

Calc 2 Exam 1 Cheat Sheet


Calc 2 Final Formula

Unit 1 - 5.5, 5.6, 6.1 - 6.4

U-Substitution - $\int f(g(x))g'(x)dx = \int f(u)du = F(u) + C$
 - where $u = g(x)$ and $du = g'(x)$

Area Under Curve - $\int_a^b f(x)dx$
 - under the x axis makes sign neg
 - use symmetry

Average Value - $\frac{1}{b-a} \int_a^b f(x)dx$



Disk Method - $\pi \int_a^b R(x)^2 dx$
 - distance between function and axis

Shell Method - $\int_a^b 2\pi x h dx$
 - $r = x$; usually leave it like that - $h = \text{height}$; usually the equation - bounds are like width.

SA of Straight Line - $\int_a^b 2\pi \text{radius}_{\text{avg}} \text{length}$

Area Between Curves - $\int_a^b [f(x) - g(x)]dx$
 - if not given bounds set equations equal
 - for horizontal; solve in terms of y and bounds also have to be in y.

Volume Using Cross Sections - $V = \int_a^b A(x)dx$
 - Cylinder \rightarrow Area of circle
 - Square Pyramid \rightarrow Area of square

Washer Method - $\int_a^b \pi R^2 - \pi r^2$
 - $R = \text{big radius}$; $r = \text{small radius}$. One radius is usually constant but the other depends on x

Arc Length - $\int_a^b \sqrt{1 + (f'(x))^2} dx$

SA of Curved Line - $\int_a^b 2\pi f(x) \sqrt{1 + (f'(x))^2} dx$

Unit 2 - 8.2 - 8.4, 8.8, 10.1

Integration by Parts - $\int u dv = uv - \int v du$
 - u to du ; derivative: Choose u using **LIATE** (Log, Inverse Trig, Algebraic, Trig, Exponential)
 - dv to v ; integral: Most likely the more complicated $f(x)$.

Trig Integrals - $\int \sin^n x \cos^n x dx$

Products and Quotients of Trig Functions

For $\int \sin^m x \cos^n x dx$ we have the following:


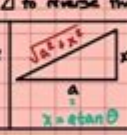
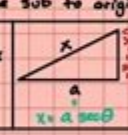
- m odd**: Step 1: save one and convert rest to cosine using $\sin^2 x = 1 - \cos^2 x$, then use the substitution $u = \cos x$.
- m even**: Step 1: convert rest and convert rest to sine using $\cos^2 x = 1 - \sin^2 x$, then use the substitution $u = \sin x$.
- m and n both odd**: Use either 1. or 2.
- m and n both even**: Use double angle and/or half angle formulas to reduce the integral into a form that can be integrated.

Trig Formulas: $\sin(2x) = 2\sin(x)\cos(x)$, $\cos^2(x) = \frac{1}{2}(1 + \cos(2x))$, $\sin^2(x) = \frac{1}{2}(1 - \cos(2x))$

Ex. $\int \sin^3 x \cos^2 x dx$

$\int \sin^3 x \cos^2 x dx = \int \sin^2 x \cos^2 x \sin x dx$
 $= \int (1 - \cos^2 x) \cos^2 x \sin x dx$
 $= \int (1 - \cos^2 x) \cos^2 x (-\cos x) dx$
 $= -\int (\cos^2 x - \cos^4 x) dx$
 $= -\int \cos^2 x dx + \int \cos^4 x dx$

Trig Sub - 1. Write down side, calculate dx and specify θ
 2. Sub expression and dx into \int and simplify
 3. Integrate - keep in mind θ restrictions
 4. Draw a reference \triangle to reverse the sub to original x

Improper Integrals - 2 types

- Integrals with infinite limits**
 - $\int_a^\infty f(x)dx = \lim_{b \rightarrow \infty} \int_a^b f(x)dx$ - if the \lim DNE or is $\infty \rightarrow$ diverges
 - $\int_{-\infty}^b f(x)dx = \lim_{a \rightarrow -\infty} \int_a^b f(x)dx$ - if it has a value \rightarrow converges
- Functions that become infinite at a point**
 - $\int_a^b f(x)dx = \lim_{t \rightarrow b^-} \int_a^t f(x)dx$
 - $\int_a^b f(x)dx = \lim_{t \rightarrow a^+} \int_t^b f(x)dx$
 - $\int_a^b f(x)dx = \lim_{t \rightarrow a^+} \int_a^t f(x)dx + \lim_{t \rightarrow b^-} \int_t^b f(x)dx$

For products of trig $f(x)$

- $\sin m x \sin n x = \frac{1}{2} [\cos(m-n)x - \cos(m+n)x]$
- $\sin m x \cos n x = \frac{1}{2} [\sin(m-n)x + \sin(m+n)x]$
- $\cos m x \cos n x = \frac{1}{2} [\cos(m-n)x + \cos(m+n)x]$

Calc 2 Exam 1 Cheat Sheet

Calculus II, often referred to as Calc 2, is a pivotal course that builds upon the foundations laid in Calculus I. This course typically covers a variety of essential topics, including integration techniques, sequences and series, polar coordinates, and many other advanced concepts. As students prepare for their first exam in this course, having a comprehensive cheat sheet can be an invaluable tool. This article serves as a detailed guide to the key concepts, formulas, and strategies that students should include in their Calc 2 exam 1 cheat sheet.

Key Concepts in Calc 2

Understanding the major topics in Calc 2 is crucial for success. The following sections outline the primary areas that students should focus on.

1. Integration Techniques

Integration is a core component of Calc 2, and mastering various techniques is essential. Here are some of the most important integration techniques to include in your cheat sheet:

- Substitution Method: Useful when the integral contains a composite function. If $u = g(x)$, then $du = g'(x)dx$.
- Integration by Parts: Derived from the product rule for differentiation. The formula is given by:

$$\int u \, dv = uv - \int v \, du$$

Choose u and dv wisely to simplify the integral.

- Trigonometric Integrals: Involves integrals that contain trigonometric functions. Common strategies include:
 - Using trigonometric identities to simplify the integrand.
 - Substituting with $\sin^2(x) + \cos^2(x) = 1$.
- Partial Fraction Decomposition: Used to break down rational functions into simpler fractions that can be integrated individually.
- Improper Integrals: These involve infinite limits or integrands that approach infinity. To evaluate, one must take the limit:

$$\int_a^{\infty} f(x) \, dx = \lim_{b \rightarrow \infty} \int_a^b f(x) \, dx$$

2. Sequences and Series

Understanding sequences and series is another fundamental aspect of Calc 2. Key items to include in your cheat sheet include:

- Definitions:
 - Sequence: An ordered list of numbers defined by a specific rule.
 - Series: The sum of the terms of a sequence.
- Convergence Tests:
 - Geometric Series Test: A geometric series converges if $|r| < 1$. The sum is given by:
$$S = \frac{a}{1 - r}$$
 - p-Series Test: A p-series $\sum \frac{1}{n^p}$ converges if $p > 1$.
 - Comparison Test: Compare with a known convergent/divergent series.
 - Ratio Test: Useful for series involving factorials or exponentials:

$$L = \lim_{n \rightarrow \infty} \left| \frac{a_{n+1}}{a_n} \right|$$

- If $(L < 1)$, the series converges.
- If $(L > 1)$, the series diverges.
- If $(L = 1)$, the test is inconclusive.

- Taylor and Maclaurin Series: Polynomial approximations of functions:

- Taylor Series:

$$f(x) = f(a) + f'(a)(x - a) + \frac{f''(a)}{2!}(x - a)^2 + \dots$$

- Maclaurin Series (Taylor at $(a = 0)$):

$$f(x) = f(0) + f'(0)x + \frac{f''(0)}{2!}x^2 + \dots$$

3. Polar Coordinates

Polar coordinates offer a different perspective on points in the plane. When studying polar coordinates, consider the following:

- Conversion between Cartesian and Polar:
 - $(x = r \cos(\theta))$
 - $(y = r \sin(\theta))$
 - $(r = \sqrt{x^2 + y^2})$
 - $(\theta = \tan^{-1}(\frac{y}{x}))$
- Area in Polar Coordinates: The area (A) enclosed by a polar curve $(r(\theta))$ can be calculated using:

$$A = \frac{1}{2} \int_{\alpha}^{\beta} [r(\theta)]^2 \, d\theta$$
- Arc Length in Polar Coordinates: The arc length (L) from $(\theta = a)$ to $(\theta = b)$ is given by:

$$L = \int_a^b \sqrt{[r(\theta)]^2 + \left(\frac{dr}{d\theta}\right)^2} \, d\theta$$

Important Formulas

Including essential formulas in your cheat sheet can help you quickly recall critical information during the exam. Below are several formulas that are frequently used in Calc 2.

1. Integral Formulas

- Basic integrals:

$$\int x^n \, dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$$

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\int e^x \, dx = e^x + C
\]
\[
\int \sin(x) \, dx = -\cos(x) + C
\]
\[
\int \cos(x) \, dx = \sin(x) + C
\]

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2. Derivative Formulas

- Basic derivatives:

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\[
\frac{d}{dx}(x^n) = nx^{n-1}
\]
\[
\frac{d}{dx}(e^x) = e^x
\]
\[
\frac{d}{dx}(\sin(x)) = \cos(x)
\]
\[
\frac{d}{dx}(\cos(x)) = -\sin(x)
\]

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Study Tips for the Exam

To maximize your performance on the Calc 2 exam, consider the following study tips:

1. Review Past Exams: Practice with past exam questions to familiarize yourself with the format and types of problems that may appear.
2. Group Study: Collaborating with classmates can help clarify concepts and provide different perspectives on problem-solving.
3. Utilize Online Resources: Websites like Khan Academy, Paul's Online Math Notes, and others provide excellent tutorials and practice problems.
4. Practice, Practice, Practice: The more problems you solve, the more comfortable you will become with the material. Focus on a variety of problem types.
5. Stay Organized: Keep your cheat sheet neatly organized, grouping similar topics together. This will make it easier to find information during the exam.

Conclusion

Creating a comprehensive Calc 2 exam 1 cheat sheet can be immensely beneficial for students preparing for their first exam. By including key concepts, formulas, and study strategies, students can enhance their understanding and recall of complex topics such as integration techniques, sequences and series, and polar coordinates. With diligent preparation and practice, students can approach their Calc 2 exam with confidence and succeed in mastering this essential mathematical discipline.

Frequently Asked Questions

What topics should be included in a Calc 2 exam 1 cheat sheet?

A Calc 2 exam 1 cheat sheet should include topics such as integration techniques, the fundamental theorem of calculus, sequences and series, convergence tests, and polar coordinates.

How can I effectively organize my Calc 2 cheat sheet?

Organize your cheat sheet by categorizing it into sections like integration methods, formulas, and key concepts. Use bullet points for clarity and include examples for complex topics.

Are there any specific formulas I should memorize for Calc 2?

Yes, important formulas include integration by parts, the power rule for integration, trigonometric identities, and the series expansion for common functions like e^x and $\sin(x)$.

What are common mistakes to avoid when using a cheat sheet during a Calc 2 exam?

Common mistakes include relying too heavily on the cheat sheet and not understanding the underlying concepts, misplacing critical formulas, and failing to practice problems similar to those on the exam.

Can I use my cheat sheet during the Calc 2 exam?

It depends on your instructor's policies. Some allow one-page cheat sheets while others do not permit any external materials. Always check your syllabus or ask your instructor.

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