Mathematics 116 Name: _____

Professor Alan H. Stein

Due Friday, February 15 This problem set will be graded on the basis of 100 points but will be worth 50 points.

Make sure that you check the course website for instructions, fill out the pledge form and hand it in with your paper. The instructions for problem sets and take-home examinations along with the pledge form are available from the *General Policies* portion of the web site. *No paper will be accepted without a signed pledge form.* Remember that your paper may be handed in before the deadline but that no late papers will be accepted regardless of the reason. The course website also includes an explanation of how your average will be calculated if you fail to complete this assignment.

Note that, since most of the calculations involved can be done routinely using either a calculator or a symbolic manipulation program such as Maple or Mathematica, it will obviously be necessary to show, through your work, exactly how you came up with your solutions.

1. Calculate $\int 6x^2 + 9\sin x - 2\sec^2 x\,dx$.
2. Calculate $\int_{\pi/4}^{\pi/3} \sin x\,dx$. *Remember: Your calculation should be exact, not a calculator approximation.*
3. Calculate $\int x^3 \sqrt{x^4 + 6}\,dx$.
4. Consider the function $f(x) = x^3 + 2x - 3$. Analyze monotonicity and concavity. Find all extrema and points of inflection. Sketch its graph.
5. Find the points of intersection of the graphs of $y = x^3 + 2x - 3$ and $y = 23(x - 1)$.

(6-21): Let D be the region in the first quadrant bounded by the graphs of $y = x^3 + 2x - 3$ and $y = 23(x - 1)$. Let C be the portion of the graph of $y = x^3 + 2x - 3$ which forms part of the boundary of D. For each question, sketch the relevant curve, plane region, surface or solid and set up a definite integral (or sum or difference of definite integrals) whose value is the quantity requested. *Do not evaluate the definite integrals.* Hint: It is expected you will wind up spending more time sketching the geometrical objects than writing down the definite integrals. These are almost short answer questions.

6. The area of D.
7. The volume of the solid obtained by rotating D about the x-axis.
8. The volume of the solid obtained by rotating D about the line $y = -3$.
9. The volume of the solid obtained by rotating D about the line $y = 70$.
10. The volume of the solid obtained by rotating D about the y-axis.
11. The volume of the solid obtained by rotating D about the line $x = 10$.

12. The volume of the solid obtained by rotating D about the line $x = 1$.
13. The volume of the solid obtained by rotating D about the line $x = -5$.
14. The length of C.
15. The area of the surface obtained by rotating C about the x-axis.
16. The area of the surface obtained by rotating C about the line $y = -3$.
17. The area of the surface obtained by rotating C about the line $y = 70$.
18. The area of the surface obtained by rotating C about the y-axis.
19. The area of the surface obtained by rotating C about the line $x = 10$.
20. The area of the surface obtained by rotating C about the line $x = 1$.
21. The area of the surface obtained by rotating C about the line $x = -5$.

Extra Credit

Extra credit will be awarded for the best joke. All jokes must observe standards of good taste. The determination of the best joke will be made by popular vote in class when the papers are returned.