

## Math 190 Homework 4: Due Wednesday October 14

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The assignment is due at the beginning of class on the due date. You are expected to provide full solutions, which are laid out in a linear coherent manner. Your work must be your own and must be self-contained. Your assignment must be stapled with your name and student number at the top of the first page.

### Questions:

When asked to compute a limit in the following problems: Find the value of the limit if it exists. If the limit does not exist but you can assign the value  $\infty$  or  $-\infty$  to the limit do so. Otherwise, explain why the limit does not exist.

1. Compute

$$\lim_{t \rightarrow 0} \left( \frac{1}{t\sqrt{1+t}} - \frac{1}{t} \right).$$

2. Compute

$$\lim_{x \rightarrow 0} \left( \frac{1}{x} - \frac{1}{|x|} \right).$$

3. Draw the graph of a function  $f(x)$  satisfying the following properties (you do not have to come up with an equation for your graph).

- The domain is  $\{x \in \mathbb{R} : -2 \leq x \leq 3\}$ .
- $\lim_{x \rightarrow 2} f(x) = 4$
- $f(2) = 5$
- $\lim_{x \rightarrow -1^+} f(x) = 2$
- $\lim_{x \rightarrow -1^-} f(x) = -1$

4. Find the equations of all vertical and horizontal asymptotes of the following function

$$f(x) = \frac{3x^2 - 14x - 5}{2x^2 - 9x - 5}.$$

Ensure you show the computation of all relevant limits.

5. Consider the function

$$g(x) = \frac{\cos(3x)}{x}.$$

- Explain what happens to the numerator as  $x$  approaches  $\infty$ .
- Explain what happens to the denominator as  $x$  approaches  $\infty$ .
- Using your answers from (a) and (b) explain what happens to the values of  $g(x)$  as  $x \rightarrow \infty$ . In this way you can suggest a value for

$$\lim_{x \rightarrow \infty} \frac{\cos(3x)}{x}.$$

- Bonus:** How many times does  $g(x)$  cross its horizontal asymptote? Explain how you know.