This is the test I gave last fall. For what it's worth, I think it was probably too easy! (Exception: Problem (5), which I love. And most students hated.)

1. (20 points each) Appropriately solve the following integrals.

$$\int (43x^{42}) \cos(x^{43} + 59)\ dx$$

$$\int \ln(x) * [99x^{-100}]\ dx$$

2. (20 points) Calculate **exactly** the arclength of the function f: [0, 1] → ℝ, where

$$f(x) = \frac{2}{3}(x-1)^{\frac{3}{2}}$$

3. (20 points) Does the following integral converge or diverge? Use an appropriate test to prove your answer.

$$\int_{101}^{\infty} \frac{x^2}{x^8 - x - \ln(x)}\ dx$$

4. (10 points) Does the following integral converge or diverge? Use an appropriate test to prove your answer.

$$\int_{0}^{2} \frac{1}{(x-1)^2}\ dx$$

5. (10 points) For this problem, I want an analysis. Are there any troublesome points where the function blows up (or down) to infinity? What happens to the function values as $x \to \infty$? What happens to the function values as $x \to -\infty$? Do you think the integral converges or diverges? Explain why! (A proof using the tests we've covered is certainly possible, but I will gladly accept a thoughtful analysis that gives a correct description, explanation, and conclusion.)

$$\int_{-\infty}^{\infty} \frac{1}{e^x + e^{-x}}\ dx$$