

Math 1231: Single-Variable Calculus 1
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Recitation 2

Jay Daigle

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Today we want to practice the way we actually compute limits.

Problem 1 (Warmup). Let $f(x) = \frac{x^2 + \sin(x) + 3}{x^2 - x - 2}$.

- (a) Where is f continuous? Where is it discontinuous?
- (b) What is $\lim_{x \rightarrow 0} f(x)$?

Problem 2. Let $f(x) = \frac{x-1}{x^2-1}$.

- (a) What is $f(2)$? Is f continuous at 2?
- (b) What is $\lim_{x \rightarrow 2} f(x)$?
- (c) What is $f(1)$? Is f continuous at 1?
- (d) What function can we find that's almost the same as f , but defined and continuous at 1? (Is this function the same as f ?)
- (e) What is $\lim_{x \rightarrow 1} f(x)$?

Problem 3. Let $g(x) = \frac{(x+1)^2 - 1}{x+2}$.

- (a) Is g continuous where it's defined? Where is it undefined?
- (b) Can you find a function that's almost identical to g but continuous everywhere?
- (c) What is $\lim_{x \rightarrow -2} g(x)$?

Problem 4. Let $h(x) = \frac{x-1}{\sqrt{5-x}-2}$.

- (a) Is this function continuous where it's defined? Where is it undefined?
- (b) We can factor an $x - 1$ out of the top, but we can't obviously factor one out of the bottom. We need to use an algebraic trick make the $x - 1$ appear. What tricks do we have that might work?
- (c) What is $\lim_{x \rightarrow 1} h(x)$?

Problem 5. Let

$$f(x) = \begin{cases} x^2 + 1 & x > 2 \\ 9 - 2x & x < 2 \end{cases}$$

Can we extend this to a continuous function on all reals?

- (a) Where is f continuous? Where is it discontinuous?
- (b) What value "should" $f(x)$ have for $x = 2$?
- (c) Can you define a function that's Almost Identical to $f(x)$, but continuous at all reals?