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Course	: Calculus 1B	Date	: January 17, 2025
Module	: 1B	Time	: 08:45 – 10:45
Course code	: 202001200	Reference	: IEM

A

Calculus 1B
Exam

Instructions

This exam contains 10 questions. You shall use the attached *answer form* to submit your answers.

▶ For questions 1–5, you are only required to fill in the **final answer** on the answer form.

▶ For questions 6–10, you are required to write down a **full calculation and argumentation**.

You will hand in your answer form only. Any text outside the answer form will not be considered.

If you run out of space, you can use the extra space at the end of the answer form. Refer clearly to that space in the original answer.

Do not write with red pen or pencil. Do not use correction fluid or tape.

The use of electronic devices is not allowed!

Final answer questions

Write only your final answer on the answer form.

1. Find the total **area** of the region enclosed by the x-axis, the lines $x = -1$ and $x = 2$, and the graph of the function f given by $f(x) = 4x^3$. (Hint: First sketch the graph of f.) [2 pt]

2. Let f be a function such that f'' is integrable. Evaluate each of the following expressions and indicate the correct answer on your answer sheet. [2 pt]

(a) $\displaystyle\int_0^3 f''(x)\,dx =$

	(A) $f'(3) - f'(0)$	(E) $f'''(3) - f'''(0)$
	(B) $f'(0) - f'(3)$	(F) $f'''(0) - f'''(3)$
	(C) $f''(3) - f''(0)$	(G) $f'(3)$
	(D) $f''(0) - f''(3)$	(H) $f''(3)$

(b) $\displaystyle\frac{d}{dt}\int_0^t f''(x)\,dx =$

	(A) $f'(t)$	(E) $f'''(t)$
	(B) $f'(x)$	(F) $f'''(x)$
	(C) $f''(t)$	(G) $f'(t) - f'(0)$
	(D) $f''(x)$	(H) $f''(t) - f''(0)$

3. Determine the second-order partial derivative $\dfrac{\partial^2 f}{\partial x \partial y}$ of the function f given by [2 pt]

$$f(x,y) = x\cos(xy + 2) + e^y\,.$$

4. Let $w = 1 - i$ and $z = \frac{\pi}{6}e^{3\pi i}$. Compute the real and imaginary part of $w + z$. [2 pt]

5. (a) Use polar coordinates to describe the shaded region in Figure 1 below. [1 pt]

(b) Use polar coordinates to describe the line segment in Figure 2 below. [1 pt]

(c) Graph the set of points whose polar coordinates satisfy the following equation: [2 pt]

$$r = \frac{6}{2\sin\theta - \cos\theta}\,.$$

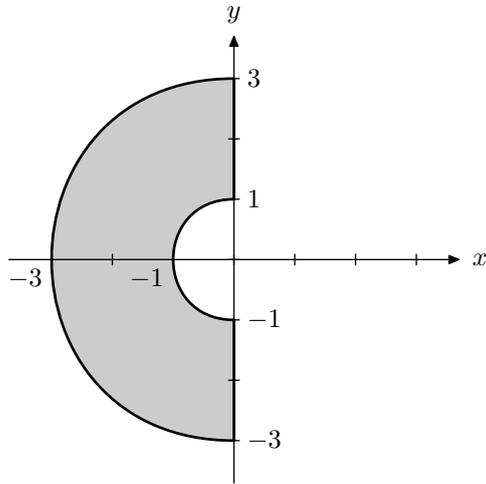(Hint: First rewrite the above equation using Cartesian coordinates.)
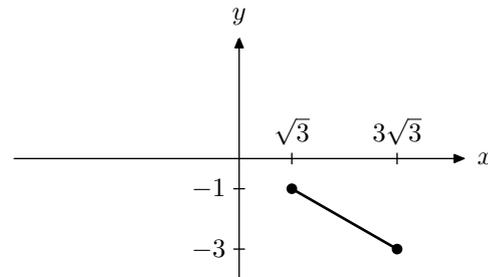

Figure 1: The shaded area of Question 5(a).

Figure 2: The line segment of Question 5(b).

Open questions

Provide a full calculation and argumentation on the answer form.

6. Evaluate the following integral: [4 pt]

$$\int (e + x)\sin x\, dx\,.$$

7. Evaluate the following integral: [5 pt]

$$\int_0^\infty \left(\frac{x}{1+x^5}\right)^4 dx\,.$$

8. Let f be the function given by [4 pt]

$$f(x,y) = e^{-xy}\cos y\,.$$

Find the linearization $L(x,y)$ of f at the point $(\pi, 0)$.

9. Find the solution $y = y(x)$ of the following initial value problem: [5 pt]

$$xy' - x = 2y + x\ln x\,, \qquad y(1) = 2025\,.$$

10. (a) Find the unique solution $y = y(x)$ of the differential equation [3 pt]

$$y'' + 8y' + 25y = 0$$

that satisfies the *boundary* conditions $y(0) = -17$ and $y(\pi/2) = 0$.

(b) Find a particular solution $y_p = y_p(x)$ of the following differential equation: [3 pt]

$$y'' + 8y' + 25y = 50x^2 + 7x - 4\,.$$

Total: 36 pt

Answer form

Calculus 1B – Exam – January 17, 2025

Full name in BLOCK LETTERS _____

Student number _____

Programme _____

⚠ FILL IN YOUR DATA AS SOON AS YOU RECEIVE THE EXAM ⚠

Question 1. *Fill in your final answer only.*

Question 2. *Check the correct alternative.*

(a)
- ☐ (A)
- ☐ (B)
- ☐ (C)
- ☐ (D)
- ☐ (E)
- ☐ (F)
- ☐ (G)
- ☐ (H)

(b)
- ☐ (A)
- ☐ (B)
- ☐ (C)
- ☐ (D)
- ☐ (E)
- ☐ (F)
- ☐ (G)
- ☐ (H)

Question 3. *Fill in your final answer only.*

Question 4. *Fill in your final answers only. Write a real number in each of the boxes.*

The real part of $w + z$ is ⬚

The imaginary part of $w + z$ is ⬚

Question 5. *Fill in your final answers only.*

(a)

(b)

(c) See next page.

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Question 5c. *Only draw your graph in the figure below.*

Question 6. *Provide a full computation/argumentation.*

Question 7. *Provide a full computation/argumentation.*

Question 8. *Provide a full computation/argumentation.*

Question 9. *Provide a full computation/argumentation.*

Question 10(a). *Provide a full computation/argumentation.*

Question 10(b). *Provide a full computation/argumentation.*

Additional writing space. *Clearly refer to this space in the original answer*

Additional writing space. *Clearly refer to this space in the original answer*