Instructions. This exam contains five problems. Your solution to each problem must contain sufficient detail so that it is clear to the reader what your reasoning process is. Full credit will not be given for solutions that are lacking in detail (such as omission of important steps in computing an integral, etc.) State your conclusions and other important steps in your reasoning in complete sentences. You may use a calculator on this exam but you may not use any books or notes. Note I have given the answers to problems 1, 2, and 4. I believe that they are correct. However, if any of them are incorrect and you provide a correct solution with a correct answer, then I will give you a 20 (overall grade) on this exam.

1. Show, by setting up and evaluating a definite integral, that the area of the shaded region pictured below is \(2\sqrt{2}/3\).

\[
\begin{align*}
y &= x^2 \\
y &= 1 - x^2
\end{align*}
\]

2. Show, by setting up and evaluating a definite integral, that the volume of the solid obtained by revolving the shaded region pictured in problem 1 about the \(x\) axis is \(2\sqrt{2}\pi/3\).

3. Make a \((t, x, y)\) table (using at least five different values of \(t\)) for the parametric curve \(x = t^3, \ y = 3, \ -1 \leq t \leq 1\) and then graph this curve (in the \(x, y, \) plane).

4. Show, by setting up and evaluating a definite integral (which uses the parametric equations given in problem 3), that the arc length of the curve that you drew in problem 3 is 2. Note: It is very easy to see without using any integration that this curve has length 2 (assuming that you drew the curve correctly). However, the point of this problem is to test your ability to use integration to find arc lengths.

5. Set up, but do not evaluate, a definite integral that gives the surface area of the surface obtained by revolving the curve \(y = e^x, \ 0 \leq x \leq 1\), about the \(x\) axis.