

Mathematics 1110H – Calculus I: Limits, Derivatives, and Integrals

TRENT UNIVERSITY, Summer 2026 (S62) [reading course]

Assignment #5

*Due on Friday, 24 July.**

Consider the region enclosed by the circle $x^2 + y^2 = 4$. You can think of this as the region below the curve $y = \sqrt{4 - x^2}$ and above the curve $y = -\sqrt{4 - x^2}$, where $-2 \leq x \leq 2$.

1. Sketch or plot this region. What is the area of this region? [2]
2. Sketch the solid obtained by revolving this region about the horizontal line $y = -4$. [2]
3. Use the disk/washer method to compute the volume of the solid in question 2. [5]

NOTE/HINT. You may use SageMath to evaluate the integral, if you're willing to look up the `integral` command, or do it by hand, which would likely mean reinterpreting the integral you get as an area rather than evaluating it directly.

4. There is a general method that would let us compute the volume of the given solid without using calculus or just looking up the formula for the volume of a torus. What is it? [1]

HINT. The name to conjure with is “Pappus”.

There are in this world optimists who feel that any symbol that starts off with an integral sign must necessarily denote something that will have every property that they should like an integral to possess. This is of course quite annoying to us rigorous mathematicians; what is even more annoying is that by doing so they often come up with the right answer.

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* You should submit your solutions via Blackboard's Assignments module, preferably as a single pdf. If that fails, please submit directly to the instructor on paper or via email to sbilaniuk@trentu.ca. You may work with others, use whatever tools you like, and look things up, so long as you write up your submission by yourself and give due credit to your collaborators and any tools or sources you actually used.