

Chapters 2 through 4

Directions: Observe the Emory College Honor Code while taking the test. Be sure to **label** all appropriate answers. Show work... it helps you get partial credit. If you use your calculator to do something, tell us what you did.

1. For each statement circle **T** for True or **F** for False. If the answer is false, correct it without using the word "not."

a. Let $f(x)$ be continuous with $f''(x) > 0$ for all x . If $f(x)$ has a critical point at $x = a$, then $f(x)$ has a minimum at $x = a$.

T **F**

b. The derivative of $f = (x^2 - 1)(6x + 1)$ is $f' = (2x)(6)$.

T **F**

c. If Marginal Cost is less than Average Cost at a given amount of production, then Average Cost will increase with an increase in production.

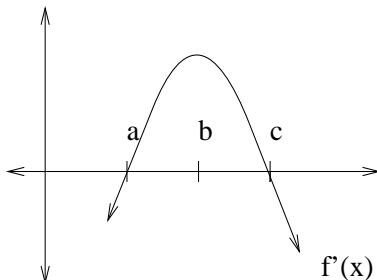
T **F**

d. If elasticity at a certain price p is .8, then you should raise the price to increase revenue.

T **F**

e. The function $f(x)$, whose **derivative** is graphed below, has a maximum at $x = a$.

T **F**



2. The following table gives the percent of the US population living in urban areas as a function of year. Estimate the rate at which this percent is increasing at the year 1960. Include units, and give your answer to one decimal place.

Year	1800	1830	1890	1920	1950	1960	1970	1980
Percent	6	9	20	35	51	64	69.9	73.5

3. Let $C(q)$ represent the cost and $R(q)$ represent the revenue, in dollars, of producing q items.

a. If $C'(50) = 25$ and $R'(50) = 34$, approximately how much profit is earned by the 51st item?

b. Suppose the company is already making a profit by producing and selling 100 items, and that $C'(100) = 35$ and $R'(100) = 38$. Should the company produce the 101st item? Why?

4. If p is price in dollars and q is quantity, demand for a product is given by $q = 5000(.953)^p$.

a. What quantity is sold at a price of \$10? Round to the nearest number of units.

b. Find the derivative of demand with respect to price.

c. Find the derivative of demand with respect to price when the price is \$10 and interpret your answer in terms of demand.

5. Cost is given by $C(q) = 10000 + 3q^2$ and the product sells for \$500 per item. At what quantity is profit maximized? Round to the nearest number of items. What is the total profit at this production level?

6. For some positive constant C , a patient's temperature change, T , due to a dose, D , of a drug is given by $T(D) = (\frac{5C}{2} - \frac{D}{3})D^2$.

a. What dosage maximizes the temperature change?

b. The sensitivity of the body to the drug is defined as $\frac{dT}{dD}$. What dosage maximizes sensitivity?

7. The average cost per item to produce q items is given by $a(q) = 0.01q^2 - 0.6q + 13$, for $q > 0$.
- What is the total cost, $C(q)$, of producing q goods?
 - At what production level is the average cost a minimum?
 - What is the lowest average cost?
8. A company estimates that the weekly sales q of its product is related to the price p by the function $q = 20000 - .65p^2$ where p is in dollars per unit. Currently each unit sells for \$70.
- Find elasticity at the current price. Round your answer to two decimal places.
 - What should you do to increase revenue?

9. A factory produces a product that sells for \$10. They currently produce 2000 items per month, at an average cost of \$4 per item. The marginal cost at this production level is \$3. Assume that the factory can sell all items that it produces.

a. What is the profit at this production level?

b. How would increasing production by one unit affect

i. average cost?

ii. profit?

10. The function $P(t) = \frac{532}{1+869e^{-1.33t}}$ is the total sales (in thousands) of a new CD, where t is in months since it was introduced.

a. At what time t is the total number of sales growing the fastest? Include units, and round your answer to one decimal place.

b. What maximum potential sales does this function predict?