Math 190 Homework 4: Due Wednesday October 12

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 ∞ or $-\infty$ to the limit do so. Otherwise, explain why the limit does not exist.

1. Compute $\lim_{x\to -3} \dfrac{\sqrt{x^2+7}-\sqrt{x+19}}{x+3}$.

2. Compute $\lim_{x\to 2} \dfrac{x^2-x-2}{|x-2|}$.

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 $\{x \in \mathbb{R} : -4 \leq x < 2\}$.
   - $f(-2) = -1$
   - $\lim_{x\to -2} f(x) = 2$
   - $\lim_{x\to 1^-} f(x) = 2$
   - $\lim_{x\to 1^+} f(x) = 1$

4. Draw the graph of a function $g(x)$ satisfying the following properties (you do not have to come up with an equation for your graph).
   - The domain is $\mathbb{R}$.
   - g has a horizontal asymptote at $y = -1$
   - $\lim_{x\to \infty} g(x) = \infty$
   - $\lim_{x\to 2^-} g(x) = \infty$

5. Consider the function
$$h(x) = e^{-x}\cos(3x).$$
   (a) Explain what happens to e^{-x} as x approaches ∞.
   (b) Explain what happens to $\cos(3x)$ as x approaches ∞.
   (c) Using your answers from (a) and (b) explain what happens to the values of $h(x)$ as $x \to \infty$. In this way you can suggest a value for
$$\lim_{x\to\infty} e^{-x}\cos(3x).$$
   (d) Find the zeros of $h(x)$. Make a rough sketch of the graph indicating the zeros as well as any asymptotes.