Math 1231: Single-Variable Calculus I
George Washington University Fall 2026
Recitation 7

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Problem 1. A twenty foot ladder rests against a wall. The bit on the wall is sliding down at 1 foot per second. How quickly is the bottom end moving when the top is 12 feet from the ground?

(a) Draw a picture of this situation.

(b) What is the question you're trying to answer? What do you expect it to look like? Should it be positive or negative? What units do you expect?

(c) What equation should we use here, and why?

(d) Use a derivative to calculate the answer to the question. Does your answer make sense?

Problem 2. A spot light is on the ground 36 ft away from a wall and a 5 ft tall person is walking towards the wall at a rate of 4 ft/sec. How fast is the height of the shadow changing when the person is 24 feet from the wall? Is the shadow increasing or decreasing in height at this time?

(a) Draw a picture of this situation.

(b) What is the question you're trying to answer? What do you expect it to look like? Should it be positive or negative? What units do you expect?

(c) What equation should we use here, and why?

(d) Use a derivative to calculate the answer to the question. Does your answer make sense?

Problem 3 (Bonus)**.** A rectangle is getting longer by one inch per second and wider by two inches per second. When the rectangle is 5 inches long and 7 inches wide, how quickly is the area increasing?

(a) Draw a picture of this situation.

(b) What is the question you're trying to answer? What do you expect it to look like? Should it be positive or negative? What units do you expect?

(c) What equation should we use here, and why?

(d) Use a derivative to calculate the answer to the question. Does your answer make sense?

(e) To check things: how long and wide will the rectangle be after one inch? How much will the area have increased? Does that make sense with your answer to the related rates problem?

(f) Bonus: where have we seen basically this argument before?

Problem 4. Consider the function $f(x) = x^3 - 3x^2 + 1$ on $[-1, 4]$.

(a) Does this function have absolute extrema? Why?

(b) What are the critical points of this function?

(c) How many absolute extrema are there? What are they, and where are they?

Problem 5. Let's find the global extrema of $g(x) = \sqrt[3]{x^3 + 6x^2}$ on the closed interval $[-5, 5]$.

(a) Does this function have absolute extrema? Why?

(b) What are the critical points of this function?

(c) How many absolute extrema are there? What are they, and where are they? (Hint: you may need to use a calculator at the last step.)