1. Find the positive number $k$ for which the curves $y = \ln(x)$ and $y = x^k$ have exactly one point of intersection.

2. What is the minimum value of the sum of a convergent geometric series whose third term is 1 and whose other terms are all positive?

3. Evaluate $\int \frac{dx}{x^7 - x}$.

4. Compute $\lim_{(x,y) \to (0,0)} \frac{x^2 + 2y^2 - 5xy^2 - 6y^4}{x^2 + 2y^2 + 3x^2y + 4x^4}$ or show that the limit does not exist.

5. Evaluate the integral $\int_S f \, dA$ where $f(x, y) = 1/(1 - xy)$ and $S = [0, 1] \times [0, 1]$ is the unit square in the first quadrant. This is an improper integral; interpret this as

$$\lim_{t \to 1^-} \int_0^t \int_0^t \frac{1}{1 - xy} \, dx \, dy$$

(Hint: you will probably need either to find an alternative description of the integrand $f$ or to transform the domain $S$ with a change of variables.)

Answers will soon appear at http://www.math.utexas.edu/users/rusin/Bennett/.