Math 114 Test 1

Instructor: Jay Daigle

- You will have ninety minutes to complete this exam.
- The exam has 5 "problems," each of which has multiple parts. Each problem is worth 30 points. The exam has 6 pages total.
- If you find a problem particularly difficult, skip it and come back. It may seem easier the second time, and even if it doesn't, you'll do better working on the other problems that seem easier.
- You may use one, one-sided sheet of handwritten notes.
- You may use a normal or scientific calculator. You may not use a graphing calculator. A calculator is not required to complete this exam.
- Read the questions carefully and make sure to answer the actual question asked. Make sure to justify your answers—math is largely about clear communication and argument, so an unjustified answer is much like no answer at all. When in doubt, show more work and write complete sentences.
- If you need more paper to show work, I have extra at the front of the room.
- Good luck!

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Problem 1.

(a) Directly from the definition of a limit, compute with proof $\lim_{x\to 3} \frac{x+1}{2}$

(b) Directly from the definition, compute with proof $\lim_{x\to 1} \frac{x-3}{x+2}$.

Problem 2.

(a) Directly from the definition of a limit, compute with proof $\lim_{x\to -1^-} f(x)$ where

$$f(x) = \begin{cases} 5x^2 - 17\sqrt{x} & x > -1 \\ 3x + 1 & x < -1 \end{cases}$$

(b) Directly from the definition of a limit, prove that $\lim_{x\to 5} g(x)$ does not exist, where

$$g(x) = \begin{cases} 1 & x < 5 \\ 3 & x > 5 \end{cases}$$

Problem 3.

(a) Directly from the definition, prove that $\lim_{x\to-\infty} \frac{2x}{x+1} = 2$.

(b) Directly from the definition, prove that $\lim_{x\to 3} \frac{x}{x-3} = \pm\infty$.

Problem 4.

Compute the following limits, showing each step and naming each limit law you use. Use only one law per line!

(a)

$$\lim_{x \to 0} \frac{x^2 + \sqrt{x+4} - 1}{x+3}$$

(b)

$$\lim_{x \to 2} \frac{x^2 + -7x + 10}{x - 2}$$

Problem 5.

Compute the following limits if they exist. Show enough work to justify your computation, or your claim that the limit does not exist.

(a)

$$\lim_{x\to 4} \frac{x^3 - 64}{x - 4} =$$

(b)

$$\lim_{x\to 7} \frac{\sqrt{9+x} - 4}{x - 7}$$

(c)

$$\lim_{x\to +\infty} \frac{x^2 + x + 1}{\sqrt{x^4 + 1}}$$

(d) If

$$f(x) = \begin{cases} x^2 - 1 & x < 3 \\ \sqrt{6+x} + 6 & x > 3 \end{cases}$$

then

$$\lim_{x\to 3^+} f(x) =$$