

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

Each Problem is worth 10 points.

Problem	1	2	3	4	5	6	7	8	9	10	11	12	Total
Score													/ 120

**Problem 1.** For each question below, circle True or False. **DON'T GUESS**, 2 points for each right answer, minus 2 points for each wrong answer.

- (a) **True** or **False**: Suppose that two cars are racing. After  $t$  seconds the first car is traveling at velocity  $v_1(t)$  feet per second and the second car at  $v_2(t)$  feet per second. If the average value of  $v_1(t)$  on  $[0, 60]$  is equal the average value of  $v_2(t)$  on  $[0, 60]$ , then the cars have travelled the same distance after 60 seconds.

- (b) **True** or **False**:

$$\int xe^x dx = e^x(x - 1) + C.$$

- (c) **True** or **False**:  $y = 1 + e^{2x}$  satisfies the differential equation

$$y' = 2y.$$

- (d) **True** or **False**:

$$\frac{d}{dx} \left[ \int_{\frac{1}{2}}^x \ln t dt \right] \Big|_{x=1} = 0.$$

- (e) **True** or **False**: As  $n$  gets very large,

$$\left[ \frac{1}{n} + \frac{2}{n} + \dots + \frac{n-1}{n} \right] \cdot \frac{1}{n}$$

approaches 1. (Hint: This is a Riemann sum.)

**Problem 2.** Compute the following indefinite integrals:

(a)

$$\int \sqrt{2x - 3} \, dx$$

(b)

$$\int e^{4+3x} \, dx$$

**Problem 3.** Compute the following definite integrals:

(a)

$$\int_0^1 \frac{3}{(4-2x)^2} dx$$

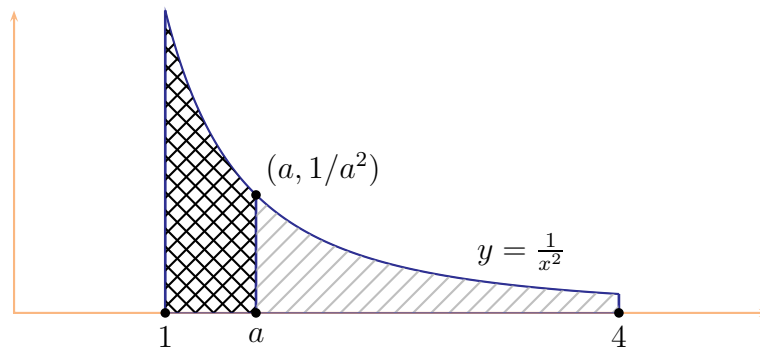
(b)

$$\int_0^2 \frac{e^x - e^{-2x}}{2e^x} dx$$

**Problem 4.** Suppose that the marginal revenue function for a company is  $200 - 2x$ . Find the additional revenue received from doubling production if currently 10 units are being produced.

**Problem 5.** Compute the area of the region between the curves  $y = x^2 - 1$  and  $y = x + 1$  from  $x = 0$  to  $x = 4$ .

**Problem 6.** For what value of  $a$  do the two shaded regions below have the same area?



**Problem 7.** Suppose that a lake is stocked with 100 fish. After 1 month, there are 150 fish in the lake. An ecological study predicts that the lake can support 600 fish. Use a logistic growth curve to estimate the number of fish in the lake after 1 year.

**Problem 8.**

(a) Find the percentage rate of change of the function  $f(x) = 2x^2 - 3x$  at  $x = 2$ .

(b) Find the relative rate of change of the function  $f(x) = \sqrt[3]{\frac{(2x+1)^2}{(2-x)e^x}}$  at  $x = 1$ .



**Problem 9.** A company can sell  $q = \frac{2000}{p} - 200$  units of a particular commodity at a price of  $p$  dollars per unit.

(a) Compute the elasticity  $E(p)$ .

(b) If the price is currently \$5 per unit, would the revenue increase or decrease when the price is raised?

**Problem 10.** Find the consumer's surplus for the demand curve  $p = \frac{200}{x+10} + 10$  at sales level  $x = 10$ .

**Problem 11.** Use a Riemann sum with  $n = 4$  and midpoints to estimate the area under the graph of  $y = 2x + 1$  on the interval  $2 \leq x \leq 4$ .

**Problem 12.** Compute the volume of a frustrum of a right circular cone with height 1, lower base radius 2, and top radius 1, obtained by rotating the shaded region below about the  $x$ -axis:

