

Math 124 - Fall 2017

Exam 1

October 24, 2017

Name: _____

Section: _____

Student ID Number: _____

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- In addition to this cover page, there are 6 pages of questions. Make sure your exam contains all these pages.
- You are allowed to use a Ti-30x IIS Calculator model ONLY (**no other calculators allowed**). And you are allowed one **hand-written** 8.5 by 11 inch page of notes (front and back).
- Leave your answer in exact form. Simplify standard trig, inverse trig, natural logarithm, and root values. Here are several examples: you should write $\sqrt{4} = 2$ and $\cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$ and $\frac{7}{2} - \frac{3}{5} = \frac{29}{10}$ and $\ln(1) = 0$ and $\tan^{-1}(1) = \frac{\pi}{4}$.
- Show your work on all problems. The correct answer with no supporting work may result in no credit. **Put a box around your FINAL ANSWER for each problem and cross out any work that you don't want to be graded.**
- If you need more room, use backs of the pages and indicate to the grader that you have done so.
- Raise your hand if you have a question.
- There may be multiple versions of the exam so if you copy off a neighbor and put down the answers from another version we will know you cheated. Any student found engaging in academic misconduct will receive a score of 0 on this exam. All suspicious behavior will be reported to the student misconduct board.
- You have 80 minutes to complete the exam. Budget your time wisely.
SPEND NO MORE THAN 10 MINUTES PER PAGE!

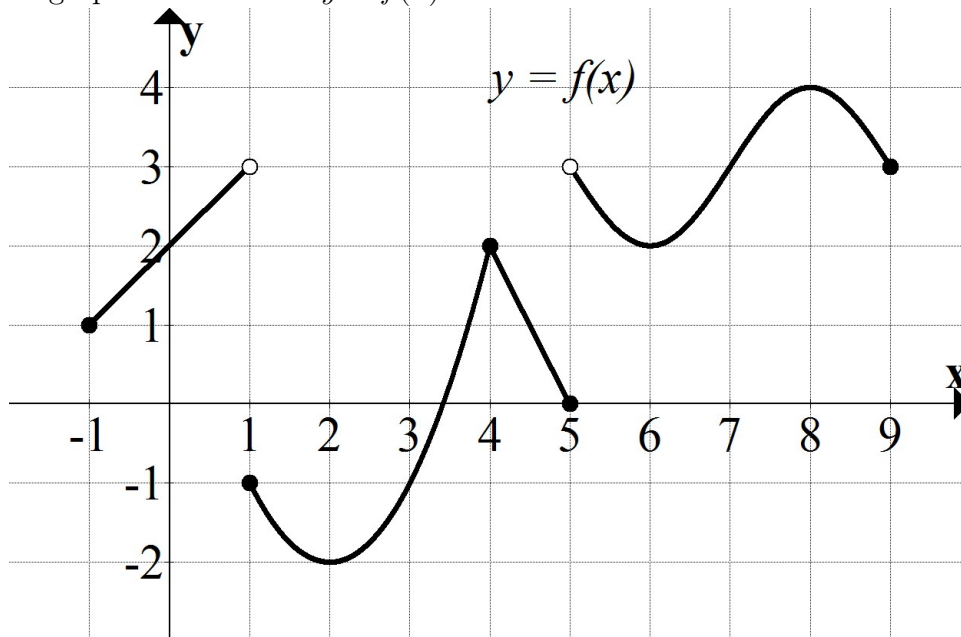
1. (9 pts) Determine the values of the following limits or state that the limit does not exist. If it is correct to say that the limit equals ∞ or $-\infty$, then you should do so. **In all cases, show your work/reasoning. You must use algebraic methods where available. And explain in words your reasoning if an algebraic method is not available.**

(a) $\lim_{x \rightarrow 4^+} \frac{5 + \cos(x) + e^x}{\sqrt{x}(4 - x)}$

(b) $\lim_{t \rightarrow \infty} \left(3e^{1/t} + \frac{3 + t^2}{5t^2 + \sqrt{1 + 9t^4}} \right)$

(c) $\lim_{x \rightarrow 0} \frac{\sqrt{1-x} - 1}{\sqrt{4-x} - 2}$

2. (12 pts) The graph of a function $y = f(x)$ is shown and is defined for all values $-1 \leq x \leq 9$.



- (a) Give all values of x where the derivative, $f'(x)$, is equal to zero.

- (b) Evaluate the following limits (estimating from the graph and using everything you've learned). If the limit is $\pm\infty$, then say so. If the limit does not exist, then say so.

i. $\lim_{x \rightarrow 4} x f(x)$

ii. $\lim_{h \rightarrow 0} \frac{f(0+h) - f(0)}{h}$ (Hint: You should know what this represents)

iii. $\lim_{x \rightarrow 5^-} \frac{x}{f(x)}$

3. (10 pts)

(a) Let $y = 5 \tan(x) + 4xe^x + 2(x + 6)^2$. Find the equation of the tangent line at $x = 0$.

(b) Consider the function $g(x) = \begin{cases} \frac{(1+x)^2 - 4}{x-1} & , \text{ if } x < 1; \\ a \cos(\pi x) + 12\sqrt{x} & , \text{ if } x \geq 1. \end{cases}$

Find the value of a that makes the function continuous at $x = 1$.
(Use limits to carefully justify your answer).

4. (9 pts) For all parts on this page, let $f(t) = \frac{4}{1+5t}$.

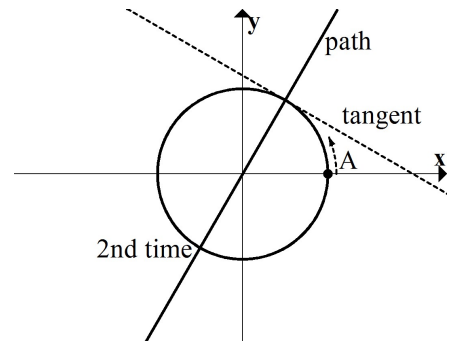
(a) Find and completely simplify $\frac{f(t+h) - f(t)}{h}$.
(Simplify until the h in the denominator cancels).

(b) Find the value(s) of t at which the slope of the tangent line to $y = f(t)$ is equal to -5.

5. (12 pts)

(a) Let $f(t) = \frac{t^2 + 7}{1 + 2\sqrt{t^3}}$. Find $f'(1)$.

(b) . Andy is jogging around a circular loop with radius 4 miles ($x^2 + y^2 = 16$). His location after t hours is given by $x = 4 \cos(\pi t)$, $y = 4 \sin(\pi t)$. A straight line path runs across the loop and is given by the equation $y = \sqrt{3}x$. (all shown at right)



i. Find the equation for the tangent line to the circle the first time Andy crosses the path (this tangent line is shown in the picture).

ii. Find the second time, t , where Andy crosses the path.

6. (8 pts) Let $f(x) = x^2 - 5x + 1$. There are two points on the curve $y = f(x)$ where the tangent line at that point would also have an x -intercept of 8.
Find the coordinates $(x, y) = (a, b)$ of the two points of tangency.