DC FELLOWS PROGRAM
MATH IMMERSION SUMMER COURSE

CALCULUS, CONTINUED
JUNE 9, 2008

(1) Refer to the graph below. The area of region I is 4. The area of region II is 6, and the area of region III is 1. Find

   (a) $\int_{-1}^{0} f(x)\,dx$

   (b) $\int_{-1}^{3} -2f(x)\,dx$

   (c) $\int_{2}^{-1} \frac{f(x)}{\pi}\,dx$

(2) Compute the following indefinite integrals:

   (a) $\int x^4 + \sqrt{x} + \frac{1}{x^2} - \cos x\,dx$

   (b) $\int \cos x\, e^{\sin x}\,dx$

   (c) $\int x(4x^2-1)^{18}\,dx$

(3) Compute the following definite integrals:

   (a) $\int_{1}^{3} t^2 - 1\,dt$

   (b) $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \cos 2x\,dx$

   (c) $\int_{0}^{1} xe^{-x^2}\,dx$

(4) If $F(x) = \int_0^{\sin x} \ln(4t^2 - t)\,dt$, find $F'(x)$.

(5) Solve the initial value problem: $\frac{dy}{dx} = 3x^2 - \sqrt{x}$, and when $x = 1$, $y = 0$.

(6) Find the area of the region bound by $y = 3x - 2$ and $y = -x^2 + 4$.

(7) Convert $0.\overline{123}$ to fraction form. Show your work, and try it on your calculator.

(8) Write a general term for the following sequence:

$$1, \frac{4}{3}, \frac{9}{5}, \frac{16}{7}, \frac{25}{9}, \ldots$$