x)$. (3 Marks)
Kirakan $f''(x)$ *dan tentukan sifat bagi setiap titik pegun pada* $y = f(x)$. *(3 Markah)*

9. By using integration by parts, find $\int \frac{1}{2} x \sin 3x \, dx$. (4 Marks)
Dengan menggunakan pengamiran bahagian demi bahagian, cari $\int \frac{1}{2} x \sin 3x \, dx$. *(4 Markah)*

10.

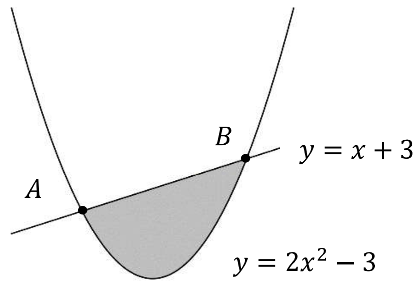


Figure 3
Rajah 3

Figure 3 shows the shaded region bounded by the curve $y = 2x^2 - 3$ and $y = x + 3$. Compute the area of the shaded region, given that the graphs intersect at point $A(-1.5,1.5)$ and $B(2,5)$. (4 Marks)
Rajah 3 menunjukkan kawasan berlorek yang dibatasi oleh lengkung $y = 2x^2 - 3$ dan $y = x + 3$. Kirakan luas kawasan berlorek, diberikan bahawa graf-graf ini bersilang pada titik $A(-1.5,1.5)$ dan $B(2,5)$. (4 Markah)

End of Question Paper
Kertas Soalan Tamat

LIST OF FORMULAE
SENARAI FORMULA

Indices

1. $a^m \times a^n = a^{m+n}$
2. $a^m \div a^n = a^{m-n}$
3. $\left(a^m\right)^n = a^{mn}$
4. $\left(ab\right)^m = a^m b^m$
5. $\left(\dfrac{a}{b}\right)^m = \dfrac{a^m}{b^m}, b \neq 0$
6. $a^0 = 1 \; \left(a \neq 0\right)$
7. $a^{-n} = \dfrac{1}{a^n}$
8. $a^{\frac{1}{n}} = \sqrt[n]{a}$
9. $a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$

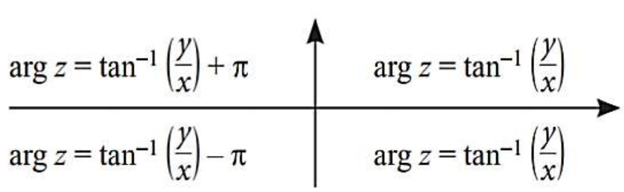
Logarithms

1. $N = a^x \Leftrightarrow \log_a N = x$
2. $\log_a a = 1$
3. $\log_a 1 = 0$
4. $a^{\log_a x} = x$
5. $\log_a MN = \log_a M + \log_a N$
6. $\log_a \dfrac{M}{N} = \log_a M - \log_a N$
7. $\log_a M = \dfrac{\log_b M}{\log_b a}$
8. $\log_a b = \dfrac{1}{\log_b a}$

Surds

1. $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$
2. $\dfrac{\sqrt{a}}{\sqrt{b}} = \sqrt{\dfrac{a}{b}}$
3. $\left(\sqrt{a} - \sqrt{b}\right)\left(\sqrt{a} + \sqrt{b}\right) = a - b$

Arguments



Matrices

1. Determinant of $A = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

2. Determinant of $\mathrm{A} = \begin{bmatrix} \mathrm{a}_{11} & \mathrm{a}_{12} & \mathrm{a}_{13} \\ \mathrm{a}_{21} & \mathrm{a}_{22} & \mathrm{a}_{23} \\ \mathrm{a}_{31} & \mathrm{a}_{32} & \mathrm{a}_{33} \end{bmatrix} = \mathrm{a}_{11}\mathrm{C}_{11} + \mathrm{a}_{12}\mathrm{C}_{12} + \mathrm{a}_{13}\mathrm{C}_{13}$

3. Inverse of 2x2 matrix

$$A^{-1} = \frac{1}{|A|}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$$

4. Inverse of 3x3 matrix

$$A^{-1} = \frac{1}{|A|} adj\ A$$

5. Adjoint matrix,

$$\mathrm{adj\,A} = \begin{pmatrix} C_{11} & C_{12} & C_{13} \\ C_{21} & C_{22} & C_{23} \\ C_{31} & C_{32} & C_{33} \end{pmatrix}^T = \begin{pmatrix} C_{11} & C_{21} & C_{31} \\ C_{12} & C_{22} & C_{32} \\ C_{13} & C_{23} & C_{33} \end{pmatrix}$$

Vectors

If $\mathbf{a} = a_1\mathbf{i} + a_2\mathbf{j} + a_3\mathbf{k}$ and $\mathbf{b} = b_1\mathbf{i} + b_2\mathbf{j} + b_3\mathbf{k}$ then

- $\mathbf{a} \bullet \mathbf{b} = a_1b_1 + a_2b_2 + a_3b_3 = |\mathbf{a}||\mathbf{b}|\cos\theta$
- $\cos\theta = \dfrac{\mathbf{a} \bullet \mathbf{b}}{|\mathbf{a}||\mathbf{b}|}$

Algebra

For the quadratic equation $ax^2 + bx + c = 0$:

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

If $b^2 - 4ac > 0$, the equation has two real roots.
If $b^2 - 4ac = 0$, the equation has one real root.
If $b^2 - 4ac < 0$, the equation has no real roots.

Trigonometry

1. Trigonometric ratios

$$\tan\theta \equiv \frac{\sin\theta}{\cos\theta}\ , \quad \sec\theta = \frac{1}{\cos\theta}\ , \quad \operatorname{cosec}\theta = \frac{1}{\sin\theta}\ , \quad \cot\theta = \frac{1}{\tan\theta}$$

2. Special angles

$$\sin 30^\circ = \frac{1}{2} \qquad \sin 45^\circ = \frac{1}{\sqrt{2}} \qquad \sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$\cos 30^\circ = \frac{\sqrt{3}}{2} \qquad \cos 45^\circ = \frac{1}{\sqrt{2}} \qquad \cos 60^\circ = \frac{1}{2}$$

$$\tan 30^\circ = \frac{1}{\sqrt{3}} \qquad \tan 45^\circ = 1 \qquad \tan 60^\circ = \sqrt{3}$$

3. Identities

$$\cos^2\theta + \sin^2\theta \equiv 1, \qquad 1 + \tan^2\theta \equiv \sec^2\theta, \qquad \cot^2\theta + 1 \equiv \operatorname{cosec}^2\theta$$

$$\sin(A+B) \equiv \sin A\cos B + \cos A\sin B$$

$$\sin(A-B) \equiv \sin A\cos B - \cos A\sin B$$

$$\cos(A+B) \equiv \cos A\cos B - \sin A\sin B$$

$$\cos(A-B) \equiv \cos A\cos B + \sin A\sin B$$

$$\tan(A+B) \equiv \frac{\tan A + \tan B}{1 - \tan A\tan B}\ , \qquad \tan(A-B) \equiv \frac{\tan A - \tan B}{1 + \tan A\tan B}$$

$$\sin 2A \equiv 2\sin A\cos A$$

$$\cos 2A \equiv \cos^2 A - \sin^2 A \equiv 2\cos^2 A - 1 \equiv 1 - 2\sin^2 A$$

$$\tan 2A \equiv \frac{2\tan A}{1 - \tan^2 A}\ , \qquad \sin^2 A = \frac{1}{2}\left(1 - \cos 2A\right)\ , \qquad \cos^2 A = \frac{1}{2}\left(1 + \cos 2A\right)$$

$$a\sin\theta + b\cos\theta = r\sin\left(\theta + \alpha\right)$$
$$a\sin\theta - b\cos\theta = r\sin\left(\theta - \alpha\right)$$
$$a\cos\theta + b\sin\theta = r\cos\left(\theta - \alpha\right)$$
$$a\cos\theta - b\sin\theta = r\cos\left(\theta + \alpha\right)$$

where $r = \sqrt{a^2 + b^2}$, $\cos\alpha = \dfrac{a}{r}$, $\sin\alpha = \dfrac{b}{r}$

4. Principal values:

$$-\frac{1}{2}\pi \le \sin^{-1} x \le \frac{1}{2}\pi, \qquad 0 \le \cos^{-1} x \le \pi,$$

$$-\frac{1}{2}\pi < \tan^{-1} x < \frac{1}{2}\pi,$$

Differentiation

$y = f(x)$	$\frac{dy}{dx}$
x^n	nx^{n-1}
$\ln x$	$\frac{1}{x}$
e^x	e^x
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$

$y = f(x)$	$\frac{dy}{dx}$
$\sec x$	$\sec x \tan x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\tan^{-1} x$	$\frac{1}{1+x^2}$

If $x = f(u)$ and $y = g(u)$ then $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

Product Rule: $\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$

Quotient Rule: $\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

Integration

(Arbitrary constants are omitted; *a* denotes a positive constant.)

$y = f(x)$	$\int \mathrm{f}(x)\mathrm{d}x$
x^n	$\dfrac{x^{n+1}}{n+1}$, $(n \neq -1)$
$\dfrac{1}{x}$	$\ln \lvert x \rvert$
e^x	e^x
e^{ax+b}	$\dfrac{1}{a} e^{ax+b}$
$\sin(ax+b)$	$-\dfrac{1}{a}\cos(ax+b)$
$\cos(ax+b)$	$\dfrac{1}{a}\sin(ax+b)$

$y = f(x)$	$\int \mathrm{f}(x)\mathrm{d}x$
$\sec^2(ax+b)$	$\dfrac{1}{a}\tan(ax+b)$
$\dfrac{1}{x^2+a^2}$	$\dfrac{1}{a}\tan^{-1}\left(\dfrac{x}{a}\right)$
$\dfrac{1}{x^2-a^2}$	$\dfrac{1}{2a}\ln\left\lvert\dfrac{x-a}{x+a}\right\rvert$ $(x > a)$
$\dfrac{1}{a^2-x^2}$	$\dfrac{1}{2a}\ln\left\lvert\dfrac{x+a}{x-a}\right\rvert$ $(\lvert x \rvert < a)$

$$\int u\frac{\mathrm{d}v}{\mathrm{d}x}\mathrm{d}x = uv - \int v\frac{\mathrm{d}u}{\mathrm{d}x}\mathrm{d}x$$

$$\int \frac{\mathrm{f}^{-1}(x)}{\mathrm{f}(x)}\mathrm{d}x = \ln\lvert \mathrm{f}(x)\rvert + c$$

$$\int \frac{1}{x^2+k^2}\,dx = \frac{1}{k}\tan^{-1}\left(\frac{x}{k}\right) + c \quad \text{and} \quad \int \frac{k}{x^2+k^2}\,dx = \tan^{-1}\left(\frac{x}{k}\right) + c$$

- Area,

  On the x-axis: $A = \int_a^b y\,dx$

  On the y-axis: $A = \int_a^b x\,dy$

- Volume of revolution

  About the *x*-axis: $V = \int_a^b \pi y^2\,dx$

  About the *y*-axis: $V = \int_a^b \pi x^2\,dy$