Disk Method from Calculus

Consider the function \( f(x) \) on the interval \([a, b]\).

Suppose that this function is continuous from \([a, b]\).

The volume of the solid is given by

\[
\int_a^b \pi f(x)^2 \, dx
\]

Therefore the volume of the function on the interval \([a, b]\) is

\[
\int_0^{10} \pi f(x)^2 \, dx
\]

The formula with a radius of \( 1 - x^2 \) on the interval \([0, 1]\).

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**Problem Description**

This verifies our algorithm for finding the volume of a solid of revolution about the line \( y = k \). To verify our method we choose two lines of the symmetry of the circle.

We rotate the chord from \((0,0)\) to \((1,1)\) on the unit \( x^2 + y^2 = 1 \) circle about the line \( y = x \) (the line on which the chord sits) using the algorithm we developed.

We then use the conventional formula from Calculus II to rotate the chord from \((0,0)\) to \((1,0)\) on the unit circle.

**Verifications**

This graphic shows the region that would be used to evaluate the volume of the function

\[
f(x) = \pi (1-x)^2 \, dx
\]

The value \( \pi \) is the volume as an integral of \( \pi \) and the approximate value is

\[
\pi \approx 3.141592
\]

Notice we are "only" using 100 rectangles in the above problem and our answer agrees with the answer found using standard calculations to a large degree of accuracy.

The variable \( n \) represents the number of rectangles used in approximating the volume.

**Future Work**

Through future studies using the Mathematica 3.0 program and studying the concepts of Calculus I, I should be able to come up with a technique in finding a formula that calculates the volume as one curve in rotation around another arbitrary curve. This research will lend to the ability to resolve a curve such as \( y = x^3 \) around the \( x \)-axis. The problem that is presented here is changing direction of the radius along the length of the two curves.

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Products and
Mathematica 3.1