116 Final Exam Part II: Applications

This exam is closed book, closed note. No collaboration. You are encouraged to use an approved calculator. Each question has exactly one correct answer; no credit will be awarded for any question with two answers marked. This exam is scantron graded, so please fill in the scantron sheet carefully with a number 2 pencil. You are free to use scratch paper, but only your scantron sheet will be graded.

1. The velocity (in ft/sec) of a vehicle is given by $f(t) = 2\sqrt{t}$ where $0 \le t \le 30$. Assuming the vehicle is initially at rest, find the function which gives the position of the vehicle at time t.

a. $\frac{4}{3}t^{3/2} + c$ b. $\frac{4}{3}t^{3/2}$ c. $t^{-1/2} + c$ d. $2t^2 + t + c$

2. The daily marginal cost of production for a certain company is given by
$C'(x) = 0.000009x^2 - 0.009x + 8$
In addition to the actual cost of producing the items, there is a $120/day fixed cost. Find the total cost incurred in producing the first 500 items of the day.

a.$7520 b.$60000 c. $3250 d. $3370

3. The registrar at a university estimates that the total student enrollment will grow at a rate of $N'(t) = 2000(1+0.2t)^{-3/2}$ students per year t years from now. If the current student enrollment is 1000, what will be the student enrollment 5 years from now?

a.1987 b.5857 c.3010 d. 6858

4. The marginal revenue for a particular product is given by
$R'(x) = -0.1x + 40$ where R' is measured in dollars/unit. Find the total revenue realized from the sale of 200 units.

a. $6000 b. $4000 c. $12000 d. $4200

5. The marginal profit function for a particular product is given by
$P'(x) = -.0003x^2 + 0.02x + 20$. How much additional profit would be realized if production were to increase from 200 to 220 units/day?

a.$3819.20 b. $219.20 c. $2.12 d. $456.15

6. Coal production has been growing at a rate of $3.5e^{0.05t}$ (in units of million metric tons/year) t years from 1980 (which corresponds to t=0). It is estimated that, had it not been for the energy crisis, the rate of production of coal would only have been

$3.5e^{0.01t}$. Determine how much additional coal (in millions of metric tons) was produced between 1980 and 2000 as a result of the energy crisis.

a. 42.79 b. 101.23 c. 4.85 d. 2.67

7. The demand function for a particular product is given by $p = -.01x^2 - 0.1x + 6$ where p is the unit price in dollars and x is the quantity demanded each week. Determine the consumer's surplus if the market price is $4/unit.

a. 11.66 b. –1948.33 c. 2000 d. 13.42

8. The total weekly revenue for a company is given by $R(x, y) = -0.2x^2 - 0.25y^2 - 0.2xy + 200x + 160y$ where x is the number of units of product A produced each week and y is the number of units of product B produced each week. The total weekly cost of production of products A and B is given by $C(x, y) = 100x + 70y + 4000$. How many units each of product A and product B should the company produce in order to maximize profit?

a.100 A and 200 B b.200 A and 200 B c. 120 A and 100B d. 200 A and 100 B

9. An open rectangular box is to be constructed from material that costs \$3/ft^2 for the bottom and \$1/ft^2 for the sides. You want to find the dimensions of the box of greatest volume which can be constructed for \$36, so you will maximize the funtion_____ subject to the constraint _____.

a. $V = xy^2$, $4xy + 3x^2 = 36$

b. $V = xyz$, $2xz + 2yz + 3xy = 36$

c. $2xz + 2yx + 3x^2 = 36$, $V = xyz$

d. $2xz + 2yx + 3xz = 36$, $V = \frac{4}{3}\pi r^3$

10. Someone wants to enclose a rectangular area of 800 ft^2 outside a building. One side of the rectangle will face the building and not need to be enclosed. The side opposite the building will be fenced with steel which costs \$3/ft and the other two sides will be fenced with pine, which costs \$6/ft. Determine the dimensions of the enclosure which will be least expensive.

a.23.68 X 89.12 b.53 X 22.1 c. 14.1 X 56.57 d. 10 X 40

11. The radius and height of a right circular cylinder area measured with a maximum error of 0.1 cm in each measurement. Approximate (by using the total differential) the maximum error in calculating the volume of the cylinder if the measured dimensions are r=8 and h=20. (Hint: V=$\pi r^2 h$)

a.110.5 b. 127.9 c.120.64 d. 241.28

12. The weekly closing price of TMA Corporation stock in week t is approximated by the rule $f(t) = 80 + 3t\cos\frac{\pi t}{6}$ $(0 \le t \le 15)$. Find the average weekly closing price of the stock over the 15 week period.

a. $85 b. $1275 c. $43.50 d. $78.75

13. The revenue of a particular company varies over a 12 week period according to the function $R(t) = 2(5 - 4\cos(\frac{\pi}{6}t))$ $(0 \le t \le 12)$ where R is measured in units of thousands of dollars. What is the total revenue realized by the company over the 12 week period?

a. $120,000 b. $240 c. $10,000 d. $23,000

14. The concentration of a drug in a patient's blood stream t hours after administration is given by $C(t) = 3te^{\frac{-t}{3}}$. Find the average concentration in the patient's bloodstream over the first 12 hours after administration.

a. 2.04 b. 24.43 c. 56.76 d. 1.79

15. The velocity of a rocket (in ft/second) if a rocket t seconds into vertical flight is given by $v(t) = -3t^2 + 192t + 120$. What is the altitude of the rocket 30 seconds after liftoff?

a.1895 ft b. 2750 ft c. 63000 ft d. 2100 ft