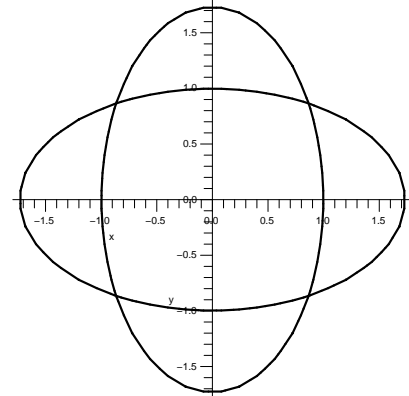


1. Suppose R is the region enclosed by the curves $y = \ln x$, $y = 0$, $x = 1$ and $x = e$. Find the area of R , the volume resulting if R is revolved about the x -axis, and the volume resulting if R is revolved about the y -axis.

2. Calculate the area inside both of the two ellipses

$$\frac{x^2}{3} + y^2 = 1 \text{ and } x^2 + \frac{y^2}{3} = 1.$$

(The picture is drawn by Maple using a command called `implicitplot`.)



3. An oil tank has the shape of a cylinder whose diameter is 4 feet. It is mounted so that the axis of the cylinder is horizontal (the circular cross-sections of the cylinder are vertical). If the depth of the water is 3 feet, what percentage of the total capacity of the tank is filled?

After drawing a picture and setting up this problem, solve it three ways:

- Use elementary geometry (compare areas of circular sectors).
- Express the answer in terms of a definite integral, then obtain an approximate numerical value for the integral using the `fnInt`(function on your calculator.
- Evaluate the integral in b) exactly in terms of elementary functions using a trig substitution, then obtain approximate numerical values for these functions using your calculator.

4. The region R is bounded below by the x -axis, bounded on the left by the line $x = 1$, bounded on the right by the line $x = 2$, and bounded above by the curve $y = \frac{5+x}{x^2+4x+3}$.

a) Sketch the region R and set up a definite integral that gives the area of R . Then calculate the integral in two ways:

- Approximately using the `fnInt`(program in your calculator.
- Exactly using the method of partial fractions.
- Check that the two answers are “the same” (that is, find approximate values for the result of the second method).

b) The region R is rotated around the x -axis to generate a solid body B . Sketch B and set up a definite integral that gives the volume of B . Calculate the integral in two ways:

- Approximately using the `fnInt`(program in your calculator.
- Exactly using the method of partial fractions (be careful how you set this up – there are *four* undetermined coefficients in the partial fraction decomposition).
- Check that the two answers are “the same” (that is, find approximate values for the result of the second method).