

NAME: _____

Test III

MATH 1100-4

FALL '98

You have fifty minutes to complete this test. Please show all of your work; I cannot give credit for answers without supporting work. You may use a calculator but no other aids. In particular, books, notes and your neighbor's paper are not allowed. The test is worth 120 points; the values of individual problems are indicated. *You need not simplify your answers unless specifically asked to do so.*

1. (4 POINTS EACH.) The figure below represents the graph of a function $f(x)$, on which six points A – F have been marked. Indicate at which of these points the following conditions occur:
 - (a) $f'(x) > 0$ and $f''(x) < 0$.
 - (b) $f'(x) = 0$ and $f''(x) < 0$.
 - (c) $f'(x) < 0$ and $f''(x) < 0$.
 - (d) $f'(x) < 0$ and $f''(x) > 0$.
 - (e) $f'(x) = 0$ and $f''(x) = 0$.

2. (25 POINTS.) Suppose that the total cost of producing a shipment of a certain product is

$$C = 5,000x + \frac{125,000}{x}, \quad x > 0,$$

where x is the number of machines used in production. Find the critical points of this function, the interval(s) over which the total cost increases, and the intervals(s) over which the total cost decreases.

3. (25 POINTS.) Suppose that the total number of units produced by a worker in t hours of an 8-hour shift can be modeled by the production function $P(t)$:

$$P(t) = 27t + 12t^2 - t^3.$$

Find the number of hours before

- (a) production is maximized.
- (b) the rate of production is maximized. That is, find the point of diminishing returns.

4. (25 POINTS.) A firm can produce only 1000 units per month. The monthly total cost is given by $C(x) = 3200 + 200x$, where x is the number produced. If the total revenue is given by $R(x) = 250x - .01x^2$, how many items should they produce for maximum profit? Find the maximum profit.

5. (25 POINTS.) The owner of an apple orchard must decide when to pick her apples. She can sell them for \$8 a bushel if she sells them now, with each tree yielding an average of 5 bushels. The yield increases by one half bushel per week for the next 5 weeks but the price per bushel decreases by \$0.50 per bushel each week. When should the apples be picked for maximum return? (HINT: Work with a function expressing the revenue *per tree*.)