Math 141 Test 5 July 29, 1996 Name _____

Show any work necessary to solve a problem. Thus if you solve a problem with your graphing calculator show what you plugged in and draw a rough sketch of what you see.

Each problem is worth 10 points.

1.) Calculate the antiderivative of $f(x) = x^2 + e^x$.

2.) Evaluate: $\int \frac{5x^3 - 4x^2 + 2x + 7}{x^2} dx$

3.) Is the following equation true or false? Justify your answer. _____

$$\int x^2 \ln x \, dx = \tfrac{x^3}{3} \ln x - \tfrac{1}{9} x^3 + C$$

4.) Find the area under the curve $y = \dfrac{1}{\sqrt{x}}$ and above the x-axis between $x = 1$ and $x = 4$.

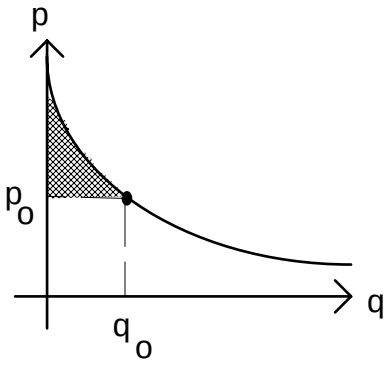
5.) Evaluate: $\int \left(8e^{2x} + \frac{1}{x}\right)dx$

6.) Evaluate: $\int_1^3 f(x)dx$ where $f(x) = \begin{cases} x^2 \text{ when } 0 \le x \le 2 \\ 6 - x \text{ when } x > 2 \end{cases}$

7.) Find the area enclosed by $f(x)$ and $g(x)$ when $f(x) = 7 - x$ and $g(x) = 3x^2 + 2x + 1$.

8.) The annual profit $P(t)$, in millions of dollars, of a pharmaceutical company at any time t, in years, is given by the equation $P(t) = 8e^{0.35t} - 25$ where $t = 0$ corresponds to the start-up time of the company. Find the average annual profit over the first five years of operation.

9.) The demand equation for a running shoe is $p(q) = 90 - 5q$ where q represents the number sold in millions. Find the consumers surplus if the selling price is $70 per pair. (Recall for any demand equation the consumers' surplus represents the amount of money saved by consumers who were willing to spend more than the price, $p_{o,}$ that the product is selling for. It is represented by the shaded region in the following picture of a general demand equation.)



10.) As Dale begins his daily training run he finds that $y = f(x)$ represents his running rate in minutes per mile as a function of x miles.

(a.) What does the derivative of $f(x)$ represent and in what units?

(b.) What does the integral of $f(x)$ represent and in what units?