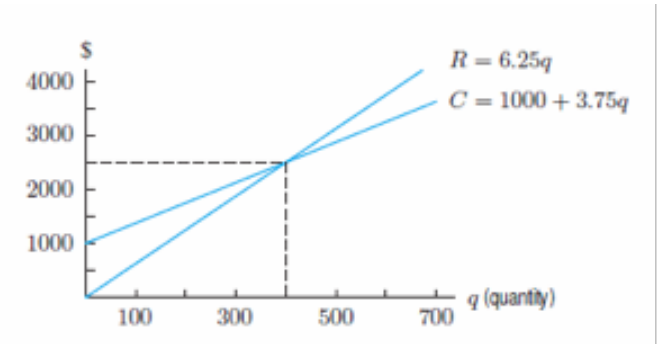
Name: _____

VIP ID: _____

- Write your name and VIP ID in the space provided above.
- The test has eight (8) pages, including this one, not counting the formula sheet attached at the end.
- You may remove the formula sheet as soon as the proctor instructs so.
- Credit for each problem is given in parentheses at the right of the problem number.
- You must show sufficient work to justify all answers except on multiple-choice questions. Correct answers with inconsistent or no work will not be given credit.
- No books or notes may be used on this test.
- No scratch paper is allowed. You may use the last page of this booklet for that purpose.
- An approved calculator may be used on this test.

Page	**Max. points**	**Your points**
2	16	
3	12	
4	28	
5	20	
6	12	
7	12	
Total	100	

Problem 1 (4 pts)**.** The cost and revenue functions for a company are given by $C = 1000 + 3.75q$ and $R = 6.25q$ respectively. The fixed costs of the company are:



- ○ \$1,000
- ○ \$3.75
- ○ \$400
- ○ \$6.25
- ○ \$0
- ○ \$2,500

Problem 2 (4 pts)**.** When a person goes into shock, the cardiac output, in liters of blood per minute, decreases. One person's cardiac output is 12 liters per minute when the person first goes into shock, and decreases by 2 liters per minute every hour that the person is in shock. Write a formula for cardiac output C as a function of t, the time in hours since a person first went into shock.

- ○ $C = 12 - 2t$
- ○ $t = 12 - 2C$
- ○ $C = -2 + 12t$
- ○ $t = -2 + 12t$
- ○ $C = 12 + 2t$
- ○ $t = 12 + 2C$

Problem 3 (4 pts each)**.** Evaluate the following integrals.

(a) $\displaystyle\int_0^4 \ln(y^2 + 5)\, dy =$

(b) $\displaystyle\int_{10}^{103} 7xe^{30x^2}\, dx =$

Problem 4 (4 pts)**.** If the graph below is that of $f'(x)$, which of the following statements is true concerning the function $f(x)$?

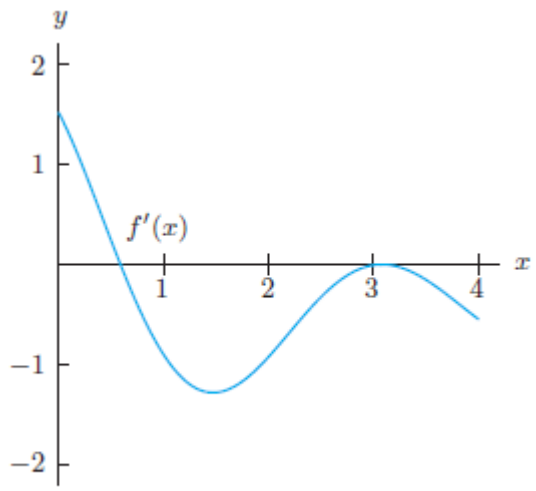


Figure 4.2

- ○ The derivative is zero at two values of x, both being local maxima.
- ○ The derivative is zero at two values of x, one is a local maximum, while the other is a local minimum.
- ○ The derivative is zero at two values of x, one is a local minimum on the interval, while the other is neither a local maximum nor a minimum.
- ○ The derivative is zero only at one value of x, where it is a local minimum.
- ○ None of the above.

Problem 5 (4 pts)**.** Find all local max, min, and inflection points of $f(x) = 2x^3 + 3x^2 - 180x + 9$.

Problem 6 (4 pts)**.** Find the global maximum and the global minimum of $f(x) = 2x^3 - 9x^2$ over the interval $-1 \leq x \leq 6$.

Problem 7 (4 pts each)**.** Find the derivative of the following functions:

(a) $f(x) = \sqrt{\dfrac{1}{x^{37}}}$

$f'(x) =$ ☐

(b) $y = 5t^5 - 12\sqrt{t} + \frac{7}{t}$

$y'(t) =$ ☐

(c) $f(x) = (3^x + x^4)(3 - \ln x)$

$f'(x) =$ ☐

(d) $f(x) = \dfrac{x^6 + 4}{x}$

$f'(x) =$ ☐

(e) $f(x) = \ln\left(18 - e^{-x}\right)$

$f'(x) =$ ☐

(f) $f(x) = \left(7 + \ln x\right)^{0.7}$

$f'(x) =$ ☐

(g) $f(x) = 7e^{2x} + e^{-x^4}$

$f'(x) =$ ☐

Problem 8 (4 pts each)**.** Compute the antiderivative of the following functions:

$\int x^4(5-3x^5)^{12}\,dx =$

$\int 10xe^{x^2}\,dx =$

$\int \frac{7x^2}{(6x^3-2)^5}dx =$

$\int \frac{dx}{4-x} =$

$\int x^2 3^{5x^2}\,dx =$

Problem 9 (4 pts)**.** The following table shows sales of the medicinal herb saw palmetto, in millions of dollars, for several different years.

Year	1997	1998	1999	2000	2001
Sales	85	107	116	122	123

The **average rate of change** of sales over the period 1997 to 2001 is:

- ○ 123 million dollars/year
- ○ 123 million dollars
- ○ 38 million dollars/year
- ○ 38 million dollars
- ○ 9.5 million dollars/year
- ○ 9.5 million dollars

Problem 10 (4 pts)**.** What is the **average value** of $f(x) = \sqrt{9 - x^2}$ over the interval $0 \leq x \leq 3$?

Problem 11 (4 pts)**.** For a product, the demand curve is $p = 53 - q^2$ and the supply curve is $p = 3 + q^2$, where q is quantity and p is price in dollars per unit. Find the **consumer surplus** when the market is in equilibrium (round your anwer to the nearest dollar).

Problem 12 (4 pts)**.** If t is years since 1990, one model of the population of the worlds, P, in billions, is

$$P = \frac{40}{1 + 11e^{-0.08t}}$$

(a) What does this model predict for the maximum sustainable population of the world?

(b) According to this model, when will the earth's population reach 30 billion?

Problem 13 (4 pts)**.** At a price of \$80 for a half-day trip, a white-water rafting company attracts 300 customers. Every \$2 decrease in price attracts an additional 12 customers. What price should the company charge per trip to maximize revenue?

Problem 14 (4 pts)**.** The marginal cost function of producing q mountain bikes is

$$MC(q) = \frac{600}{0.3q + 5}.$$

If the fixed cost in producing the bicycles is \$2000, find the total cost to produce 30 bicycles.