**Workshop 4**
**September 28, 2001**

Some workshops are being turned in with little or no explanation of the mathematics that is being done. *This is not acceptable and will be penalized, with increasing strictness, in the grading.* You should include explanations of what you are doing; these do not have to be lengthy but should be written in *complete sentences*.

It is helpful to have models of good writeups. One such is viewable on the Web; go to the course web page

`http://math.rutgers.edu/courses/151-152/151-f01`

and click on "Sample Workshop Write-up". Simpler problems will require simpler write-ups, of course, but the principle of full explanations given in complete sentences is the same. You can use examples presented in the book as models. To get an idea of how much to write on some very straightforward problems, look for example at Example 2 of Section 6.2, Example 5 of Section 7.3, and Example 2 or 3 of Section 7.4.

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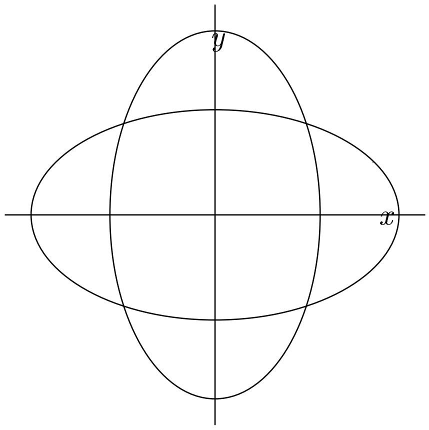
**1.** Calculate each of the indefinite integrals (these are all pretty easy):

(a) $\displaystyle\int \sec^4 x\,dx$  (b) $\displaystyle\int \sec^3 x\tan x\,dx$  (c) $\displaystyle\int \sec^2 x\tan^2 x\,dx$  (d) $\displaystyle\int \sec x\tan^3 x\,dx$

**2.** Calculate the area which lies inside both of the ellipses $\dfrac{x^2}{3}+y^2=1$ and $x^2+\dfrac{y^2}{3}=1$.

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**3.** The region $R$ is bounded below by the $x$-axis, bounded on the left by the line $x = 0$, bounded on the right by the line $x = 2$, and bounded above by the curve

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

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

(i) the `fnInt(` program in your calculator; (ii) the method of partial fractions.

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

(i) the `fnInt(` program in your calculator;

(ii) the method of partial fractions (**warning:** there are *four* undetermined coefficients).

**4.** Many integrals can be done with "rationalizing substitutions" which change the integrals into integrals involving rational functions. In turn, these integrals can be computed (at least theoretically) using partial fractions, although often it is simpler to integrate directly or to use a trig substitution.

Integrate:

$$\int \frac{1}{x+\sqrt{x}}\,dx \qquad (\text{try } x = t^2); \qquad\qquad \int \frac{1}{e^{2x}+1}\,dx \qquad (\text{try } t = e^x).$$