

Name: \_\_\_\_\_

Each problem is worth the indicated number of points; show all your work (excluding arithmetic) for full credit.

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

(a)  $\int \frac{\sqrt[3]{x^5}}{\sqrt[5]{x^3}} dx$

(b)  $\int \frac{x^4 - 3x + 5}{x^2} dx$

(c)  $\int \frac{x^2 - 3x - 4}{x + 1} dx$

(d)  $\int \left( (5 - \sqrt{t})^2 (5 + \sqrt{t})^2 \right) dt$

(e)  $\int \frac{\sqrt[4]{e^x}}{\sqrt{e^{3x}}} dx$

(f)  $\int \ln \sqrt{\frac{5x^2 - 3}{\sqrt[4]{x^3 + 2x + 3}}} du$

2. (10 pts) Suppose the marginal average cost to produce  $q$  kilograms of an amalgam dental filling is given by  $MAC(q) = 25 - \frac{50,000}{q^2}$ . The total cost to produce 500kg of amalgam is \$375,000.
- (a) Find the average cost to produce 500kg of the amalgam.
  - (b) Find a formula for the average cost to produce  $q$  kg of amalgam.
  - (c) Find a formula for the total cost to produce  $q$  kg of amalgam.
  - (d) Find the fixed costs of amalgam production.

3. (10 pts) Suppose the worldwide average length of copyright terms (the length of time an individual copyright remains in effect) has been increasing by  $r(t) = \frac{3}{\sqrt{t}}$  years/year, where  $t$  is the number of years since 1700. If copyright terms were 105 years long in 1989 (when Disney began lobbying the U.S. Congress for passage of the Mickey Mouse Protection Act), determine how long they were in 1709 (when the British Parliament invented copyright by passing the Statute of Anne).

4. (10 pts) Find the exact value of the area underneath the graph of  $f(x) = \frac{1}{x^2}$  for  $1 \leq x \leq 5$ .

5. (10 pts) Approximate

$$\int_2^4 \left[ \ln \frac{1}{x} \right] dx$$

using a Rimeann sum with

- (a) 2 subintervals
- (b) 4 subintervals
- (c) 8 subintervals

For each approximation, write down the values of  $a$ ,  $b$ ,  $n$ ,  $\Delta x$ , and  $x_0, \dots, x_{n-1}$  alongside the sum.