TAKE HOME Exam 3 Calculus 2 M193 Prof. L. A. Month

MW Class Due Monday April 4 Before Class
TTh Class Due Tuesday April 5 Before Class

NO HELP ALLOWED. YOU MUST SHOW YOUR WORK TO RECEIVE ANY CREDIT
(You may use Mathematica and the website where the handouts, etc. are for this class. OTHERWISE USE OF THE COMPUTER OR INTERNET IS NOT PERMITTED.)

(20%) 1. For each integral find all values of p for which the integral converges.
\[
\int_1^\infty \frac{dx}{(x-1)^p} \quad \int_6^7 \frac{dx}{x^p} \quad \int_2^{10} \frac{dx}{(x-2)^p} \quad \int_2^\infty \frac{dx}{(x-1)^p}
\]

(20%) 2. For each integral, prove whether it converges or diverges. If any of the integrals are convergent pick one convergent integral and evaluate it.
\[
\int_5^\infty \frac{dx}{\sqrt{x^2-5}} \quad \int_1^\infty |\sin 2x| \, dx \quad \int_2^{\infty} \frac{\ln(x^2)}{x^3} \, dx \quad \int_0^1 x^{-1} e^{-x} \, dx \quad \int_2^{\infty} x^{1000} e^{-5x} \, dx
\]

(20%) 3. Prove whether each of the following sequences are (eventually) increasing, decreasing, or neither?
\[
\left\{ \frac{1}{\sqrt{n}} - 1 \right\} \quad \left\{ \frac{5(n^2)}{n \cdot (n!)} \right\} \quad \left\{ \frac{n^e}{3^n} \right\} \quad \left\{ \frac{n^3 \ln n}{2^n} \right\} \quad \left\{ \frac{n^{\sqrt{n}}}{\sqrt{2n}} \right\}
\]

(20%) 4. Prove whether each of the sequences are convergent or divergent. Find the limit of each convergent sequence. Which of the sequences are eventually monotone. Explain
\[
\left\{ \frac{\sin n}{n^2} \right\} \quad \left\{ \frac{n^n}{n!} \right\} \quad \left\{ \frac{(\ln n)^3}{\sqrt{n}} \right\} \quad \left\{ \ln(n!) - n \right\} \quad \left\{ \frac{n^{\sqrt{2}}}{\sqrt{2n}} \right\}
\]

(20%) 5. Consider the sequence \( \left\{ \frac{(-3)^n}{(5n)^5} \right\} \).
   a. Prove whether the sequence is convergent or divergent?
   b. List the first five nonzero terms of the sequence. Start the sequence at \( n = 1 \). Leave your answer in rational form.
   c. Sketch the graph of the sequence. Clearly show the end behavior of the sequence.

Please sign the following:
This exam is completely my own work. While working on this exam, I did not consult anyone else, real or virtual.