

name: _____

exam 1

math1117.07
Fri, 11 Oct

- *justify all answers unless otherwise noted*
- *no notes, phones, calculators, or friends*
- *if you cheat, you will receive a zero on this exam*
- *there are no makeup exams*
- **good luck!**

1. (2 pts each) Let $f(x) = x^3 - 2$, $g(x) = x^4$, $h(x) = \frac{1}{3x}$. Evaluate the expressions

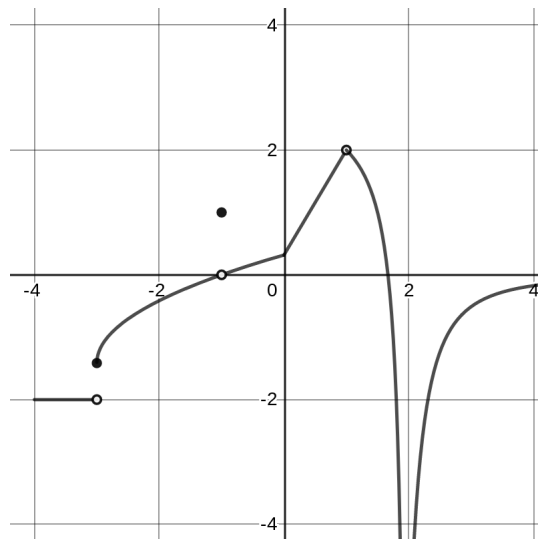
(a) $g \circ f(u)$

(b) $f \circ h(x)$

(c) $g(h(f(x)))$

2. (4 pts) Compute the inverse of $f(x) = e^{5x+7}$

3. (2 pts each) Given this graph of a function f , compute the limits below



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

(b) $\lim_{x \rightarrow -2} f(x)$

(c) $\lim_{x \rightarrow -1} f(x)$

(d) $\lim_{x \rightarrow 1} f(x)$

(e) $\lim_{x \rightarrow 2} f(x)$

4. (4 pts) Simplify, i.e. find an algebraic expression, for $\sin(\arccos(\frac{x}{2}))$.

5. (4 pts each) Respond to two of the three following items. If you answer more than two, specify which you would like me to grade, otherwise I will grade the first two.

- (a) Write down the definition for the derivative of a function f .
- (b) What is wrong with the following definition of a limit? What should it be?

“Suppose the function f is defined at $x = a$. If $f(x)$ is arbitrarily close to L for all x sufficiently close to a , we write

$$\lim_{x \rightarrow a} f(x) = L$$

and say the limit of $f(x)$ as x approaches a equals L .”

- (c) If a function f is continuous at $x = a$, then what equation must, by definition, be true.

6. (4 pts each) Determine the truth of the following statements and give an explanation if true or counterexample if false. Assume that a and L are finite numbers.

- (a) If $\lim_{x \rightarrow a^-} f(x) = L$, then $\lim_{x \rightarrow a^+} f(x) = L$.
- (b) The limit $\lim_{x \rightarrow a} (f(x)/g(x))$ does not exist if $g(a) = 0$.

You do not need to show your work for questions on this page

7. (2 pts) $\lim_{\theta \rightarrow \infty} \frac{\sin(\theta)}{\theta^3 - 3}$

- (a) ∞ (b) $-\infty$ (c) 0 (d) $-1/3$ (e) None of the above

8. (2 pts) $\lim_{x \rightarrow \infty} \frac{x+4}{x-4} + \frac{x-3}{x^2-9}$

- (a) ∞ (b) $-\infty$ (c) 0 (d) 1 (e) None of the above

9. (2 pts) $\lim_{x \rightarrow \infty} x^2 + 4x - \cos(\sqrt{2x})$

- (a) ∞ (b) $-\infty$ (c) 0 (d) 1 (e) None of the above

10. (2 pts) $\lim_{x \rightarrow \infty} \frac{24x^3 + 12x^2 - 4}{3x^4 + 9x^3}$

- (a) ∞ (b) $-\infty$ (c) 0 (d) 8 (e) None of the above

11. (2 pts) $\lim_{x \rightarrow 2} \frac{1}{(x-3)(x-2)^3}$

- (a) ∞ (b) $-\infty$ (c) 0 (d) -1 (e) None of the above

12. (2 pts) $\lim_{x \rightarrow 1} \frac{x}{|x-1|}$

- (a) ∞ (b) $-\infty$ (c) 0 (d) 3 (e) None of the above

13. (4 pts) For a function f and a point a , suppose we know that

$$\lim_{x \rightarrow a^-} f(x) \neq \lim_{x \rightarrow a^+} f(x).$$

What can we then conclude about $\lim_{x \rightarrow a} f(x)$

14. (4 pts) Is the function

$$f(x) = \begin{cases} 4x + 4, & x \leq 2 \\ 3x^2, & x > 2 \end{cases}$$

continuous at $x = 2$? Justify your answer.

15. (4 pts) Use the definition of a derivative to find $g'(x)$ for $g(x) = 2x^2 + 3x$.

16. (4 pts) For g from the previous problem, what is the equation to the line tangent to g at $x = 2$?

For the questions on this page, be sure to show all of your work.

17. (4 pts) Compute

$$\lim_{x \rightarrow e} \frac{(x - e)^{50} - x + e}{x - e}$$

18. (4 pts) Compute

$$\lim_{x \rightarrow 36} \frac{\sqrt{x} - 6}{x - 36}$$

extra credit survey

‘ If you answer all of the following questions, you will receive 4 points.

- (a) About how many hours did you study for this exam?
- (b) What materials did you use to study?
- (c) Did you study alone or with others?
- (d) Which, if any, external resources (Center for Learning Resources, my office hours, youtube, etc?) did you use to study for this exam?
- (e) What grade do you expect on this exam?