

Name: _____

Student ID number: _____

TA/classroom: _____

Guidelines for the test:

- Put your name or student ID number on every page.
- There are 16 problems: 12 problems in Part I (5 points each) and 4 problems in Part II .
- The exam is closed book; calculators are not allowed.
- There is no partial credit for problems in the Part I (multiple-choice (選擇) and fill-in (填充) problems).
- For problems in the Part II (problem-solving (計算題) problems), please show all work, unless instructed otherwise. Partial credit will be given only for work shown. Print as legibly as possible - correct answers may have points taken off, if they're illegible.
- Mark the final answer.

Part I: (5 points for each problem)

Multiple Choice - Single Answer (選擇題- 單選題).

1. Which of the following pairs of functions are inverse functions of each other on the implied domains?

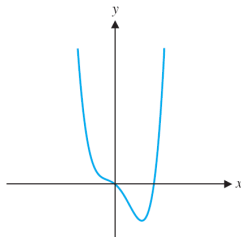
A) $f(x) = |x|$; $g(x) = |x|$

B) $f(x) = \frac{2}{x}$; $g(x) = \frac{1}{2x}$,

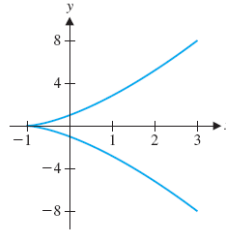
C) $f(x) = \frac{x}{2}$; $g(x) = \frac{x}{2}$,

D) $f(x) = \frac{x}{2}$; $g(x) = \frac{2}{x}$.

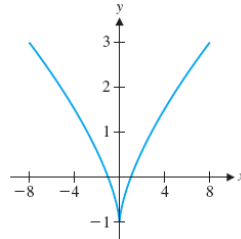
2. Which of the following curves is **NOT** a graph of a function?



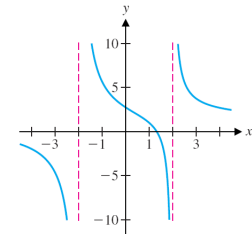
(A)



(B)

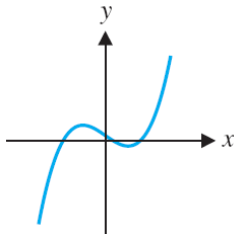


(C)

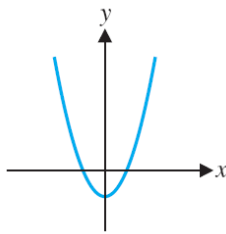


(D)

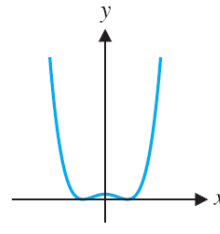
3. Find the graph corresponding to the derivative of the given function?



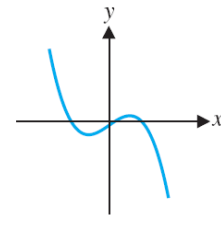
f(x)



(A)



(B)



(C)

4. Which of the following function is differentiable at $x = 0$?

A) $f(x) = \begin{cases} x^2, & x < 0 \\ x, & x \geq 0 \end{cases}$.

B) $f(x) = \begin{cases} x^3, & x < 0 \\ x^2, & x \geq 0 \end{cases}$.

C) $f(x) = |x|$.

D) $f(x) = \ln |x|$.

5. $\frac{d}{dx}(x^x) = ?$

A) x^x

B) $x^x(\ln x + 1)$,

C) $x^x \ln x$,

D) x^{x-1}

6. $\lim_{x \rightarrow 1^-} \frac{x^2}{x^2 - 1} = ?$

A) ∞

B) $-\infty$,

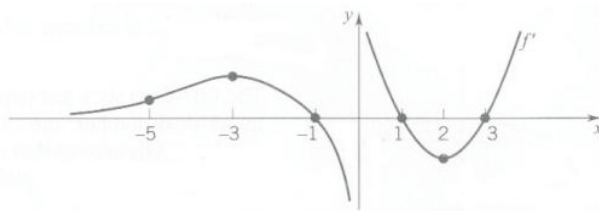
C) 1,

D) 0

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7. $f(x)$ is a continuous function on $(-\infty, \infty)$ and the graph of its derivative, $f'(x)$, is shown in the figure below. (Note: $\lim_{x \rightarrow -\infty} f'(x) = 0$; $\lim_{x \rightarrow \infty} f'(x) = \infty$)



which one of the following is **NOT** true? (Note: Choose E if A-D are all true; Choose F if A-D are all false.)

- A) $f(x)$ has a horizontal asymptote.
 - B) $f(x)$ has 3 critical numbers.
 - C) f has no absolute maximum,
 - D) f has a local extremum at $x = 0$
 - E) None of the above.
 - F) All of the above.
8. Given $f(x)$ defined in Problem 7, which one of the following is **NOT** true? (Note: Choose D if A, B and C are all true.)
- A) $(0, f(0))$ is an inflection point.
 - B) $(2, f(x))$ is an inflection point,
 - C) $(-3, f(-3))$ is an inflection point,
 - D) None of the above.

Fill-In Problems(填充)

9. Given that $f(1) = 4$, $f'(1) = 3$, $f(2) = 2$, $f'(2) = 1$, $g(1) = 4$, $g'(1) = 1$, $g(2) = 1$ and $g'(2) = 2$,
 $(f \circ g)'(2) =$ _____ .

10. Let $f(x) = \begin{cases} 3x - 1, & x < 1 \\ 1, & x = 1 \\ x^2 - x, & x > 1 \end{cases}$.
 Find $10 \lim_{x \rightarrow 1^-} f(x) + f(1) + 100 \lim_{x \rightarrow 1^+} f(x) =$ _____ .

11. Let $f(x) = \begin{cases} x^{99}, & x < 1 \\ Ax - 2, & x \geq 1 \end{cases}$. Find A such that f is continuous at 1.
 $A =$ _____

12. The horizontal asymptote (水平漸近線) of $\frac{x^2}{2-x^2}$ is _____ .

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Part II: Problem-Solving Problems (計算題 **Show all work**)

13. • (5 pts) Find the derivative of $f(x) = \ln \sqrt{e^{2x} e^{1/x} (x^2 + 1)^{10}}$, $x \neq 0$.

• (5 pts) $\frac{d}{dx}(e^{x^3+x})$.

14. Given the curve $y^2 - x^3 = -7$,

• (5 pts) find $\frac{dy}{dx}$ implicitly;

• (5 pts) what is the equation of the tangent line at $(2, 1)$?

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15. • (5 pts) Find $\frac{d}{dx} \left(\frac{x+1}{\sqrt{x^2+4}} \right)$

- (5 pts) Using the definition of derivative (limits), compute $f'(x)$.

$$f(x) = \sqrt{x-1}, \quad x \geq 1$$

16. Given that $f(x) = x^3 - 3x + 9$,

- (5 pts) find the critical numbers of $f(x)$.

- (5 pts) Find the absolute maximum and absolute minimum values of the $f(x)$ on the interval $[0, 2]$.