

Name _____

1. [10 pts.] Integrate the following

$$\int x^3 \ln x \, dx$$

2. [12 pts.] Determine whether the improper integral

$$\int_0^1 \frac{e^{-x}}{\sqrt{1-e^{-x}}} \, dx$$

converges. If it does, evaluate the integral.

3. [10 pts.] The function $f(x) = e^{\cos x}$ does not have a known antiderivative. Name 3 ways we can approximate $\int_5^{3\pi} f(x) \, dx$ without knowing the antiderivative. And state the general form of one precisely.

4. [12 pts.] A population of starving students decreases at a rate directly proportional to its current size. Suppose the population starts at 500 students. After 2 months there are only 400 students. How long will it take before there are only 300 starving students?

5. [12 pts.] Find the volume of the solid formed by revolving the graph of

$$y = \frac{1}{x} \quad x \geq 1$$

around the x -axis.

- 6a) [4 pts] Graph $y = \ln x$. Please label the intercept.

- 6b) [10 pts] Find the area of the region bounded by

$$y = \ln x \quad 1 \leq x \leq e$$

and the x -axis.

7. [5 pts.] If $F(x)$ is the antiderivative of $f(x)$ and $F(a) = 2$ and $F(b) = 9$, then find

$$\int_a^b f(x) \, dx.$$

8. [20 pts.] The weekly demand for a Burrito at the MU Grill is modeled by the function

$$f(x) = \frac{1}{2\sqrt{2x-1}}$$
 over the interval $[1, 5]$.

- (a) [10 pts.] Verify $f(x)$ is a probability density function.

- (b) [10 pts.] Find the expected weekly demand for a Burrito at the MU Grill.

[Too bad the starving students in Problem 4 didn't know about these tasty burritos!]

9. [5 pts.] Suppose the variance of the random variable x is $V(x) = 4e^{-1} + \cos^2(7)$. Find the standard deviation, σ .