



University of Connecticut
Department of Mathematics

MATH 1131

PRACTICE PROBLEMS FOR EXAM 1

Sections Covered: 2.1, 2.2, 2.3, 2.5, 2.6, 2.7, 2.8, 3.1, 3.2, 3.3, 3.4, 3.5

Read This First!

- The exam will be 50 minutes, timed, and administered via HuskyCT.
- Please read each question carefully. All questions are multiple choice. There is only one correct choice for each answer.
- On the exam, please carefully check all submitted answers. The submitted letter answers are the **ONLY** place that counts as your official answers.
- You may use a calculator on the exam. No books or other references or are permitted, and **you are expected to work independently.**

1. The distance traveled by a particle in t seconds is given by $s(t) = t^2 + 3t$. What is the particle's average velocity over the interval $1 \leq t \leq 4$? [1]

(A) 8 (B) 0 (C) 2
(D) 5 (E) -1

2. Evaluate the following limit: [1]

$$\lim_{x \rightarrow 1^-} \frac{x - 3}{x - 1}.$$

(A) 2 (B) -2 (C) -1
(D) $+\infty$ (E) $-\infty$

3. Using the table below, what appears to be the value of the limit

[1]

$$\lim_{x \rightarrow 2^+} f(x)$$

x	1.9	1.99	1.999	1.9999	2	2.0001	2.001	2.01	2.1
$f(x)$	3	7	291	4081	?	-9532	-112	-17	-1

- (A) ∞ (B) $-\infty$ (C) 0
(D) -1000 (E) None of the above.

4. If $\lim_{x \rightarrow 3^+} f(x) = 5$ what can be said about $\lim_{x \rightarrow 3^-} f(x)$?

[1]

- (A) It must be 5 (B) It must be $f(3)$ (C) It must be $f(5)$
(D) It must be -5 (E) It cannot be determined

5. If $-x^2 - x + 1 \leq g(x) \leq x^2 - x + 1$ for all $x \neq 0$, what is $\lim_{x \rightarrow 0} g(x)$?

[1]

- (A) 0 (B) 1 (C) 2
(D) $g(0)$ (E) Cannot be determined

6. Evaluate the following limit:

$$\lim_{x \rightarrow 4} \frac{x^2 - 8x + 16}{x - 4}.$$

- (A) 0 (B) 8 (C) -8
(D) $+\infty$ (E) $-\infty$

[1]

7. If $\lim_{x \rightarrow 1} f(x) = 3$, $\lim_{x \rightarrow 1} g(x) = -2$, and $\lim_{x \rightarrow 1} h(x) = 4$, evaluate the limit

$$\lim_{x \rightarrow 1} \left(\frac{2f(x)}{g(x)} + \sqrt{h(x)} \right).$$

- (A) -1 (B) 3 (C) 13
(D) 5 (E) 7

[1]

8. If the function $f(x)$ is continuous on the interval $[-1, 3]$, $f(-1) = 1$, and $f(3) = 11$, which numbers below are guaranteed to be values of $f(x)$ by the Intermediate Value Theorem on the interval $(-1, 3)$? [1]

I. 3

II. $\sqrt{2}$

III. 3π

(A) I only (B) II only (C) III only

(D) I and II only (E) I, II, and III

9. Determine the value of the number k that makes the function $f(x)$ below continuous: [1]

$$f(x) = \begin{cases} 1 - kx & \text{if } x < 1, \\ k + x & \text{if } x \geq 1. \end{cases}$$

(A) 0 (B) 1 (C) $-3/4$

(D) $1/2$ (E) $15/17$

10. Consider the function

[1]

$$h(x) = \begin{cases} \frac{1}{x} & \text{if } 0 < x < 1, \\ x & \text{if } x > 1. \end{cases}$$

Which of the following are true?

- I. $\lim_{x \rightarrow 1^+} h(x)$ exists
 - II. $\lim_{x \rightarrow 1^-} h(x)$ exists
 - III. $\lim_{x \rightarrow 1} h(x)$ exists
 - IV. $h(x)$ is continuous at $x = 1$
- (A) I only (B) I and II only (C) I, II, and III only
(D) IV only (E) I, II, III, and IV

11. Evaluate the following limit:

[1]

$$\lim_{x \rightarrow \infty} \frac{\sqrt{x^2 + 2}}{x}.$$

- (A) $+\infty$ (B) $-\infty$ (C) 0
(D) 1 (E) -1

12. The function $f(x) = \frac{x^2 + 1}{x^3 + 8}$ has which of the following?

[1]

- (A) no vertical or horizontal asymptotes
- (B) 1 vertical asymptote and 1 horizontal asymptote
- (C) 2 vertical asymptotes and 1 horizontal asymptote
- (D) 1 vertical asymptote and 2 horizontal asymptotes
- (E) 1 vertical asymptote and no horizontal asymptotes

13. For what value of the number k is the following function differentiable at $x = 0$?

[1]

$$f(x) = \begin{cases} -x & x \leq 0 \\ k & x > 0 \end{cases}$$

- (A) -2 (B) -1 (C) 0
- (D) 1 (E) No value of k makes this function differentiable at $x = 0$

14. If $f(x) = 3x^{10}$, then $\lim_{h \rightarrow 0} \frac{f(1+h) - f(1)}{h}$ is which of the following?

[1]

(A) $f'(x)$ (B) $f'(1)$ (C) Does not exist

(D) 0 (E) None of the above

15. If we want to calculate the derivative $f'(x)$ of $f(x) = 3x + 4$ using the limit definition of the derivative which of the following limits do we need to evaluate and to what does the limit evaluate?

[1]

(A) $\lim_{h \rightarrow 0} \frac{3(x+h) + 4 - (3x+4)}{h} = 3$

(B) $\lim_{h \rightarrow 0} \frac{3(x+h) + 4 - (3x+4)}{h} = 0$

(C) $\lim_{h \rightarrow 0} \frac{3h + 4 - (3x+4)}{h} = 3x + 3$

(D) $\lim_{h \rightarrow 0} \frac{3(x+h) + 4 - (3h+4)}{h} = 3$

(E) None of the above.

16. Below is the graph of the derivative $g'(x)$ of a function $g(x)$.

[1]

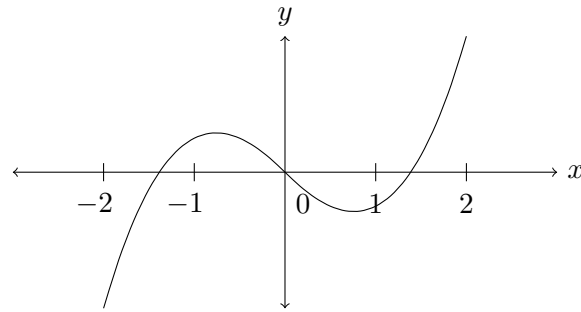
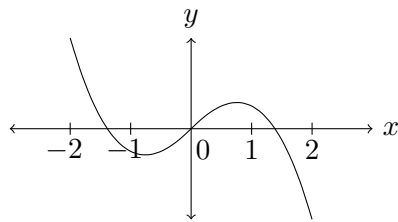


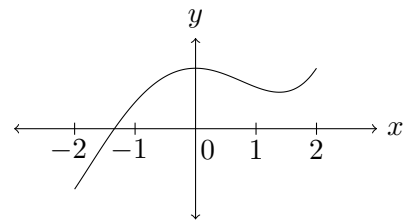
Figure 1: Graph of $g'(x)$.

Which of the following is a possible graph of $g(x)$?

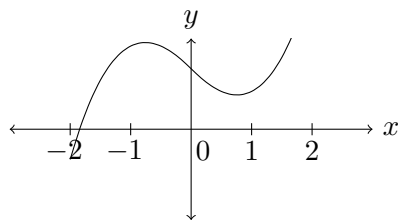
(A)



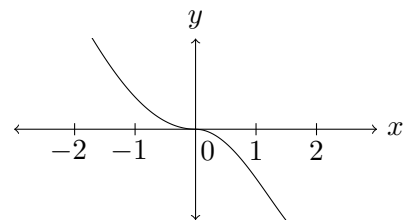
(B)



(C)



(D)



(E) None of the above. It looks like:

17. If $f(x) = \sqrt{x} + \frac{1}{\sqrt{x}}$ for $x > 0$, then $f'(4)$ is which of the following?

[1]

(A) $\frac{5}{4}$ (B) $\frac{3}{4}$ (C) $\frac{3}{16}$

(D) $\frac{255}{32}$ (E) $\frac{257}{32}$

18. Determine $f'(1)$ for the function $f(x) = (x^3 - x^2 + 1)(x^4 - x + 2)$.

(A) 3 (B) 0 (C) 4

(D) 2 (E) 5

19. Find the equation of the tangent line to the curve $y = \frac{x}{x+1}$ at $x = 1$.

(A) $y = \frac{1}{2}$ (B) $y = -\frac{1}{2}x + 1$ (C) $y = \frac{1}{2}x$

(D) $y = -\frac{1}{4}x + \frac{3}{4}$ (E) $y = \frac{1}{4}x + \frac{1}{4}$

20. If $f(x) = \sin(x)$, determine $f^{(125)}(\pi)$.

(A) 1 (B) -1 (C) 0

(D) $1/2$ (E) $\sqrt{2}/2$

21. To compute the derivative of $\sin^2 x$ with the chain rule by writing this function as a composition $f(g(x))$, what is the “inner” function $g(x)$?

(A) x (B) x^2 (C) $\sin x$

(D) $\sin^2 x$ (E) None of the above

22. Let $y = f(x)g(x)$. Using the table of values below, determine the value of $\frac{dy}{dx}$ when $x = 2$.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	5	2	4	4
2	3	4	1	3
3	2	3	2	2
4	4	1	5	5
5	1	5	3	1

- (A) 9 (B) 12 (C) 13
(D) 15 (E) 23

23. If $g(x) = \frac{ax + b}{cx + d}$, then $g'(1)$ is which of the following? Note: The numbers a, b, c , and d are constants.

- (A) $\frac{a + b - c - d}{c + d}$ (B) $\frac{ad - bc}{(c + d)^2}$ (C) $\frac{a + b - c - d}{(c + d)^2}$
(D) $\frac{ad + bc}{c + d}$ (E) $\frac{ad + bc}{(c + d)^2}$

24. For the function $f(x) = x^3 \arctan(x)$, which of the following is $f'(1)$?

- (A) $\frac{3\pi}{4}$ (B) $\frac{3\pi}{4} + \frac{1}{2}$ (C) $\frac{1}{2}$
(D) $\frac{\pi}{4}$ (E) $3 \tan(1) + \sec^2(1)$

25. Consider the functions $f(x) = \sin(x^2)$ and $g(x) = \sin^2(x)$. Which of the following is true?

- (A) $f'(x) = \cos(x^2)$ (B) $g'(x) = -2 \sin(x) \cos(x)$ (C) $f'(x) = g'(x)$
(D) $f'(\pi) = g'(\pi) = 0$ (E) $f'(0) = g'(0)$

26. If $\frac{d}{dx} [f(4x)] = x^2$, then find $f'(x)$.

- (A) $\frac{x^2}{64}$ (B) $\frac{x^2}{16}$ (C) $\frac{x^2}{4}$
(D) x^2 (E) $4x^2$

27. Find an equation of the tangent line to the curve $(x^2 + y^2)^2 = 4x^2y$ at the point $(1, 1)$.

- (A) $y = 1$ (B) $y = x$ (C) $y = 2x - 1$
(D) $y = -x + 2$ (E) $y = -2x + 3$