Exam 3 **Calculus 2** **3/31/23**

Each problem is worth 10 points. For full credit give good justification for your answers.

1. Determine the exact sum of the geometric series

$$1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \ldots$$

2. Find the first 3 partial sums of the series

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

3. Write the 5^{th} degree MacLaurin polynomial for $f(x) = \sin x$.

4. Determine whether the series $\sum_{n=1}^{\infty} \frac{2+(-1)^n}{\sqrt{n}}$ converges or diverges.

5. Determine whether the series $\sum_{n=2}^{\infty} \frac{1}{n^3 - 1}$ converges or diverges.

6. Write the 4th degree Taylor polynomial for $f(x) = \ln x$ centered at $x = 1$.

7. Bunny is a Calculus student at Enormous State University, and she's having some trouble. Bunny says "Ohmygawd! This series stuff is literally turning my brain into a donut! So, like, they had us find a Taylor thingy for ln, right? And it was centered at 1, right? So then they asked us to use it for $\ln 2$ and $\ln 4$, right? And the answer for $\ln 4$ was really far off, right? And they asked us, like, how high the degree needed to be to make it better, right? And I just cried."

   Help Bunny out by explaining what happens when using higher and higher degree Taylor polynomials like this.

8. Find the radius of convergence of $\sum_{n=0}^{\infty}(-1)^n \frac{x^{2n+1}}{2n+1}$.

9. Find the interval of convergence of $\sum_{n=0}^{\infty}(-1)^n \frac{x^{2n+1}}{2n+1}$.

10. Use a Maclaurin polynomial of degree at least 4 to approximate $\int_0^{0.2} e^{-x^2}\,dx$.

Extra Credit [5 points possible]: If two series both diverge, does their sum have to diverge?