UNIVERSITY OF TWENTE.

Course	: Calculus 1B	Date	: January 16, 2026
Module	: 1B	Time	: 13:45–15:45
Course code	: 202001[194–201]	Reference	: Test 1

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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 $x = -\frac{\pi}{2}$ and $x = \pi$, and the graph of the function f given by $f(x) = 5\sin x$. [2 pt]

2. Let $f\colon [0,1] \to \mathbb{R}$ be a continuous function with $f'(x) > 0$ for all $x \in [0,1]$. [2 pt]
For any positive integer n, let S_n^L be the Riemann sum for f on the interval $[0,1]$ that is obtained by partitioning $[0,1]$ into n equal subintervals and using the **left-hand** endpoint of each subinterval to evaluate f. Let S_n^R be the corresponding Riemann sum for f obtained using the **right-hand** endpoints.
For each of the following statements, indicate whether it is true, false, or cannot be determined from the information provided.

(a) $S_{100}^L \geq \int_0^1 f(x)\,dx$

(b) $S_{100}^L \geq S_{50}^L$

(c) $S_{100}^L \geq S_{100}^R$

(d) $S_{50}^L \geq 50$.

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

$$f(x,y) = y^7 + e^{2xy}\ln y\,.$$

4. **(a)** Let $w = \pi\, e^{-\frac{\pi}{6}i}$ and $z = i$. Compute the absolute value (modulus) and argument of $\dfrac{z}{w}$. [2 pt]

(b) Find all complex numbers z that satisfy the equation [2 pt]

$$2z^4 + 7z^2 - 4 = 0\,.$$

Give your answers in Cartesian form (that is, in the form $z = x + yi$ with $x, y \in \mathbb{R}$).

5. Let C be the circle with center $(1,-3)$ that is described by the polar equation

$$r^2 - 2r\cos\theta + ar\sin\theta = -8\,,$$

where $a \in \mathbb{R}$ is a constant.

(a) Find a. [1 pt]

(b) Find the radius of circle C. [1 pt]

Open questions

Provide a full calculation and argumentation on the answer form.

6. Evaluate the following integral: [4 pt]

$$\int \frac{\cos\sqrt{x}}{\sqrt{x}\sin^2\sqrt{x}}\,dx\,.$$

7. Evaluate the following integral: [5 pt]

$$\int_0^1 (x-1)^2 \ln x\,dx\,.$$

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

$$f(x,y) = \sqrt{x - e^{4y}}\,.$$

Find the linearization $L(x,y)$ of the function f at the point $(5,0)$.

9. **(a)** Exactly one of the four slope fields in Figure 1 below is a slope field for the first-order differential equation $y' = xe^{x^2-y}$. Which one? Clearly motivate your answer. [2 pt]

(b) Find the solution $y = y(x)$ of the following initial value problem: [4 pt]

$$y' = xe^{x^2-y}, \qquad y(0) = 1.$$

10. Find the unique solution $y = y(x)$ of the differential equation [5 pt]

$$y'' + \cos x = 4(y + \sin x)$$

that satisfies the initial conditions $y(0) = 0$ and $y'(0) = 0$.

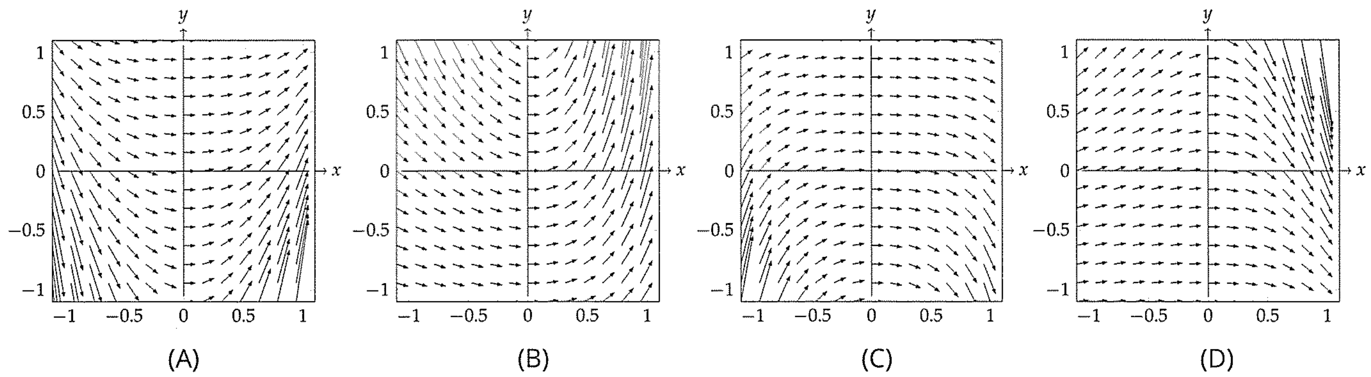

Figure 1: The four slope fields of Question 9(a).

Total: 36 pt