Reassessing D1

D1: I can interpret the meaning of a derivative in context.

Basic Preparation

1. Did you do the written practice?
2. Did you do the WeBWorK?
3. Go back to your notes, any handouts from class, the desmos activities, WeBWorK and any written practice you were able to use to prepare. Compare this to your quiz/homework.
4. Do you understand what your mistake was? If so, briefly describe what the mistake is below. If you are unsure, please go to the Calculus Center and work with a tutor until you can describe what your mistake was.

Metacognition

Now, *WHY* did you make the mistake? Answering this question is asking you to think about HOW you think about math (metacognition). Spending time here will help you become more efficient at learning math and is therefore worth the time!

1. Was your incorrect answer due to
   (a) not understanding a concept;
   (b) an error in logical reasoning (e.g., used the correct theorem/test but made the wrong conclusion, used a theorem/test/technique when it did not apply);
   (c) being careless (e.g. not reading directions, not answering the question completely, making arithmetic or basic algebra errors);
   (d) not knowing how to start or formulate an approach to the problem;
   (e) others?

   Briefly describe why your answer was incorrect:

2. What helped you recognize your mistake(s). Here are some examples: the course notes, the textbook, homework or conversations from the Calculus Center. In other words, which strategies for identifying mistakes work well for you and will help you in the future?

3. Rework the ENTIRE PROBLEM. Rewrite your solution from start to finish, carefully fixing the mistake(s) you diagnosed above. By doing the entire problem over again, you can make sure you fix your mistake and better understand the point of the exercise.

4. Describe (in detail) what you have done in order to learn from your mistake(s) and prepare for your next attempt. Did you read the textbook or class notes? Did you look at examples and/or work problems on your own or with your tutor/classmate/instructor, and if so, which problems? Did you take a different approach than listed here? (Again, the point of this isn't just to look at what you did on this problem, but how can you learn from this and be more likely to meet expectations on future assignments on the first try.)

Where topic was first introduced: Module 5

Video:

- Interpret Derivative Notation `https://youtu.be/kqP-YFXTpnA`
- Interpret Derivative Context `https://youtu.be/LKDogdBDqGg`

Thoughts/notes

- Dimensions are things like length, time, volume. Units are how we measure these quantities, i.e. meters, seconds, cubic centimeters.
- If a derivative is negative, then the quantity is decreasing. Adjust your answer accordingly, either stating that h increases by a -64 feet or, preferred, h decreases by 64 feet.
- There are two common ways to translate a derivative.
  - Consider the derivative as a slope or rate of change: When the time is 3 hours, the temperature is changing at a *rate* of -3 degrees per hour. Notice when we are using the perspective of *rate* we use the units of degrees *per hour*.
  - Consider the "rise over run" triangle, or split the rate into change in input and change in output: A one unit increase in time (from 3 hours to 4 hours) results in approximately a decrease of 3 degrees in temperature.Notice when we are using the perspective of *separating rise and run* we use the units of *degrees*. We don't need to include the "per hour" because we already did the "per hour" when we increased from 3 to 4 hours.)

Favorite Mistakes

- Not reading carefully.
- Leaving a blank unfilled or not circling either increasing or decreasing.
- Omitting units.
- Writing a double negative: if the rate of change is negative, it's a mistake to say "decreasing by -64".
- Doubling up on the "change in input:"
  If the question asks you to split up the change in time and the change in input, and you say the input is changing by 64ft per second, then you have doubled up on the change in input and you are saying that if the time increases by 1 second, the output decreases by approximately -64ft/second, then you are saying the output is velocity instead of height, because ft/second is a measure of velocity when ft is a measure of height. See the example below.
- Not including "approximately:"
  Because we don't know if the derivative is constant or not: so when we let the input vary by 1 input unit, we make an assumption that the rate of change is constant. Thus the change in output is at best an approximation.

Examples:

1. Fill in the blank or circle the correct word.
   We are told that h measures the altitude of a parachutist in feet t seconds after jumping out of a plane.
   Thus: $h'(2) = -64$ means that if the time increases by 1 second , the altitude of the parachutist will decrease by approximately 64 feet (give a number and units.) (Notice the units: 64 feet and NOT 64 feet/second!)
2. Circle all correct statements and correct the incorrect ones.
   The cost, C, in dollars, to produce q quarts of ice cream is $C = f(q)$. Let $C(50) = \$480$ and $C'(50) = 0.95$
   (a) Hugh Manatee interprets the information to mean that it takes 50 dollars to make 480 quarts of ice cream. It takes $480 to make 50 quarts of ice cream.
   (b) Bob the Iguana says that it takes 480 dollars to make 50 quarts of ice cream. yes
   (c) Boaty McBoatface reasons that if the number of quarts increases by 1, it will cost approximately $480.95 to make the ice cream. Each additional quart will add approximately $0.95 to the bill, when making around 50 quarts, so yes, 51 quarts should cost approximately $480.95.
   (d) Gritty disagrees with McBoatface, thinking that $480.95 will make approximately 100 quarts of ice cream. See above, sorry Gritty, this is too ambitious.
   (e) Mr. Nutterbutter states that at 50 quarts of ice cream the cost to make ice cream is increasing at a rate of $0.95 dollars per quart. yup!!! Good job, Mr. Nutterbutter!
3. Generate a counterexample to show that the statement below is false. Explain why your example is a counter example to the statement.

   If an object has a negative acceleration, then its velocity must also be negative.
   Acceleration corresponds to the second derivative and velocity to the first derivative. Acceleration is the derivative of velocity. Something with positive velocity and negative acceleration is going forward but slowing down, like a car approaching a stop sign.

Prepare for revision:

First, reflect on your mistake and the correct solution and what you learned: fill in the blanks "I used to think _____but now I think _____because I learned _____."

It's an excellent idea to check your work in the Calculus Center before the next quiz attempt. Make sure you have fixed ALL of your mistakes!!!

Interpret the derivatives. Be sure you can fill in the blanks similar to this: $h'(2) = -64$ means that if the time increases by 1 second , the altitude of the parachutist will decrease by approximately 64 feet (give a number and units.)

1. If R measures units of moisture in grams per cubic meter and t measures time in seconds, interpret $R'(4) = 0.05$.
2. If Q measures thirst t minutes after running 1 mile, interpret $Q'(4) = 0.05$. Thirst is measured in mm on a scale from 0=no thirst to 100=severe thirst.
3. If P measures the concentration of adrenaline in micrograms per milliliter and t measures minutes, interpret $P'(7) = -0.25$.