Math 152: Summer 2019, Section C2
Workshop 5

1. Show that $\sum_{n=2}^{\infty} \frac{\sin n}{\sqrt{n^3+n}}$ converges absolutely.

2. Goofus is trying to show that the series $S = \sum_{n=0}^{\infty} \frac{2+(-1)^n}{e^n}$ converges. He notes that, for every value of n, $\frac{2+(-1)^n}{e^n} = \frac{2+\cos(\pi n)}{e^n}$; since $f(x) = \frac{2+\cos(\pi x)}{e^x}$ is a positive continuous function and $\int_0^{\infty} \frac{2+\cos(\pi x)}{e^x}\,dx$ is finite, S converges by the integral test. What fallacy did Goofus make in his reasoning? How would you determine if S converges?

3. Below are six series, and six convergence tests. For each series, match it with the corresponding test that works best for determining whether the series converges, and determine whether it converges.

$\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt[3]{n}}$	n^{th} Term Divergence Test
$\sum_{n=1}^{\infty} \frac{\tan^{-1}(n)}{3}$	Limit Comparison Test
$\sum_{n=1}^{\infty} \left(\frac{\tan^{-1}(n)}{3}\right)^n$	Ratio Test
$\sum_{n=2}^{\infty} \frac{1}{n \ln n}$	Root Test
$\sum_{n=1}^{\infty} \frac{(n!)^2}{(2n)!}$	Integral Test
$\sum_{n=1}^{\infty} \frac{5}{n^5+n}$	Alternating Series Test

Analysis of the Workshop

This workshop, from my summer Calculus 2 course, was designed with my philosophy of prioritizing an understanding of the reasoning behind the material learned in lecture. A workshop is a set of problems that students work on in groups during recitation period, with the TA (or instructor, in the case of the summer) providing guidance where needed. Afterwards, each student writes up an individual solution to one of the problems, chosen by the instructor, outside of class. For any such solution, students are expected to show and justify all of their work, rather than just give a final answer.

Historically, the Calculus 2 workshops at Rutgers consisted of extremely difficult problems, roughly founded on concepts from lecture but made much more complex; this caused all but the strongest students to feel very lost during the workshop. During the summer of 2019, the instructors for Calculus 2 began a push to make the problems on the workshop more accessible to students, while still providing more in-depth problems than the "find the answer" problems that make up the bulk of online homework.

The first question is mostly intended as a warmup, and connects less to making the student understand the underlying concepts, but it does require the student to use both the definition of absolute convergence and the comparison test to solve it. The second problem forces students to reflect upon their understanding of the integral test by requiring them to show what a sample individual did incorrectly (in this case, the integral test can only be used if the function is decreasing). The third question is the most intensive in enforcing understanding – students need not only to show that they can apply the variety of convergence tests that they learn, but also recognize a situation that a given test is particularly well-suited for. The fact that the tests that they would use are listed out for them aids in accessibility, since a student could use process of elimination to give themselves a starting point in assessing a series they were particularly struggling with.