

ON THE FRONT OF YOUR BLUEBOOK write: (1) your name, (2) your student ID number, (3) your instructor's name, (4) your recitation number, and (5) a grading table. You must work all of the problems on the exam. Show ALL of your work in your bluebook and **BOX IN YOUR FINAL ANSWERS**. A correct answer with no relevant work may receive no credit, while an incorrect answer accompanied by some correct work may receive partial credit. Text books, class notes and calculators are NOT permitted. Please start each new problem on a new page of the bluebook.

1. (30 points) Compute the following integrals. If the integral is improper, determine whether it converges or diverges, and if possible, determine its value. Be sure to show all your work to receive full credit.

(a)  $\int_1^2 x \ln(x) dx$

(c)  $\int_{-3}^3 \frac{dx}{(x-2)^2}$

(b)  $\int_1^{\infty} \frac{x^3 dx}{x^2 + 2x + 1}$

2. (25 points) Determine whether the following sequences converge or diverge. If the sequence converges, find the limit. Be sure to show your work.

(a)  $a_n = \left(\frac{1}{n^2}\right)^{n^2}$

(b)  $a_n = \frac{\log_n e}{\log_n n}$  for  $n \geq 2$

(c)  $a_n = \frac{a_{n-1}}{n}$  if  $a_1 = 1$

3. (25 points) Determine if each of the following series converges or diverges, and clearly state the test you are using. Please show all of your work.

(a)  $\sum_{n=1}^{\infty} \frac{2n+1}{2n}$

(c)  $\sum_{n=2}^{\infty} \frac{1}{(\ln n)^3}$

(b)  $\sum_{n=2}^{\infty} \frac{1}{(\ln 3)^n}$

4. (20 points) For your birthday, you treat yourself to a bungee-jump. When you are dropped, the initial distance you fall is 100 feet. Each time you bounce, the bungee cord only pulls you up 80% of the previous distance fallen. Find the total distance you travel up and down.