

Name (20 pts): \_\_\_\_\_

1. (20 pts) Evaluate the following indefinite integrals:

$$\int \frac{(2x+3)^2}{4x} dx$$

$$\int \left[ \frac{x^e + e^x}{e} \right] dx$$

$$\int xydz$$

$$\int [\sqrt{e^x} + \sqrt{x^e} + \sqrt{x} + \sqrt{e}] dx$$

2. (20 pts) Find the average value of  $f(x) = x^3 - 9x^2 + 27x - 27$  on  $[1, 5]$ .

3. (20 pts) Find the area enclosed by the graphs of  $f(x) = \frac{3}{\sqrt{x}}$  and  $g(x) = -\frac{x}{4} + \frac{13}{4}$  using FTC.

4. (20 pts) Find the fixed costs of producing Mimolette if the marginal cost is given (in \$/pound) by  $MC(q) = \frac{30}{\sqrt[4]{q}} + 5$ , and the cost to produce 625 pounds of the cheese is \$13,625.

5. Find (40 pts)

$$\int \frac{xe^{-x^2}}{5 + e^{-x^2}} dx$$

6. (40 pts) Find the producer and consumer surplus for a product with supply and demand curves given by  $s(q) = 9e^{0.05q}$  and  $d(q) = 50 - e^{0.05q}$ .

7. (40 pts) Suppose the growth rate in the population of a barnacle colony on the hull of an abandoned shrimp trawler is given (in barnacles/year) by  $r(t) = 100\sqrt{t}$ , where  $t$  is the number of years since the boat was abandoned. Use a Riemann sum with  $n$  subintervals (for  $n = 4, 10, 100$  and  $800$ ) to approximate

$$\int_0^{10} r(t) dt$$

Give units and interpret your answer.