

Math 1231: Single-Variable Calculus 1
George Washington University Fall 2025
Recitation 5

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

- (a) Write down a limit expression to compute $g'(2)$. Be careful with order of operations and parentheses!
- (b) Now compute $g'(2)$.
- (c) Write a limit expression to compute $g'(x)$. Again, make sure you get your order of operations right.
- (d) Compute $g'(x)$.

Problem 2. Let $a(x) = |x|$ be the absolute value function.

- (a) Write down a formula for a as a piecewise function.
- (b) Write down a limit expression for the derivative of a at 0.
- (c) What is the limit from the right?
- (d) What is the limit from the left?
- (e) What does that tell you about the derivative?

Problem 3. Let $g(x) = \sqrt[3]{x}$.

- (a) Write down a limit formula to compute the derivative of g at 0.

- (b) What is $g'(0)$? What does this tell you?
- (c) Now write down a limit formula to compute the derivative of $p(x) = \sqrt[3]{x^2}$.
- (d) What is this limit? What does that tell you?
- (e) Write down a limit formula to compute the derivative of g at a when $a \neq 0$.
- (f) (Bonus) Can you compute this limit? What do you have to do here? (It's not obvious, but there's an algebraic trick we've mentioned that can help us.)

Problem 4. (a) Use the product rule to differentiate $(x^2 + 1)(3x^3 - 5)$.

- (b) Multiply out $(x^2 + 1)(3x^3 - 5)$ to get one big polynomial. Use our derivative rules to compute that derivative.
- (c) Which process was easier?

Problem 5. Compute $\frac{d}{dx} \frac{x^5 - 7x}{4x^2 + 3}$.

Problem 6. (a) Let $h(x) = \tan^2(x)$. Find functions f and g so that $h(x) = (f \circ g)(x)$.

- (b) Compute $f'(x)$ and $g'(x)$. Use that info to compute $h'(x)$.
- (c) Now let $h(x) = \tan(x^2)$. Find functions f and g so that $h(x) = (f \circ g)(x)$.
- (d) Compute $f'(x)$ and $g'(x)$. Use that information to compute $h'(x)$.