Calculus and Analytical Geometry II

Information on Learning Targets and Checkpoints

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The purpose of this document is to give details on how Checkpoints are used to attain mastery on Learning Targets, what Checkpoint problems cover, how they are graded, what resources are approved for use on Checkpoints and how to use them, and let you know when Checkpoints will take place and what will be covered on each. **Complete transparency** is the goal; if you have questions or if there's something that needs to be added to this document, please let me know.

§A. Learning Targets

The star (★) marked LTs are counted as Core LTs.

- **Group DC:** Demonstrate proficiency in fundamentals of calculus topics, including derivatives, antiderivatives, and the Fundamental Theorem of Calculus.
  - **DC1★:** I can state and apply the Fundamental Theorem of Calculus correctly.
- **Group IT:** Evaluate Integrals by correctly identifying the Technique.
  - **IT1★:** I can use u-substitution to compute integrals, including integrals involving the exponential and logarithmic functions.
  - **IT2★:** I can compute integrals involving the exponential and logarithmic functions.
  - **IT3★:** I can use the method of integration by parts to compute integrals.
  - **IT4:** I can evaluate and simplify integrals whose integrands are of the form $\sin^m(x)\cos^n(x)$, where one (or both) of m and n are integers. I can evaluate and simplify trigonometric integrals using an appropriate Product-to-Sum identity, i.e. whose integrands of the form $\sin(Ax)\sin(Bx)$, $\sin(Ax)\cos(By)$, or $\cos(Ax)\cos(By)$; by learning necessary trigonometric identities (double angle, product-to-sum).
  - **IT5:** I can evaluate and simplify integrals using techniques such as trigonometric substitution.
  - **IT6★:** I can demonstrate understanding of a strategy for determining an appropriate technique of integration.
- **Group AI:** Apply Integrals to real-life problems.
  - **AI1★:** I can use definite integrals to calculate the area of a region bounded by one or more functions, including integrating with respect to either axis.
  - **AI2★:** I can use definite integrals to calculate the volume of a solid formed by a region bounded by one or more functions being rotated around a coordinate axis; a region bounded by one or more functions being rotated around a line parallel to a coordinate axis; and other volumes of revolution.
  - **AI3:** I can apply definite integrals to calculate arc length and surface area.

- **AI4:** I can apply definite integrals to calculate work done by a variable force, or other similar physical quantities.

- **Group DE:** Use a Differential Equation to model phenomena, and solve the resulting initial value problem.
  - **DE1⋆:** I can model exponential processes using Differential Equations, correctly use half-life to find the decay constant, and vice-versa.
  - **DE2⋆:** I can solve Separable Differential Equations using Integration Techniques.

- **Group SS:** Learn why infinity is not a number and what it means to add infinitely many terms together.
  - **SS1⋆:** I can correctly identify whether or not an integral is improper and determine whether improper integrals converge or diverge.
  - **SS2⋆:** I can interpret and convert between the explicit, list, and recursive notations of a sequence. I can explain what it means for a sequence to converge or diverge. I can use methods from Calculus I, specifically L'Hopital's rule, to evaluate limit of a sequence.
  - **SS3⋆:** I can convert between expanded notation and sigma notation of a series. Identify a geometric series. I can determine whether a geometric series converges or diverges. I can apply the test for divergence to determine if an infinite series diverges.
  - **SS4:** I can check if the four conditions of the Integral Test apply in a particular situation. I can make correct connections between improper integrals and infinite series. I can recognize and apply the p-Test for infinite series.
  - **SS5:** I can determine if a series converges or diverges by comparing it to a known series. I can determine if a series converges or diverges by performing a limit comparison and making appropriate conclusion.
  - **SS6:** I can recognize an alternating series. I can check the conditions for, and apply, the Alternating Series Test when appropriate. I can Define absolute convergence and conditional convergence. I can determine if an infinite series converges absolutely, converges conditionally, or diverges.
  - **SS7⋆:** I can use the Root test and the Ratio test to determine if a series converges absolutely.
  - **SS8⋆:** I can correctly identify which test to use to determine whether a series converges or diverges.

- **Group PA:** Learn how to use Polynomials to Approximate smooth functions.
  - **PA1⋆:** I can define what a power series is. I can Explain what the radius of convergence and the interval of convergence for a power series is, and correctly determine a given power series' radius and interval of convergence.
  - **PA2:** I can use algebraic manipulations, differentiation, or integration to find the power series expansion for a function. For example, starting with the power series expansion for $\frac{1}{1-x}$, find a power series for $\frac{x^5}{1-2x}$.
  - **PA3⋆:** I can find the Taylor polynomial of specified degree for a function. I can use Taylor polynomials to approximate a function, e.g. "Approximate $\sqrt{16.03}$ using a quadratic Taylor polynomial.".

Checkpoint	Learning Targets	Date assigned	Date due
1	DC1, IT1, IT2	Jan 27 (Wednesday)	Jan 29
2	DC1, IT1, IT2, IT3	Feb 2	Feb 4
3	DC1, IT1, IT2, IT3, IT4, IT5, IT6	Feb 9	Feb 11
4	IT3, IT4, IT5, IT6, AI1, AI2	Feb 16	Feb 18
5	IT4, IT5, IT6, AI1, AI2, AI3, AI4	Feb 23	Feb 26
6	AI1, AI2, AI3, AI4, DE1, DE2	Mar 2	Mar 5
7	AI3, AI4, DE1, DE2, SS1	Mar 8 (Monday)	Mar 12
8	DE1, DE2, SS1, SS2, SS3	Mar 16	Mar 19
9	SS1, SS2, SS3, SS4, SS5	Mar 23	Mar 26
10	SS2, SS3, SS4, SS5, SS6, SS7	Mar 30	Apr 2
11	SS4, SS5, SS6, SS7, SS8	Apr 5 (Monday)	Apr 10
12	SS6, SS7, SS8, PA1	Apr 13	Apr 16
13	SS8, PA1, PA2, PA3	Apr 20	Apr 23
14	PA1, PA2, PA3	Apr 27	Apr 29

§B. Learning Targets by Checkpoints

§C. Overall Grading Criteria for Checkpoints

There are some common criteria for a solution to be considered **"acceptable"**:

- **There can be no instances of significant errors.** A "significant" error is one that is *directly related to the Learning Target itself and causes the solution to fail to provide conclusive evidence of mastery*. Examples include (but are not limited to) the following:
  - *A significant computational error* that shows more work needs to be done on mastering the computation (for example: getting the sign wrong in integration by parts; computing the integral of $\cos(x)$ as $-\sin(x)$ instead of $+\sin(x)$; or switching the order in a definite integral evaluation)
  - *A significant conceptual error* that demonstrates the need to understand the concept further (for example: using the wrong formula for disk vs. washer method; using integral test for a series that is not always positive etc.)
  - *An unclear explanation* that demonstrates the need to understand the concept further
  - *Significant omissions* including not doing a part of a multi-part problem (even if by accident); or leaving out an essential part of a solution, for example not finding the value of the constant for an initial value problem
  - *A highly disorganized presentation of a solution* - That is, the solution is so messy and incoherent that it is not easy for the reader to determine if the student has mastered the concept
  - *A copy error that oversimplifies the problem* - For example, copying down $f(x) = e^{x^2}$ on a question as $f(x) = x^2$ or $f(x) = e^x$.
- **There can be no more than a single instance of a "simple" error.** A "simple" error is an error that is *not directly related to the Learning Target itself and doesn't get in the way of seeing that the student has*

mastered the concept. Examples of simple errors include:

- Errors in arithmetic or algebra that are not central to the Learning Target and do not oversimplify the problem. For example, working through a definite integral and everything is correct except simplification of the final answer.
- Copy errors that do not oversimplify the problem. For example, if your mistake makes the problem roughly the same level of difficulty as the correct version, I will read your solution to make sure the answer and process are correct.

Generally speaking, **you are not being graded on your answers but on your explanations, processes, and reasoning.** While correct answers are expected and required (except for simple errors), the evidence of your mastery of the Learning Targets does not come from the answers; it comes from your work that leads to the answer. So **make every effort not only to provide right answers but also full, correct, clearly expressed explanations** that back up your answers. *Remember you are doing work here to convince the reader that you have mastered the ideas*. Like in a courtroom, provide ample evidence, clearly expressed, that you have done so.

Finally please note that:

- *Two simple errors in the same problem, no matter what the type, results in unacceptable work.* It is acceptable to make a simple error once, but not twice.
- To avoid all forms of error, use the approved tools listed below to double-check all your work before submitting it. For example, you are allowed to use `WolframAlpha` to double check the answers for integral calculations; you just need to supply a complete and clear solution. In this way, your work should never really contain errors unless they are significant conceptual misunderstandings.

§D. Approved resources for Checkpoints

You are approved to use the following resources on all Checkpoints:

- The two textbooks and any external site that is linked inside the textbook.
- Any video or document posted to the class Moodle site.
- Class recordings in MS Teams.
- The websites WolframAlpha and Desmos.

Any resource not included on above list is to be considered off-limits and not approved for use on Checkpoints. Evidence of using unapproved resources will be considered academic dishonesty. Resources that are NOT allowed include:

- Solution websites such as Chegg
- Other students in the class, or past students from other Math 112 classes
- Other textbooks or videos not included above

Please see the **Collaboration and Academic Honesty** policy in the `Assessment` document for more information. If there is a resource that is not on the approved list that you'd like to use, please ask me (Prof. Chowdhury) for permission. Additional resources may be added to this list later.