Math 142, Exam 3, Fall 2016

Write everything on the blank paper provided. **You should KEEP this piece of paper.** If possible: return the problems in order (use as much paper as necessary), use only one side of each piece of paper, and leave 1 square inch in the upper left hand corner for the staple. If you forget some of these requests, don't worry about it – I will still grade your exam.

The exam is worth 50 points. Please make your work coherent, complete, and correct. Please $\boxed{CIRCLE}$ your answer.

No Calculators or Cell phones.

(1) (9 points) Find $\displaystyle\int \frac{1}{\sqrt{x^2+1}}\,dx$. **Please check your answer.**

(2) (9 points) Find $\displaystyle\int_0^4 \frac{1}{(x-3)^2}\,dx$.

(3) (8 points) Find the limit of the sequence whose n^{th} term is $a_n = \left(\dfrac{2n-1}{2n}\right)^n$.

(4) (8 points) Find a closed formula for the sum

$$\sum_{k=2}^{100} \pi^k = \pi^2 + \pi^3 + \pi^4 + \cdots + \pi^{99} + \pi^{100}.$$

Remember that a closed formula does not have any summation signs or any dots. Be sure to give a formula for the given sum and not something else.

(5) (8 points) Approximate $\displaystyle\sum_{k=1}^{\infty} \frac{1}{k^5}$ with an error at most $\frac{4}{10^4}$. **Explain what you are doing. Write in complete sentences.**

(6) (8 points) Does the series $\displaystyle\sum_{k=1}^{\infty} \frac{1}{k^2+5}$ converge? **Justify your answer very thoroughly. Write in complete sentences.**