

MTH 201: Calculus

Daily Preparation, Module 3B: The second derivative and concavity

Due by: 11:59pm ET, Tuesday September 22

Estimated time requirement: About 45-60 minutes for the whole assignment. *If you have worked on this assignment for 30 minutes and you're not at least halfway done, DON'T work any further — instead, stop and ask for help* on the `#dailyprep` channel on CampusWire.

Overview

In Part B of Module 3 we introduce a powerful new tool for examining the rate of change in a function — the **second derivative**. The second derivative is what you get when you find the derivative of a function, then find the derivative of *the result*. The second derivative gives information about a function's rate of change that is subtle but important — namely, what we call the **concavity** of the function. Having information about a function, its derivative, and its second derivative gives us a complete “fingerprint” of how the function behaves.

What you will learn

Learning Targets addressed in this module:

- **D.2 (CORE):** I can use derivative notation correctly, state the units of a derivative, estimate the value of a derivative using difference quotients, and correctly interpret the meaning of a derivative in context.
- **D.3 (CORE):** Given information about f , f' , or f'' , I can correctly give information about f , f' , or f'' and the increasing/decreasing behavior and concavity of f (and vice versa).

BEFORE your class meeting, use the Resources for Learning (below) to learn how to do the following:

- State the definition of the *second derivative* of a function.
- Determine whether a function is increasing, decreasing, or constant on an interval by examining the sign of its derivative. (Conversely, state the sign of a function's derivative using information about whether the function is increasing, decreasing, or constant.)
- Determine whether a function is concave up or concave down on an interval by examining its graph.

DURING AND AFTER your class meeting, you will learn how to do the following:

- Explain the connection between concavity of a function and its first and second derivatives.

- If a function is given with units for the input and output, state the units of the second derivative.
- Given the graph of a function, make a reasonable sketch of the graph of its second derivative.

Resources for Learning

Text: Read through [Section 1.6](#) of the *Active Calculus* textbook. Work through the examples and all interactive exercises found at the end of the section.

Video: At the MTH 201 playlist on YouTube (<http://bit.ly/GVSUCalculus>), watch the following videos. The total running time is 10:50.

- Screencast 1.6.1: Quick review: The second derivative (3:07) <https://www.youtube.com/watch?v=UtzyPEk2zxA>
- Screencast 1.6.3: Determining concavity from a graph (7:43) https://www.youtube.com/watch?v=o1_o4E-LGsA

Bonus screencasts: These are optional, but good:

- Concavity, inflection points, and second derivative (Organic Chemistry Tutor) (12:49) <https://www.youtube.com/watch?v=OhqNbQi9QPk>
- Concavity introduction (Khan Academy) (9:41) <https://www.youtube.com/watch?v=LcEqOzNov4E>
- Concavity, inflection points, and second derivative (PatrickJMT) (10:23) <https://www.youtube.com/watch?v=c1N8zyVhWxM>
- Not a screencast, but [a tutorial website at Khan Academy on concavity and the second derivative](#).
- [Another tutorial website from Lamar University on concavity](#). Nice pictures.

You are free to search for and use other resources in addition to, or instead of the above, as long as you can work the exercises below.

Exercises

The exercises for this assignment are on Desmos this time. **Be sure to only use the link below for your section** or your work will end up in the wrong place.

- Section 02: <https://student.desmos.com/join/5mekk5>
- Section 04: <https://student.desmos.com/join/mkxb62>

Your work is saved as you go, so there's no "submit" step at the end.

Submission, grading, and getting help

Submitting your work: Just work through the activities; your work is saved as you go.

How this is graded: Daily Prep assignments are graded on the basis of *completeness and effort*: If your submission has **all parts completed** (no blank entries, even if left blank accidentally) and **a good-faith effort to provide a correct solution or explanation is given** (no responses of “I don’t know” or “I didn’t understand”) and **the work is submitted on time**, it gets a “check”. Otherwise it gets an “x”. If you are stuck on an item, you’re expected to ask questions and give your best effort.

Getting help on this assignment: *You may work with others on this assignment, but you may not copy each others’ answers.* Evidence of copying will be treated as academic dishonesty. You may also ask questions on the #dailyprep channel on CampusWire, but you may not ask simply to be given the answers; giving and receiving answers on CampusWire will be treated as academic dishonesty.