Math 123, Practice Questions for Exam #3, December 3, 2008

1. Find the following:

   (a)
$$\int (5t^3 - \frac{7}{t^4} + 6\sqrt{t} - 4\sin t)\,dt$$

   (b)
$$\int (2e^x + \frac{3}{x} - \pi^x + 7\sec^2 x)\,dx$$

   (c)
$$\int_1^2 \frac{1-x^3}{x^2}\,dx$$

   (d)
$$\frac{d}{dx}\int_3^x \sqrt{t^3+1}\,dt$$

   (e)
$$\int_0^{\sqrt{\pi}} \frac{d}{dt}\cos t^2\,dt$$

   (f)
$$\int_{-1}^{10} f(x)\,dx$$

   where
$$f(x) = \begin{cases} -x^2, & \text{if } x \le 0 \\ 2x & \text{if } 0 < x < 3 \\ -5 & \text{if } x \ge 3. \end{cases}$$

   (g)
$$\int \frac{3x^2 - 16x + 5}{\sqrt{x^3 - 8x^2 + 5x + 3}}\,dx$$

   (h)
$$\int (x - \frac{3}{2})\sin(x^2 - 3x)\,dx$$

2. Find the following:

   (a)
$$\frac{d}{dx}\int_{\sin x}^{x^3} e^{t^2}\,dt$$

   (b) $f(t)$ which satisfies the equation
$$\int_1^x \frac{f(t)}{t}\,dt = 3x^{\frac{1}{3}} - 3$$

(c) the average speed an object moving along a line between $-2 \leq t \leq 6$ if its velocity at time t is given by $v(t) = t^2 - 3t - 4$

3. Michelle begins walking along a line at time $t = 0$. Her acceleration at time $t \geq 0$ is $a(t) = 6t - 7$. Suppose that her initial velocity is 1 and her initial position is 3. If $s(t)$ denotes her position at time t and $v(t)$ denotes her velocity at time t then anser the following:

   (a) Find her velocity at $t = 4$.

   (b) Find her position at $t = 2$.

   (c) When does she return to her starting position?

4. Consider the following Riemann sum:

$$I := \lim_{n \to \infty} \sum_{i=1}^{n} \left(1 + \frac{2i}{n}\right)^8 \left(\frac{2}{n}\right).$$

   (a) Write I as a definite integral.

   (b) Calculate I (using any method you like).

5. Consider the graph below. Find the following:

   (a)

$$\int_{-5}^{0} f(x)\,dx$$

   (b) $F'(-3)$ where

$$F(x) := \int_{-6}^{x} f(t)\,dt$$

   (c)

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

   (d)

$$\int_{-3}^{4} f'(x)\,dx$$

   (e)

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

   (f)

$$\int_{5}^{7} (9(f(x))^2 - 8)\,dx$$

   (g) Let $g(x) = \int_{-1}^{x} f(t)\,dt$. Consider only those x values $-4 \leq x \leq 1$. Find the values of x over which $g(x)$ is increasing. Find the values of x over which $g(x)$ is concave up.