

# MATH 1450 – EXAM 2

Wednesday, October 26

Name: \_\_\_\_\_

Circle your Tu/Th discussion time: 8am 9am 10am 11am 12pm 1pm

## Read ALL instructions carefully.

1. You have 50 minutes to complete this exam.
2. **No calculators**, notes, books, or other resources may be used.
3. Please remove all **headphones** and **smartwatches** and put them away.
4. Please silence your **cell phone** and put it away.
5. Keep your eyes on your own paper, and try not to leave your paper easily visible to others.
6. You must show your work and explain all reasoning unless otherwise stated.
7. If I cannot read your writing, you will not receive credit.
8. **Read the instructions of each section.**

## Scores

page 1	/6
page 2	/6
page 3	/9
page 4	/9
page 5	/10
page 6	/10
page 7	/10
Total	/60

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*The Marquette University honor code obliges students:*

- To fully observe the rules governing exams and assignments regarding resource material, electronic aids, copying, collaborating with others, or engaging in any other behavior that subverts the purpose of the exam or assignment and the directions of the instructor.
- To turn in work done specifically for the paper or assignment, and not to borrow work either from other students, or from assignments for other courses.
- To complete individual assignments individually, and neither to accept nor give unauthorized help.
- To report any observed breaches of this honor code and academic honesty.

**If you have read the instructions above and you understand and agree to abide by the honor code, sign here:**

\_\_\_\_\_

**Section 1: True / False.** Choose True or False. If you choose False, explain briefly why the statement is wrong.

1. If  $\lim_{x \rightarrow -2} f(x) = -1$ ,  $\lim_{x \rightarrow -2} g(x) = 2$ , and  $\lim_{x \rightarrow -2} h(x) = 4$ , then

$$\lim_{x \rightarrow -2} \left( g(x) - \frac{h(x)}{f(x)} \right) = 6.$$

True

False

2.  $\frac{d}{dx} (2x^5 - x^3) = 5x^4 + 3x^2$ .

True

False

3.  $\lim_{x \rightarrow -1} \frac{x}{(1+x)^2} = -\infty$

True

False

4. If the derivative of  $f(x)$  is increasing at  $x = c$ , then the tangent line at  $x = c$  has positive slope.

True

False

5. Let  $g(x)$  be a function. If  $g'(0)$  exists, then  $g(x)$  is continuous at  $x = 0$ .

True

False

6. If  $R(x)$  and  $S(x)$  are continuous for all  $x$ -values, then so is  $R(S(x))$ .

True

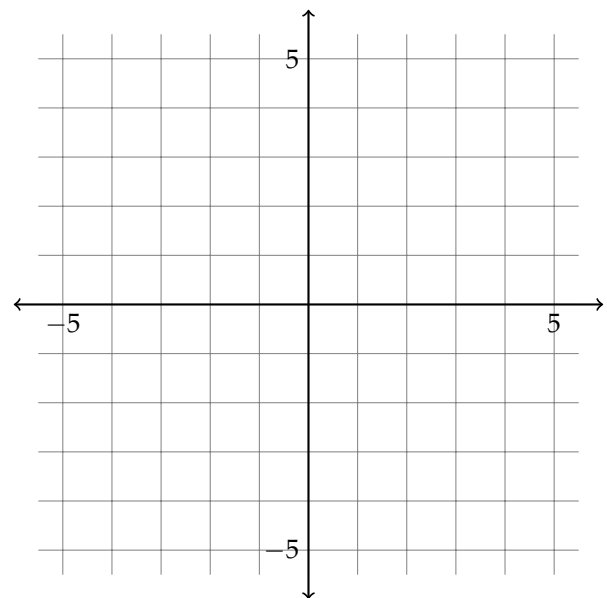
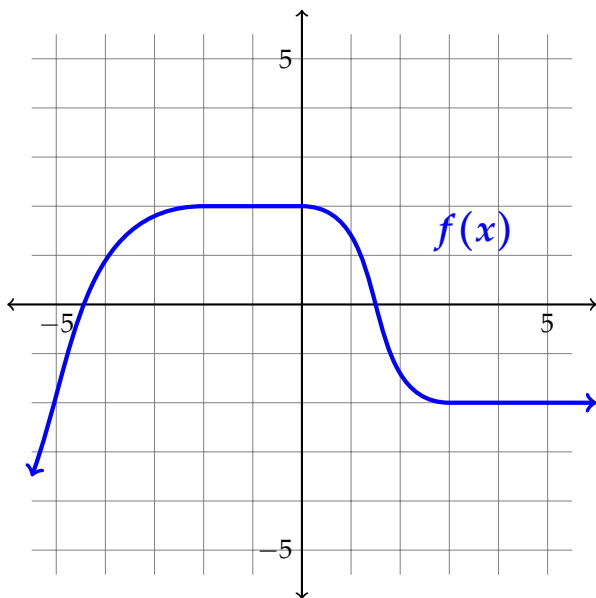
False

**Section 2: Short Answer.** You do not need to show your work in this section, but it may help us give you partial credit.

7. For each of the functions  $f(x)$  in the top row of the table below, and each of the numbers  $c$  in the left column, determine if  $f'(c)$  is positive (write "+"), negative (write "-"), zero (write "0"), or if it doesn't exist (write "DNE").

$c \backslash f(x)$	$x^2 + 4x$	$ x $	$\frac{1}{x}$	$2^{-x}$
-2				
0				
2				

8. The function  $f(x)$  is shown on the left below. On the blank axes on the right, plot  $f'(x)$ .



9. Let  $T(t)$  denote the temperature outside in Fahrenheit in Milwaukee  $t$  hours after noon on a sunny warm July 1. Consider the statement "At 8pm, the rate at which the temperature is dropping is speeding up."

Is  $f(8)$ :      positive      zero      negative      unknown      (circle one)

Is  $f'(8)$ :      positive      zero      negative      unknown      (circle one)

Is  $f''(8)$ :      positive      zero      negative      unknown      (circle one)

Is  $f'''(8)$ :      positive      zero      negative      unknown      (circle one)

10. The cost of resurfacing a playground of area  $A$  square feet is  $C(A)$  dollars. Interpret each of the following statements into an English sentence *including a unit of measure*.

(a)  $C(140) = 2100$

(b)  $C'(140) = 10$

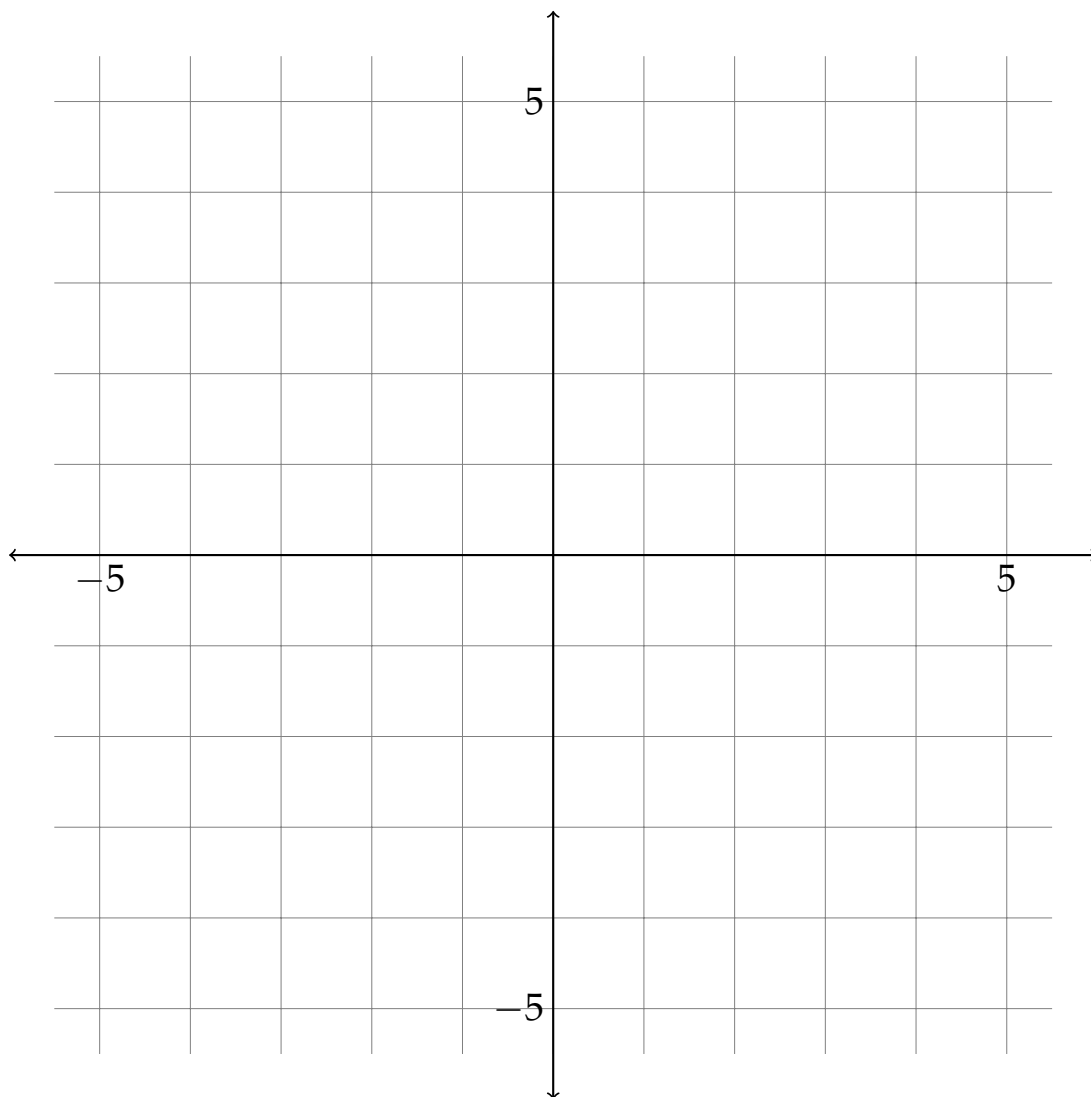
(c)  $C''(140) = -1$

**Section 3: Long Answer.** Answer each question. You must show your work.

11. On the axes below, draw a function  $f(x)$  satisfying ALL of conditions below.

You may want to draw it on the back of an exam page first, then transfer it to the axes below, so that your final answer is neat and readable.

- ★  $f(x)$  is continuous at all  $x$ -values.
- ★  $f(x)$  is differentiable at all  $x$ -values except at  $x = 3$
- ★  $f(x)$  is positive on the interval  $(2, \infty)$
- ★  $f(x)$  is negative on the interval  $(-\infty, 2)$
- ★  $f(x)$  increasing on the intervals  $(-\infty, -3)$  and  $(0, \infty)$
- ★  $f(x)$  is decreasing on the interval  $(-3, 0)$
- ★  $f(x)$  is concave up on the interval  $(-1, 3)$
- ★  $f(x)$  is concave down on the intervals  $(-\infty, -1)$  and  $(3, \infty)$



12. Compute each of the limits below. (Make sure to explain your work.)

(a)  $\lim_{x \rightarrow 0} \left( x^2 \cos \left( \frac{1}{x} \right) + 3 \cos(x) \right)$

(b)  $\lim_{x \rightarrow \infty} x e^{-x}$

(c)  $\lim_{x \rightarrow -\infty} \frac{3x^2 - 4x + 1}{2 - x^2}$

13. Let  $p(x) = \frac{1}{1+x}$ .

(a) Use the limit definition of derivative to find  $p'(2)$ .

(b) Determine the equation for the tangent line of  $p(x)$  as  $x = 2$ .

(c) Use the values of  $p(2)$  and  $p'(2)$  to estimate  $p(2.1)$ . (You may leave your answer as an expression involving the sum and/or difference of fractions.)