

MATH 104 – Extra credit project - Fall 2016

For each of the four series below do the following:

1. Explain why each one converges (use an appropriate test).
2. Using a calculator or computer, add together enough terms so that you are convinced you know the sum as a decimal number correct to at least four decimal places.
3. (*Optional, and not so easy*) Prove that your approximation really is correct to four decimal places.
4. Identify the four numbers you have obtained (they are all more or less famous numbers).

Here are the four series:

$$\sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots$$

$$\sum_{n=0}^{\infty} \frac{1}{n!} = 1 + 1 + \frac{1}{2} + \frac{1}{6} + \frac{1}{24} + \cdots$$

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = 1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \frac{1}{25} + \cdots$$

$$\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \cdots$$