Exam 1 Guidance

MATH 126 A/B • Fall 2025

The following is intended to help you focus your studying for Exam 1, which is on all the material we've studied through Wednesday, September 24. The following notes might not encompass everything you could see on the exam, but it is intended to help you think about the course content and study effectively.

Important Notes

- You may use one side of a 4×6-inch (10×15 cm) card (or a piece of paper of that side) containing notes that you prepare in advance. Anythink you want can go on that card.
- Calculators will not be helpful and definitely *not necessary*. This exam will test calculus concepts, not your ability to do arithmetic. However, you may use a calculator, but only simple arithmetic, and you must state where exactly you used your calculator. You may not use a phone or computer.
- As you study, focus on fluency and deep understanding of calculus concepts rather than only pure memorization.

What should I know and be able to do?

"Basics" and prerequisite knowledge

- Be able to graph and identify graphs of several "basic" functions: $y = mx+b$, $y = x^2$, $y = x^3$, $y = \sqrt{x}$, $y = a^x$ ($y = e^x$ in particular), $y = \ln(x)$, $y = \cos(x)$, $y = \sin(x)$.
- Be able to find, as part of the steps required in a problem, the derivatives of functions (including those that use derivative rules such as the product and/or chain rules).

Integration Review and Estimation

- Understand that the definite integral represents accumulated change if the function being integrated is a *rate of change* of an amount.
- Understand that the definite integral *also* calculates area (below x-axis counts as negative) and how this is connected to "accumulated change."
- Understand the Fundamental Theorem of Calculus (both versions) and how FTC states ways in which derivatives and integrals are inverse processes.
- Know the "basic/easy" indefinite integrals (don't forget the $+C$ on those). Remember, the ONLY "basic" integrals you should know how to do without a technique look like one of:

$$\int u^n \, du \qquad \int \frac{1}{u} \, du \qquad \int \sin u \, du \qquad \int \cos u \, du \qquad \int a^u \, du$$

Integration Review and Estimation

- Understand the different techniques of integration we have learned, including *how* to do them and *when* each technique is most commonly used. You should be able to do both definite and indefinite integrals.
- **Substitution (also called u-substitution)**: Know the basic kinds of examples, how to pick your variable of substitution (often called u) and its derivative (du), how to substitute, integrate, and then change back to the original variable. If the integral is definite, be careful with bounds!
- **Integration by parts**: Know the basic kinds of examples, how to pick u and dv. Be able to apply integration by parts multiple times, if needed.

Applications/uses of integrals

- Understand how to use integrals to find **area** of a region under one function (and above an axis) or bordered by more than one function.
- Understand how to use integrals to find the **arc length** of a curve or curves.
- Understand how to use integrals to find the **volume** of a region that has been rotated about an axis - the axis may not be the x or y axis, though. Be able to draw a "sample" cross section: cylinders or cylinders with a hole (often called disks or washers).

Common mistakes to watch out for

- It may be tempting to try to combine antiderivatives with derivative rules. There are no easy "rules" for antidifferentiation, only techniques! In particular, there is no such thing as a product rule or chain rule for antiderivatives.
- Small algebra mistakes happen. We'll learn from them but move on. Be careful not to make *fundamental* algebra mistakes. Square roots and other powers can't be distributed on addition, and neither can sine, cosine, or logarithms. For example:

$$\begin{aligned}
\sqrt{x^2+9} \quad &\text{IS NOT} \quad x+3 \\
(x+4)^3 \quad &\text{IS NOT} \quad x^3+4^3 \\
\cos(a+b) \quad &\text{IS NOT} \quad \cos a+\cos b \\
\ln(a+b) \quad &\text{IS NOT} \quad \ln a+\ln b
\end{aligned}$$

- People often *overuse* natural logs for antiderivative. Just because you see a fraction "$\frac{1}{\text{something}}$" does not mean natural log is even part of the answer. For example:

$$\begin{aligned}
\int \frac{1}{x^2+4x+4}\,dx \quad &\text{IS NOT} \quad \ln|x^2+4x+4|+C \\
\int \frac{1}{\text{something}}\,dx \quad &\text{IS NOT} \quad \ln|\text{something}|+C
\end{aligned}$$

How should I study?

First, understand that people learn differently and process information in different ways and at different speeds. I suggest:

- Read through each section of *Active Calculus* again and think about whether or not the main ideas make intuitive sense. Can you explain them out loud?
- The problems in each section of *Active Calculus* are great practice problems. There is also a large set of practice problems available on Edfinity.
- Do a few problems each day, ramping up as we get closer to the exam day. Talk with your classmates about the problems. Talk with me and visit the help sessions if you want to make sure things are correct or if you want to chat.
- Work on fluency! The exam is timed and you want to be able to do some of the problems efficiently. Perhaps give each other a few selected problems from a few different sections and time yourselves. This way, you won't know which section the problem came from.
- COME VISIT PROF. WRIGHT AND ASK QUESTIONS.