

Math 123, Practice Questions for Exam #3, December 4, 2000

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

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

2. 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 answer 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?

3. A box with a square base and open top has a total surface area of 300 square centimeters. Find the dimensions of the box which maximize its volume.

4. Consider the following Riemann sum:

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

(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)

$$\int_5^7 (9(f(x))^2 - 8) \, dx$$