CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
MATHEMATICS CENTRAL COMMITTEE

FINAL EXAMINATION
MARCH 2025 SEMESTER

COURSE CODE	:	WQD10203
COURSE NAME	:	TECHNICAL MATHEMATICS 2
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	DET IN NAVAL ARCHITECTURE SHIPBUILDING & DET SHIP CONSTRUCTION AND MAINTAINENCE
DATE	:	25 JUNE 2025
TIME	:	09:00 AM – 11:30 AM
DURATION	:	2 HOURS AND 30 MINUTES

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections.
4. Answer ALL questions in Section A and TWO (2) questions in Section B.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English language ONLY.
7. Formula sheet is appended for your reference.

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING THESE COVER PAGES.

SECTION A (Total: 60 marks)

Instructions: Answer ALL questions.
Please use the answer booklet provided.

Question 1

Given $f(x)=\sqrt{2x-4}$, $g(x)=2x+5$ and $k(x)=x-3$. Determine:

(a) $g(x)-k(x)$.

(2 marks)

(b) $(g\circ k)(x)$.

(4 marks)

(c) $f^{-1}(x)$.

(4 marks)

Question 2

(a) Determine the limit for the following function:

i. $\lim_{x \to 1} \frac{x^2 - 4}{x + 1}$.

(2 marks)

ii. $\lim_{x \to -1} \frac{x^2 + 2x + 1}{1 - x^2}$.

(4 marks)

(b) Given the graph in Figure 1.

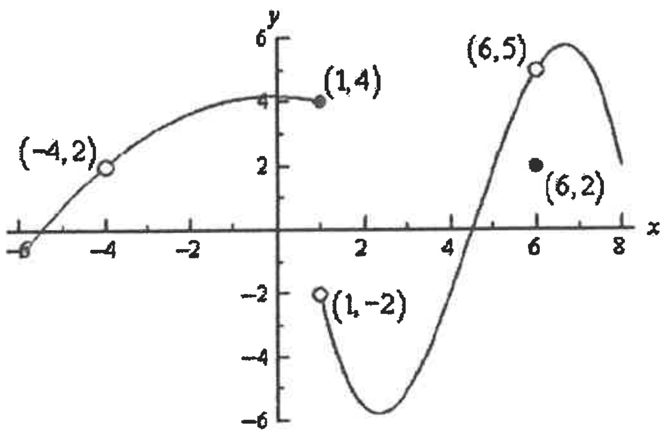

Figure 1

Compute the following:

i. $\lim_{x \to -4^-} f(x)$.

(1 mark)

ii. $\lim_{x \to 1^+} f(x)$.

(1 mark)

iii. $\lim_{x \to 6} f(x)$.

(1 mark)

iv. $f(6)$.

(1 mark)

Question 3

Differentiate the following functions:

(a) $y = 6x^5 + 2e^{4x} + \sin 5x$.

(3 marks)

(b) $y = \left(3x^2 + 8x\right)^3$.

(3 marks)

(c) $y = (2x-1)^4\sqrt{x}$.

(4 marks)

Question 4

(a) Differentiate the logarithm function, $y = \ln x + \ln\left(x^3 + 2x\right)$.

(3 marks)

(b) Given the curve, $g(x) = x^3 - 6x^2 + 12x - 19$. Determine:

i. the gradient of the curve, $g'(x)$.

(3 marks)

ii. the coordinate of the point when $g'(x) = 0$.

(4 marks)

Question 5

Determine:

(a) $\int \frac{2}{3x+4}\,dx$

(2 marks)

(b) $\int \frac{4}{e^{4x}}\,dx$

(3 marks)

(c) $\int_{-1}^{2} x^2+1\,dx$

(5 marks)

Question 6

Solve the following:

(a) $\int \frac{3x}{x^2+1}\,dx$ by using substitution method.

(5 marks)

(b) $\int xe^{3x}\,dx$ by using integration by parts method.

(5 marks)

SECTION B (Total: 40 marks)

Instructions: Answer TWO (2) questions only.
Please use the answer booklet provided.

Question 1

(a) By using implicit differentiation, calculate the gradient of the tangent line for the function $x^2 + xy - y^2 = 1$ at point (2, 3).

(10 marks)

(b) Based on Figure 2, determine the area of the shaded region R.

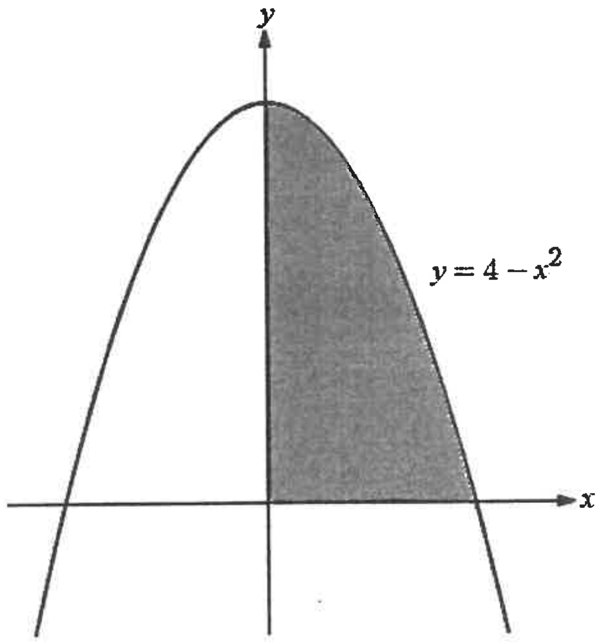

Figure 2

(10 marks)

Question 2

(a) Figure 3 shows a cuboid metal slab with a width of x meter, length $2x$ meter and height 2 meter. When heated, the width expanded at the rate of $0.01mh^{-1}$.

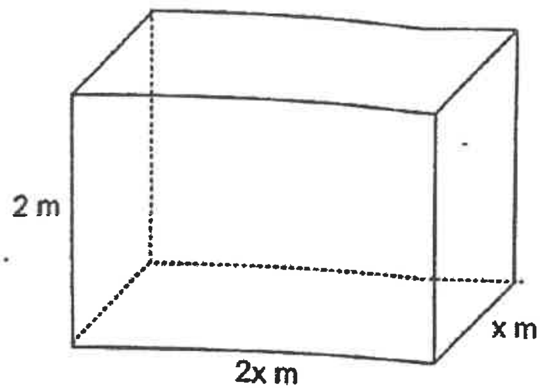

Figure 3

Determine the rate of change of the surface area when the volume is $36\,m^3$.

(10 marks)

(b) Solve $\int \frac{8}{3x^2 - 4 - 4x}\,dx$ by using partial fraction method.

(10 marks)

Question 3

(a) Given a function of $f(x)=\frac{1}{x^3}+(3x+4)^2-\sqrt{x}$.

i. Determine $f'(x)$.

(6 marks)

ii. Based on your answer in (a) i., calculate $f'(1)$ and $f'(4)$.

(4 marks)

(b) Figure 4 shows R is the region bounded by the line $y=x+3$ and the curve $y=x^2+1$.

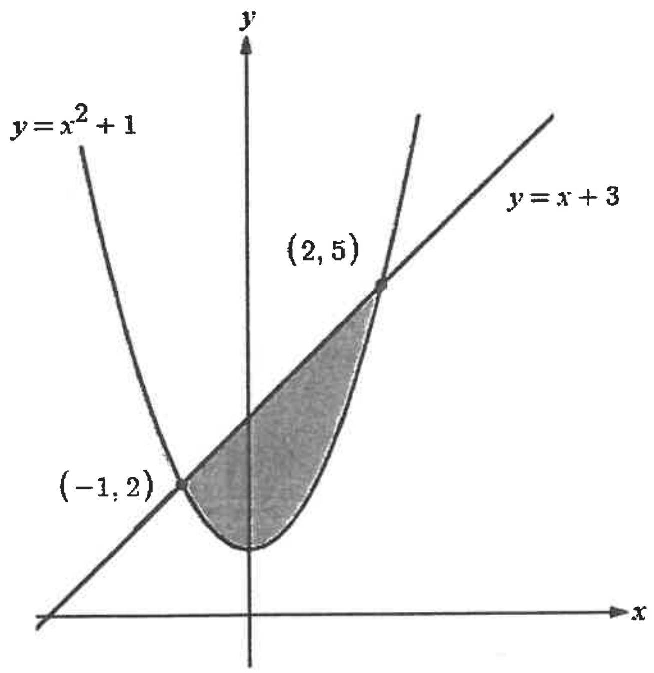

Figure 4

Calculate the volume of the solid generated by rotating R about the x-axis.

(10 marks)

END OF EXAMINATION PAPER

FORMULA SHEET

DIFFERENTIATION

TRIGONOMETRIC FUNCTION	
$\frac{d}{dx}(\sin f(x)) = [\cos f(x)] \cdot f'(x)$	$\frac{d}{dx}(\csc f(x)) = [-\csc f(x) \cot f(x)] \cdot f'(x)$
$\frac{d}{dx}(\cos f(x)) = [-\sin f(x)] \cdot f'(x)$	$\frac{d}{dx}(\sec f(x)) = [\sec f(x) \tan f(x)] \cdot f'(x)$
$\frac{d}{dx}(\tan f(x)) = [\sec^2 f(x)] \cdot f'(x)$	$\frac{d}{dx}(\cot f(x)) = [-\csc^2 f(x)] \cdot f'(x)$

EXPONENTIAL FUNCTION	LOGARITHMIC FUNCTION
$\frac{d}{dx} e^{f(x)} = \left[e^{f(x)} \right] \cdot f'(x)$	$\frac{d}{dx} \ln f(x) = \left[\frac{1}{f(x)} \right] \cdot f'(x)$

INTEGRATION

TRIGONOMETRIC FUNCTION Where : $f(x) = ax + b$	
$\int \cos f(x) dx = \frac{\sin f(x)}{f'(x)} + c$	$\int \sec f(x) \tan f(x) dx = \frac{\sec f(x)}{f'(x)} + c$
$\int \sin f(x) dx = \frac{-\cos f(x)}{f'(x)} + c$	$\int \csc f(x) \cot f(x) dx = \frac{-\csc f(x)}{f'(x)} + c$
$\int \sec^2 f(x) dx = \frac{\tan f(x)}{f'(x)} + c$	$\int \csc^2 f(x) dx = \frac{-\cot f(x)}{f'(x)} + c$

EXPONENTIAL FUNCTION Where : $f(x) = ax + b$	RECIPROCAL FUNCTION Where : $f(x) = ax + b$
$\int e^{f(x)} dx = \frac{e^{f(x)}}{f'(x)} + c$	$\int \frac{1}{f(x)} dx = \frac{\ln\lvert f(x) \rvert}{f'(x)} + c$

FORMULA SHEET

INTEGRATION

DEFINITE INTEGRAL
$\int_a^b f(x)dx = [F(x)]_a^b = F(b) - F(a)$

INTEGRATION BY PART
$\int u\,dv = uv - \int v\,du$

AREA UNDER CURVE	AREA BETWEEN CURVES
$A = \int_a^b f(x)dx$	$A = \int_a^b f(x) - g(x)dx$

VOLUME (SOLIDS OF REVOLUTION)	VOLUME OF TWO CURVES
$V = \pi\int_a^b [f(x)]^2\,dx$	$V = \pi\int_a^b [f(x)]^2 - [g(x)]^2\,dx$