# Test #3

Name: _____

Math 140, Prof. Beydler

Wednesday, November 30, 2016

**Directions:** Show all work. No books or notes. A **scientific calculator** is allowed. Your desk and lap must be clear (no phones, notebooks, etc.). Write your answers in the indicated places, or box your answers. Good luck!

1. (2 points) Evaluate the following integral:

$$\int \left( \frac{3}{x} - e^{5x} + \sqrt[3]{x} \right) dx$$

Answer: _____

2. (5 points) Evaluate the following integral:

$$\int_0^1 x e^{x^2} \, dx$$

Answer: _____

3. (4 points) Evaluate the following integral:

$$\int x \ln x \, dx$$

Answer: _____

4. (4 points)  Evaluate the following integral:

$$\int \frac{3x + 6}{\sqrt{2x^2 + 8x + 3}} dx$$

Answer: _____

5. (3 points)  Find the function $f(x)$ whose tangent line has slope $1 - \frac{1}{x^2}$ and whose graph passes through $(1,4)$.

$$f(x) = \underline{\hspace{5cm}}$$

6. (4 points)  Find the area of the region enclosed by the curves $y = 3x^2$ and $y = x^3$.

Answer: _____

7. (3 points)  A manufacturer supplies $S(p) = 0.3p^2 + 5p + 9$ thousand bottles to the market when the price is $p$ dollars per bottle.  Find the average supply as the price varies from $p = \$1$ to $p = \$4$.  Be sure to write the units of your answer.

Average value formula:  $\dfrac{1}{b-a} \displaystyle\int_a^b f(x)\, dx$

Answer: _____

8. (4 points)  Suppose a demand curve (in dollars per unit) is $D(q) = 40e^{-0.01q}$. First, find the price at which 5 units will be demanded.  Then, compute the consumer surplus at that price.  Be sure to write the units of your answer.

Unit price at which 5 units demanded: _____

Consumer surplus: _____

9. (5 points)  Either evaluate the given improper integral or show that it diverges.

$$\int_2^{+\infty} \frac{1}{x \ln x} dx$$

Answer: _____

**Simpson's rule:** $\int_a^b f(x)\,dx \approx \frac{\Delta x}{3}[f(x_1) + 4f(x_2) + 2f(x_3) + \cdots + 4f(x_n) + f(x_{n+1})]$

10. (3 points)  Use Simpson's rule with $n = 4$ to approximate $\int_{-1}^0 \sqrt{1 + x^2}\,dx$.  (Round to 3 decimal places.)

Answer: _____

11. (1 point)  Let $f(x)$ be continuous on the interval $-2 \le x \le 3$ and satisfy

$$\int_{-2}^3 f(x)\,dx = 5 \qquad \int_1^3 f(x)\,dx = -2$$

Use this information along with the rules for definite integrals to evaluate the following.

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

Answer: _____

12. (4 points)  Find the general solution of the differential equation $\frac{dy}{dx} = \frac{(3x-1)^2}{y^2}$.  Be sure to solve for $y$ in terms of $x$.

Answer: $y =$ _____

13. (1 point) Find the particular solution of the differential equation $\frac{dy}{dx} = \frac{(3x-1)^2}{y^2}$ that satisfies $y = 1$ when $x = 0$. (You can make use of your answer from the previous problem.)

Answer: $y =$ _____

Note: Be sure to double check your work. And don't forget to turn in your homework! ☺