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Alternating Series- Application



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A Mini Project for Module 3

Project Description

This project demonstrates the following concepts in integral calculus:

1. Partial sums
2. Alternating Series
3. Estimating the Sum of a Series

Your Assignment

Your assignment is to shade a disk of radius 1. Then your friend paints a white disk of radius $1/2$ over it. You shade a disk of radius $1/3$ on top of that, and your friend paints a white disk of radius $1/4$ on top of that... As you continue, the shade portion looks more and more like a target.



Figure: Painting a target by shading concentric disks blue then white ad infinitum

If you could continue this forever (with *really* small paintbrushes!), how much of the circle would be shaded *in the limit*?

To answer this question:

1. Calculate the shaded area in each step of the process
2. Find an expression for the sum of the first n terms, s_n .
3. Prove that the limit of the partial sums exist and therefore the series converges.
4. How many summands (terms) are needed to approximate the alternating series to within 0.0001 of its actual value?