KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN MATEMATIK, SAINS DAN KOMPUTER

PEPERIKSAAN AKHIR

SESI II : 2025/2026

FB20154: MATHEMATICS 2

TARIKH : 24 MEI 2026
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas soalan ini mengandungi **SEMBILAN (9)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

TERBUKA

INSTRUCTION

This section consists of **FOUR (4)** questions. Answer **ALL** questions.

ARAHAN

*Bahagian ini mengandungi **EMPAT (4)** soalan. Jawab semua soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) i. Show $\frac{dy}{dx}$ for the function $y=(x-3)^2$.

Tunjukkan $\frac{dy}{dx}$ *bagi fungsi* $y=(x-3)^2$.

[3 marks]

[*3 markah*]

ii. Determine the second order differentiation for the function $y=e^{2x}+\ln(x+1)$.

Tentukan pembezaan peringkat kedua bagi fungsi $y=e^{2x}+\ln(x+1)$.

[5 marks]

[*5 markah*]

CLO1 (b) The parametric equations are given as $x=t^3-6t$ and $y=2t^3+18t$. Determine $\frac{dy}{dx}$.

Persamaan-persamaan parametrik diberi sebagai $x=t^3-6t$ *dan* $y=2t^3+18t$.

Tentukan $\frac{dy}{dx}$.

[5 marks]

[5 *markah*]

CLO1 (c) Solve $\frac{dy}{dx}$ for $5y^2 + \sin y = x^2$ by using implicit differentiation.

Selesaikan $\frac{dy}{dx}$ *bagi* $5y^2 + \sin y = x^2$ *dengan menggunakan pembezaan tersirat.*

[6 marks]

[*6 markah*]

CLO1 (d) Given that $z = 2x^3y^2 + 2y + 4x$. Calculate $\frac{\delta z}{\delta x}, \frac{\delta z}{\delta y}$ and $\frac{\delta^2 z}{\delta x \delta y}$.

Diberi $z = 2x^3y^2 + 2y + 4x$. *Kira* $\frac{\delta z}{\delta x}, \frac{\delta z}{\delta y}$ and $\frac{\delta^2 z}{\delta x \delta y}$.

[6 marks]

[*6 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Calculate the integral for $\int 3x^2 + 5x - 2dx$.

Kira kamiran bagi $\int 3x^2 + 5x - 2dx$.

[3 marks]

[*3 markah*]

CLO1 (b) Compute the definite integral for $\int_0^1 x^4 + 4x^2 + 4dx$.

Hitung kamiran tentu bagi $\int_0^1 x^4 + 4x^2 + 4dx$.

[4 marks]

[*4 markah*]

CLO2 (c) Determine the integral for the following functions:

Tentukan kamiran bagi fungsi berikut:

i. $\int 4\sec^2(2x+1) + e^{7x} - \frac{8}{2x-1}dx$.

[5 marks]

[*5 markah*]

ii. $\int \cos 3x \sin^4 3x dx$ using substitution method.

$\int \cos 3x \sin^4 3x dx$ *menggunakan kaedah gantian.*

[6 marks]

[*6 markah*]

CLO2

(d) Use the partial fraction method to solve the following integral.

Guna kaedah pecahan separa bagi menyelesaikan kamiran berikut.

$$\int \frac{3}{(x+2)(x-2)} dx$$

[7 marks]

[7 *markah*]

QUESTION 3

SOALAN 3

CLO2 (a) Identify order and degree for the following differential equations:

Kenal pasti peringkat dan darjah bagi persamaan pembezaan berikut:

i. $$5x\left(\frac{dy}{dx}\right)^2 - \frac{d^2y}{dx^2} - 6y = \log x$$

[2 marks]

[*2 markah*]

ii. $$x^3\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^4 = 0$$

[2 marks]

[*2 markah*]

CLO2 (b) Solve the following first order differential equation using suitable method.

Selesaikan persamaan pembezaan peringkat pertama yang berikut menggunakan kaedah yang sesuai.

i. $$\frac{1}{x^2}\frac{dy}{dx} = \frac{3}{4y^3}$$

[5 marks]

[*5 markah*]

ii. $$\frac{dy}{dx} + 2y = e^{2x}$$

[5 marks]

[*5 markah*]

CLO2 (c) Solve the following second order differential equation.

Selesaikan persamaan pembezaan peringkat kedua yang berikut.

$$2\frac{d^2y}{dx^2}+5\frac{dy}{dx}-3y=0$$

[5 marks]

[*5 markah*]

CLO1 (d) Determine that the equation $\ln x+x-4=0$ has a root between $x=2$ and $x=3$.

Tentukan bahawa persamaan $\ln x+x-4=0$ *mempunyai punca di antara* $x=2$ *dan* $x=3$.

[6 marks]

[*6 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Simplify the following expressions.

Permudahkan ungkapan berikut.

$$\frac{a^{4n} \times a^{2n-3}}{a^{5n+2}}$$

[3 marks]

[*3 markah*]

CLO2 (b) Calculate the value of x for the following equations:

Kira nilai x bagi persamaan yang berikut:

i. $2^x.32^{x+1} = 256$

[4 marks]

[*4 markah*]

ii. $\log_3(3x+1) - \log_3(x-7) = 4$

[5 marks]

[*5 markah*]

CLO2 (c) Compute the area of the region bounded by the curve $y = \sqrt{x+4}$ and the $y-axis$ from $y = -1$ to $y = 1$.

Hitung luas kawasan yang dibatasi oleh lengkung $y = \sqrt{x+4}$ *dan paksi y dari* $y = -1$ to $y = 1$.

[6 marks]

[*6 markah*]

CLO2 (d) Calculate the volume of the solid generated by revolving the region between $x-axis$ and $y=2x+4$ through 360^o between $x=3$ to $x=7$.

Kira isipadu pepejal yang terjana antara paksi x dan $y=2x+4$ *melalui* 360^o *di antara* $x=3$ hingga $x=7$.

[7 marks]

[*7 markah*]

SOALAN TAMAT

FORMULA FB20154 – MATHEMATICS 2

INDICES AND LOGARITHMS	
LAWS OF INDICES	**LAWS OF LOGARITHMS**
1. $a^m \times a^n = a^{m+n}$	8. $\log_a a = 1$
2. $\frac{a^m}{a^n} = a^{m-n}$	9. $\log_a 1 = 0$
3. $(a^m)^n = a^{m \times n}$	10. $\log_a b = \frac{\log_c b}{\log_c a}$
4. $a^0 = 1$	11. $\log_a MN = \log_a M + \log_a N$
5. $a^{-n} = \frac{1}{a^n}, a \neq 0$	12. $\log_a \frac{M}{N} = \log_a M - \log_a N$
6. $a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$	13. $\log_a N^P = P \log_a N$
7. $\left(ab^n\right) = a^n b^n$	14. $N = a^x \Leftrightarrow \log_a N = x$

DIFFERENTIATION	
1. $\frac{d}{dx}(k) = 0, \quad k$ is constant	11. $\frac{d}{dx}\left(\ln\lvert ax+b\rvert\right) = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
2. $\frac{d}{dx}(ax^n) = anx^{n-1}$ [Power Rule]	12. $\frac{d}{dx}\left(\sin x\right) = \cos x$
3. $\frac{d}{dx}(ax+b)^n = n(ax+b)^{n-1} \times \frac{d}{dx}(ax+b)$ [Composite Rule]	13. $\frac{d}{dx}\left(\cos x\right) = -\sin x$
4. $\frac{d}{dx}\left(f(x) \pm g(x)\right) = f'(x) \pm g'(x)$	14. $\frac{d}{dx}\left(\tan x\right) = \sec^2 x$
5. $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$ [Product Rule]	15. $\frac{d}{dx}\left[\sin(ax+b)\right] = \cos(ax+b) \times \frac{d}{dx}(ax+b)$
6. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\left(\frac{du}{dx}\right) - u\left(\frac{dv}{dx}\right)}{v^2}$ [Quotient Rule]	16. $\frac{d}{dx}\left[\cos(ax+b)\right] = -\sin(ax+b) \times \frac{d}{dx}(ax+b)$
7. $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$ [Chain Rule]	17. $\frac{d}{dx}\left[\tan(ax+b)\right] = \sec^2(ax+b) \times \frac{d}{dx}(ax+b)$
8. $\frac{d}{dx}\left(e^x\right) = e^x$	18. $\frac{d}{dx}\left[\sin^n u\right] = n\sin^{n-1} u \times \cos u \times \frac{du}{dx}$
9. $\frac{d}{dx}\left(e^{ax+b}\right) = e^{ax+b} \times \frac{d}{dx}(ax+b)$	19. $\frac{d}{dx}\left[\cos^n u\right] = n\cos^{n-1} u \times (-\sin u) \times \frac{du}{dx}$
10. $\frac{d}{dx}\left(\ln\lvert x\rvert\right) = \frac{1}{x}$	20. $\frac{d}{dx}\left[\tan^n u\right] = n\tan^{n-1} u \times \sec^2 u \times \frac{du}{dx}$

INTEGRATION	
1. $\int ax^n dx = \frac{ax^{n+1}}{n+1} + c, \quad n \neq -1$	8. $\int e^{ax+b} dx = \frac{1}{a} \times e^{ax+b} + c$
2. $\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{a(n+1)} + c, \ n \neq -1$	9. $\int \sin x dx = -\cos x + c$
3. $\int k dx = kx + c, \ k$ is constant	10. $\int \cos x dx = \sin x + c$
4. $\int_a^b f(x)dx = F(b) - F(a)$	11. $\int \sec^2 x dx = \tan x + c$
5. $\int \frac{1}{x} dx = \ln\lvert x\rvert + c$	12. $\int \sin(ax+b)dx = -\frac{1}{a} \times \cos(ax+b) + c$
6. $\int \frac{1}{ax+b} dx = \frac{1}{a} \times \ln\lvert ax+b\rvert + c$	13. $\int \cos(ax+b)dx = \frac{1}{a} \times \sin(ax+b) + c$
7. $\int e^x dx = e^x + c$	14. $\int \sec^2(ax+b)dx = \frac{1}{a} \times \tan(ax+b) + c$
INTEGRATION BY PARTS	
15. $\int udv = uv - \int vdu$	

APPLICATION OF INTEGRATION	
AREA UNDER CURVE	
1. $A_x = \int_a^b ydx$	2. $A_y = \int_a^b xdy$
VOLUME UNDER CURVE	
3. $V_x = \pi \int_a^b y^2 dx$	4. $V_y = \pi \int_a^b x^2 dy$

ORDINARY DIFFERENTIAL EQUATIONS

SOLUTION FOR 1ST ORDER DIFFERENTIAL EQUATION

Logarithmic	Linear Factors (Integrating Factors)
$a = e^{\ln a}$ $a^x = e^{x \ln a}$ $\int a^x dx = \frac{a^x}{\ln a} + c$	$\frac{dy}{dx} + Py = Q$ $y.IF = \int Q.IF dx$ Where $IF = e^{\int P dx}$

GENERAL SOLUTION FOR 2ND ORDER DIFFERENTIAL EQUATION

Equation of the form	$a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + cy = 0$
Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Real & Different roots	$y = Ae^{m_1 x} + Be^{m_2 x}$
Real & Equal roots	$y = e^{mx}(A + Bx)$
Complex Roots	$y = e^{ax}(A\cos\beta x + B\sin\beta x)$

NUMERICAL METHOD

NEWTON RAPHSON METHOD

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