INTRODUCTION. Do not turn to the attached copy of ‘a modified combination of subsets of two old exams’ until you feel that you are close to ready to take our third exam. The ‘combination of parts of an old third exam and an old fourth exam’ is NOT A SAMPLE EXAM: It is just an example of what an exam on the relevant material could look like. YOUR ACTUAL EXAM MAY BEAR LITTLE RESEMBLANCE TO THE ONE THAT IS ATTACHED HERE. You want to come to the exam with a good, working understanding of the material related to Chapter 10 and Section 11.1 in addition to any mathematics that is prerequisite to that material. Our view of the material comes from exposure to the perspectives from the text, in class discussions, class handouts, self-help work sheets, series practice sets, office hour participation, discussion sets, discussion sessions, etc.

- Chapter 4 of Cameos in Multivariable Calculus and Series (http://www.math.ucdavis.edu/~emsilvia) offers a workbook format approach to sequences and the introduction to series.

- Some Practice Problems with proposed solutions are offered in Self-Help Work-sheets #12 which is posted in Chapter 2 of Cameos.

- The introduction to Discussion Set C7 summarizes an approach to analyzing given series. On page 617 of our text, there is a great table that pulls together the various tests for series. The flow chart that I distributed in class, illustrates another view of how to approach a series.

REMEMBER that reading the directions is important; justifications can be very brief, in some cases, you may opt to create a column next to your work on a problem in order to list properties or results that you are using.

Directions for Use of this Self-Help Drill Exam. The general idea is for you to take the ‘self-help drill exam’ under exam conditions, followed by self-grading of your work. An annotated key is offered in a separate file so that you will be able to grade your own work on the old exam. If you have a study group or partner, it can be helpful to trade off on the grading. Since everyone has different talents and rates of problem completion, don’t be surprised or concerned if you do not complete the drill exam in the 50 minutes to which you limit yourself. Your goal is to gain a better understanding of how well you know some of the material, thus far, and to gain some information concerning the types of errors that you make when trying to work exam problems related to the material of emphasis. Also, your overall performance can give you some insights concerning how best to use your time during the actual exam.
STEPs TO FOLLOW

1. When you feel close to ready to take the exam, allow yourself 50 minutes to take the self-help drill exam. Then, you might take a break and allow yourself 20 minutes to work on problems that you did not get to during the initial 50 minute block plus 30 minutes for a combination of self-grading of your work and reflection on what you learned from the exercise.

2. Keep track of the problems that you worked on after the 50 minute block was up; if you did better on some of those problems than on the others, this might give you some ideas for how you should organize your approach to taking the actual exam on Friday, 6/1.

3. During the first 50 minutes, work on the copy of the self-help 3rd drill exam, as much as possible, under close-to-exam conditions. DO NOT USE NOTES, CALCULATORS, TEXTS OR CONSULTATION WITH ANYONE while you are “taking” the third self-help drill exam.

4. After taking the drill exam under exam conditions, use the annotated key to grade your own work. Doing the grading is very important to the usefulness of this activity, so please give it a good try. When you have made an error that is not described in the grading comments, make your best guess to classify the type of error. As a general guideline, for simple algebraic and arithmetic errors, take off one point each; for failure to follow the directions, like providing unjustified answers or not using the approach that was specified in the directions, give yourself zero. When your approach to a solution varies significantly from the one offered in the annotated key, ask yourself if the variation is still mathematically acceptable. Coming to the same conclusion or arriving at the same numerical answer does not automatically mean that things are okay.

5. Take a moment to reflect on the types of errors that you made. Were some due to working too quickly (dropping minus signs, leaving off constants, algebraic errors when adding rational expressions, leaving off powers of expressions that were needed for correct comparisons, etc.)? Were some of them due to your not knowing definitions (a sequence, limit of a sequence, a series, sequence of nth partial sums, limit of a series, Taylor polynomials of degree n), the key results (Squeeze Principle, Theorem on Bounded Monotone Sequences, Geometric Series Theorem, p-series Theorem), or the names of our series tests for brief justifications of your work? KEEP IN MIND THAT “IT IS OBVIOUS” IS NEVER AN ACCEPTABLE JUSTIFICATION.

If the answer to the first question is yes, then slow down a bit and review your work to check for such things: You don’t need to complete the whole exam in order to do well, but you want to do what you do as correctly as possible.
If the answer to the second question is yes, then review the important definitions, terminology, and/or names of the series tests. Be careful to try writing definitions, separately, without looking and then compare what you did to the actual.

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Remember that doing “what you do well” can be more beneficial than madly, or carelessly, racing through everything.
Part I: Instructions. Take the following ‘modification of subsets of two old exams’ under mimicked exam conditions. Sometimes it helps to have a noisy timer running during this part of the exercise. Since there is not enough space provided for you to work the problems, you should have 7-9 sheets of paper on hand. Work out one problem per page. Do not bother to copy the problems over because that will take too much time. On our actual exam, space will be provided for you to show your work. Before you start, look at the array of problems: If you don’t think that you can complete the whole drill exam in 50 minutes, decide on a “plan of attack” that will maximize the benefit gained from the time that you spend. After the 50 minutes is up, you might take a break and then work on the other problems to see how well you can do on them. (If you do better on the problems that you wouldn’t have gotten to than on some of the ones you chose, then you might want to think about how you went about making the choices that you made.)

NO USE OF NOTES, TEXTS, CALCULATORS, OR EACH OTHER ALLOWED.

I. (A) (16 points) For \( \{a_n\} = \left\{ \frac{3n}{2n - 1} \right\}_{n=1}^{\infty} \), give an \( \varepsilon - N \) proof that

\[
\lim_{n \to \infty} \left( \frac{3n}{2n - 1} \right) = \frac{3}{2}.
\]

(B) (5 points) For \( \varepsilon = \frac{1}{4} \), on the numberline given, use the \( N = N\left(\frac{1}{4}\right) \) that you would get from your part (A) to illustrate the conclusion you can draw about the sequence for all \( n > N \).

II. (15 points) Use the definition of the limit of a series to justify that the following series is convergent and to find its sum.

\[
\sum_{k=0}^{\infty} \frac{1}{(k^2 + 3k + 2)}
\]
III. (14 points) TRUE or FALSE. State your position on the line segment that is provided and briefly justify it.

(a) ______ Given \( \sum_{k=1}^{\infty} a_k, a_k \) real, if \( a_{k+1} \leq a_k \) for all \( k \) and \( \lim_{k \to \infty} a_k = 0 \), then the series is convergent.

(b) ______ For any fixed real number \( x \) such that \( |x - 2| \leq 1 \), the series \( \sum_{k=1}^{\infty} \frac{(-1)^k (x - 2)^k}{k} \) is absolutely convergent.

IV. (30 points) For each of the following, determine whether the given series is absolutely convergent, conditionally convergent or divergent. Briefly justify your conclusions; name convergence tests or known series to which you appeal.

(a) \( \sum_{k=1}^{\infty} \frac{(-1)^k k}{(k^2 + 1) 2^k} \)

(b) \( \sum_{k=1}^{\infty} \frac{(-1)^{k+1} e^k}{e^{2k} - 1} \)

(c) \( \sum_{k=1}^{\infty} \frac{(-1)^k k^2}{\sqrt{2k^3 + 1}} \)

V. (20 points) Showing your work carefully, find the Taylor polynomial of degree 6 for \( f(x) = \sin 2x \) about \( x = \frac{\pi}{4} \); i.e., \( P_6(x; \frac{\pi}{4}) \).