

Take Home Problem

1. The area under the standard normal curve between $x=0$ and $x=a$ is given by the definite integral shown. Unfortunately, this integral can't be integrated algebraically. Follow the steps listed below to approximate the area under the standard normal curve on the interval $[0, 2]$.

$$\frac{1}{\sqrt{2\pi}} \int_0^a e^{-\frac{1}{2}x^2} dx$$

- a. Make a substitution into a known Maclaurin series to write the Maclaurin series for $e^{-\frac{1}{2}x^2}$. Write the series in sigma notation.
- b. Use the alternating series test to find the least number of terms needed so that the Maclaurin series for $e^{-0.5x^2}$ is accurate to 5 decimal places on the interval $[-4,4]$.
- c. Use the Remainder Estimation Theorem to find the least number of terms needed so that the Maclaurin series for $e^{-0.5x^2}$ is accurate to 5 decimal places on the interval $[-4,4]$.

- d. Write the n^{th} order Maclaurin series for $e^{-\frac{1}{2}x^2}$, where n is the number of terms found using the remainder estimation theorem in part c.
- e. Find the indefinite integral of the Maclaurin series from part d.
- f. Use the Fundamental Theorem of Calculus to evaluate the definite integral from part e. at $x = a$ and $x = 0$ and then multiply by $\frac{1}{\sqrt{2\pi}}$ to approximate the original integral.
- g. Evaluate the integral at $x=2$ to approximate the area under the curve between $x=0$ and $x=2$ accurate to 4 decimal places.

There are eight tests for convergence that we are going to study in sections 10.5 through 10.7. Each student will be assigned one of the tests. Your assignment is to teach that test to the class. You may teach the test for convergence alone or you may partner with another student and both team teach, but you are responsible for the test assigned to you.

For the test assigned to you, do the following.

1. Familiarize yourself with the assigned test.
 - a. Read the section in the book dealing with that test. You may need to read other sections as some tests are related to others.
 - b. Read the summary of convergence tests on page 691.
2. Present the material for that test to the class.
 - a. You may use any method, lecture, handout, group discussion, etc that you wish to use. Some people have made Power Point presentations. There is Power Point 2000 on the computer hooked to the projection unit.
 - b. Each presentation should take no more than 20 minutes. Ten minutes is probably sufficient to teach any of these tests and if you're still going after 20 then you're either confusing the class or boring them.
 - c. You must do at least two examples using that technique. These problems may be from the homework problems. Be sure to show each possible outcome from the test. That is, if the test can indicate convergence or divergence, then be sure you show at least one example that converges and one that diverges.
 - d. Explain when the best time to use that technique is. Explain when it doesn't work and if you have time, show an example of why it doesn't work.
 - e. Be able to answer any questions on the technique.

3. Assign three even problems that require the use of the technique.
 - a. These may not be the problems that you worked as examples.
 - b. Try to spread the problems around so that all outcomes are used.
 - c. Collect and grade the problems from the rest of the students. Each problem is worth 1 point and is either right or wrong. Record the number correct for each student on a paper to give to the instructor.
 - d. You are allowed to help the other classmates with their homework, but you are not allowed to give them the answer.
 - e. You decide when the problems are due. Most students make them due two class periods after the material is covered so that if there are any questions, the students have a chance to ask.

4. Your grade will be based on the following criteria
 - a. You may get up to 21 points for the three problems assigned for each of the tests that you didn't present.
 - b. To encourage you to do a good job explaining the topic and helping the other students understand the material, you will be awarded up to nine points based on how well the other students do with your topic. Take the number of points earned divided by the total number of points for your topic and multiply by 9. Example: The other students earned 19 out of 21 on your topic. You get $19/21 * 9 = 8.14 \approx 8$ points.
 - c. The entire project is worth 30 points.

Name : _____

Points : _____

Test : _____

Test	Person	My score on their test	Their score on my test
Divergence Test (10.5)			
Integral Test (10.5)			
Comparison Test (10.6)			
Ratio Test (10.6)			
Root Test (10.6)			
Limit Comparison Test (10.6)			
Alternating Series Test (10.7)			
Ratio Test for Absolute Convergence (10.7)			
Totals			

In the chart above, there will be no scores for the row containing your test. The “my score on their test” is how many of the three problems they assigned that you got right. The “their score on my test” is how many of the three problems you assigned that they got right.

Your score for the take home is the sum of the my score on their test” column plus 9 times the sum of the “their score on my test” column divided by the maximum possible score on your test.