In-Class Assignment 5

MATH 141

Directions: Work neatly on a separate sheet of paper. Your group will hand in one write-up with everyone's name on it. **DO NOT** fold the corner over to hold everything together! Your final write-up should be very neat and well-written. Remember to use complete sentences as appropriate.

Work together on each problem; do not delegate different problems to different people.

The goal of this worksheet is to make more precise terms like "as close as we want." Here is our definition of limit so far: Let f be a function defined on an interval I containing a point a, except possibly at a. We say that the **limit as x approaches a of $f(x)$ is L** if we can make $f(x)$ as close to L as we want by taking x sufficiently close to a.

Note that "$f(x)$ close to L" can also be written as "$|f(x) - L|$ small."

1. Consider $f(x) = 2x$.
   (a) What value do we expect for $\lim_{x \to 3} 2x$? Identify L and a for this problem.
   (b) Suppose that we want to make $|f(x) - L|$ smaller than 0.1. How close must x be to a to make this happen? Express your answer as a distance from a. (That is, express it in the form $|x - a| <$(something).
   (c) Suppose that we want to make $|f(x) - L|$ smaller than 0.01. How close must x be to a to make this happen? Express your answer in the form above.
   (d) Suppose that we want to make $|f(x) - L|$ smaller than 0.001. How close must x be to a to make this happen? Express your answer in the form above.
   (e) Suppose that we want to make $|f(x) - L|$ smaller than ϵ. How close must x be to a to make this happen? Express your answer in the form above.
2. Consider $f(x) = 5x + 2$.
   (a) What value do we expect for $\lim_{x \to 1} 5x + 2$? Identify L and a for this problem.
   (b) Suppose that we want to make $|f(x) - L|$ smaller than 0.1. How close must x be to a to make this happen? Express your answer as a distance from a. (That is, express it in the form $|x - a| <$(something).
   (c) Suppose that we want to make $|f(x) - L|$ smaller than 0.01. How close must x be to a to make this happen? Express your answer in the form above.
   (d) Suppose that we want to make $|f(x) - L|$ smaller than 0.001. How close must x be to a to make this happen? Express your answer in the form above.
   (e) Suppose that we want to make $|f(x) - L|$ smaller than ϵ. How close must x be to a to make this happen? Express your answer in the form above.
3. Consider $f(x) = x^2$.
   (a) What value do we expect for $\lim_{x \to 0} x^2$? Identify L and a for this problem.
   (b) Suppose that we want to make $|f(x) - L|$ smaller than 0.1. How close must x be to a to make this happen? Express your answer as a distance from a. (That is, express it in the form $|x - a| <$(something).
   (c) Suppose that we want to make $|f(x) - L|$ smaller than 0.01. How close must x be to a to make this happen? Express your answer in the form above.
   (d) Suppose that we want to make $|f(x) - L|$ smaller than 0.001. How close must x be to a to make this happen? Express your answer in the form above.
   (e) Suppose that we want to make $|f(x) - L|$ smaller than ϵ. How close must x be to a to make this happen? Express your answer in the form above.
4. As a class, let's determine a "good" definition of limit based on what you found above.