

Math 1231: Single-Variable Calculus 1
George Washington University Spring 2023
Recitation 7

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Problem 1. Find the tangent line to $y = 6 \cos x$ at $(\pi/3, 3)$.

Problem 2. Find an equation for a tangent line to $y \cos(x) = 1 + \sin(xy)$ at the point $(0, 1)$.

Problem 3 (Bonus). (a) If $\sqrt{xy} = x^2y - 2$, find a formula for $\frac{dy}{dx}$ in terms of x and y .

(b) Find an equation of the tangent line at the point $(1, 4)$.

Problem 4. 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 5. 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 6 (Bonus). A kite is flying 100 feet over the ground, moving horizontally at 8 ft/s. At what rate is the angle between the string and the ground decreasing when 200ft of string is let out?

- (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) Of the numbers in the problem and in your picture, which are variables and which are constants? This is an important question, and sometimes a tricky one.
- (d) What equation should we use here, and why? Note: this uses a relationship we haven't used yet in class. Look at the picture carefully and think about what quantities you need to relate!
- (e) Use a derivative to calculate the answer to the question. Does your answer make sense?