2009testtwosample.pdf

1. Find the intervals of increase and decrease for $f(x)=14x^3+0x^2-1512x-4$.
   A) Increasing on $x \le -6$ and $x \ge 6$, decreasing on $-6 \le x \le 6$
   B) Increasing on $x < -6$ and $x > 6$, decreasing on $-6 < x < 6$
   C) Increasing on $-6 < x < 6$, decreasing on $x < -6$ and $x > 6$
   D) Increasing on $x < -6$ and $x > 6$, decreasing on $-6 < x < 6$

2. The revenue derived from the production of x units of a particular commodity is $R(x)=\frac{24x-x^2}{x^2+24}$ million dollars. What level of production results in maximum revenue? What is the maximum revenue?
   A) Maximum at $x = 4$ and maximum revenue is $R(4) = 8$ (million dollars)
   B) Maximum at $x = 4$ and maximum revenue is $R(4) = 1.43$ (thousand dollars)
   C) Maximum at $x = 4$ and maximum revenue is $R(4) = 2$ (million dollars)
   D) Maximum at $x = 5$ and maximum revenue is $R(5) = 1.43$ (million dollars)

3. Determine the critical points of the given function and classify each critical point as a relative maximum, a relative minimum, or neither. $f(x)=\frac{8}{x^2-8x+7}$
   A) (4, –0.888889) relative maximum; $x = 7$ neither; $x = 1$ neither,
   B) (4, –0.888889) relative minimum; (7, 8) relative maximum; (1, 8) relative maximum;
   C) (7, 8) relative maximum; (1, 8) relative maximum
   D) (7, 8) relative minimum; (1, 8) relative maximum

4. A small manufacturing company estimates that the total cost in dollars of producing x radios per day is given by the formula $C=0.1x^2+20x+500$. Find the number of units that will minimize the average cost.
   A) 100
   B) 147
   C) 36
   D) 71

5. The second derivative test reveals that $f(x)=x^4-4x^2+1$ has
   A) a relative maximum only
   B) a relative minimum only
   C) both a relative maximum and a relative minimum
   D) neither a relative maximum nor a relative minimum

6. Determine where the graph of $f(x)=x^3-3x^2-9x+1$ is concave down.
   A) $x > 1$
   B) $x < 1$
   C) $x > -1$
   D) $x < -1$

7. Locate all inflection points of $f(x)=x^4+6x^3-24x^2+26$.
   A) (1, 9) and (–4, –486)
   B) (1, 9)
   C) None
   D) (0, 26)

8. Find all the critical numbers of the function $f(x)=2x^2-8x+7$.
   A) –7
   B) $-\frac{7}{2}$
   C) 2
   D) None

9. A 5-year projection of population trends suggests that t years from now, the population of a certain community will be $P(t)=-t^3+12t^2+144t+55$ thousand.
   1) At what time during the 5-year period will the population be growing most rapidly?
   2) At what time during the 5-year period will the population be growing least rapidly?
   3) At what time is the rate of population growth changing most rapidly?
   A) t = 4 years; t = 0 years; t = 0 years
   B) t = 0 years; t = 0 years; t = 4 years
   C) t = 4 years; t = 3 year; t = 5 years
   D) t = 4 years; t = 0 years; t = 4 years

10. The function $f(x)=\frac{1}{x-2}$ has
    A) a vertical asymptote at x = –2 and no horizontal asymptote
    B) a vertical asymptote at x = 2 and no horizontal asymptote
    C) a vertical asymptote at x = 2 and a horizontal asymptote at y = 0
    D) no asymptote

11. Find the absolute maximum of the function $f(x)=x^5-x^4$ on the interval $-1 \le x \le 1$.
    A) 0
    B) 1
    C) –1
    D) –2

12. The cost of producing x units of a certain commodity is $C(x)=1x^2+5x+6$ dollars. If the price is $p(x) = (44 – x)$ dollars per unit, determine the level of production that maximizes profit.
    A) $x = 2$
    B) $x = 4$
    C) $x = 6$
    D) $x = 10$

13. An apartment complex has 260 units. When the monthly rent for each unit is $320, all units are occupied. Experience indicates that for each $12 per month increase in rent, 4 units will become vacant. Each rented apartment costs the owner of the complex $40 per month to maintain. What monthly rent should be charged to maximize profit?
    A) $114
    B) $228
    C) $342
    D) $570

14. A commuter train carries 600 passengers each day from a suburb to a city. It now costs $1 per person to ride the train. A study shows that 50 additional people will ride the train for each 5 cent reduction in fare. What fare should be charged in order to maximize total revenue?
    A) 78 cents
    B) 79 cents
    C) 80 cents
    D) 85 cents

15. Find two non-negative numbers whose sum is 10 if it is required that the product of one number and the square of the other is to be as large as possible.
    A) $\frac{10}{3}$ and $\frac{20}{3}$
    B) 10 and 20
    C) 5 and 5
    D) 9 and 1

16. If the total cost of manufacturing a commodity is $C(x)=\frac{1}{8}x^2+4x+200$ dollars when x units are produced, for what value of x is the average cost the least?
    A) 37
    B) 38
    C) 39
    D) 40

17. The demand function for a certain commodity is $x=\frac{300-p^2}{60}$. For what values of p is the demand elastic?
    A) $p = 100$
    B) $p > 100$
    C) $p < 100$
    D) $p > 0$

18. A Florida citrus grower estimates that if 40 orange trees are planted, the average yield per tree will be 200 oranges. The average yield will decrease by 2 oranges per tree for each additional tree planted on the same acreage. How many trees should the grower plant to maximize the total yield?
    A) 70 trees
    B) 20 trees
    C) 30 trees
    D) 65 trees

19. Find two non-negative numbers whose sum is 10 for which the product of their squares is as large as possible.
    A) 5 and 5
    B) 0 and 10
    C) 1 and 9
    D) 3 and 7

20. If $3,000 is invested at 10% compounded continuously, what is the balance after 9 years?
    A) $7,378.79
    B) $7,378.81
    C) $7,391.90
    D) $7,342.10

21. Find $f(3)$ if $f(x)=e^{kx}$ and $f(1) = 100$.
    A) 10
    B) 100
    C) 1000
    D) $\frac{1}{10}$

22. If $4,000 is invested at 8 percent compounded continuously, what is the balance after 11 years?
    A) $1,659.13
    B) $4,320
    C) $9,643.6
    D) $9,326.56

23. A manufacturer of light bulbs estimates that the fraction $F(x)$ of bulbs that remain burning after t weeks is given by $F(t)=e^{-kt}$, where k is a positive constant. Suppose twice as many bulbs are burning after 3 weeks as are burning after 9 weeks. Compute the fraction of the bulbs that remains burning after 18 weeks.
    A) $\frac{1}{7}$
    B) $\frac{1}{8}$
    C) $\frac{1}{3}$
    D) $\frac{1}{16}$

24. A radioactive substance decays exponentially. If 800 grams were present initially and 600 grams are present 100 years later, how many grams will be present after 400 years?
    A) 251.93 grams
    B) 251.97 grams
    C) 252.01 grams
    D) 253.13 grams

25. Solve for x: $2\ln x - \frac{1}{3}\ln x^2 = 4$. Do not use a calculator!

A) $x = e$
B) $x = e^3$
C) $x = e^4$
D) $x = e^2$

26. An archaeologist has found a fossil in which the ratio of ^{14}C to ^{12}C is $\frac{1}{7}$ the ratio in the atmosphere. Approximately how old is the fossil? The half-life of ^{14}C is 5,730 years.

A) 16,086.144 years
B) 16,116.144 years
C) 20,055 years
D) 40,110 years

27. Solve for x: $5^x = e^8$.

A) $x = \frac{8}{\ln 5}$
B) $x = \ln 5$
C) $x = 8\ln 5$
D) $x = 8 - \ln 5$

28. At what interest rate, compounded continuously, should $3,000 be invested today so that 14 years from now the account will be worth $6,000?

A) 9.9%
B) 0.05%
C) 2.48%
D) 4.95%

Answer Key

1. B
2. C
3. A
4. D
5. C
6. B
7. A
8. C
9. A
10. C
11. A
12. B
13. B
14. C
15. A
16. D
17. B
18. A
19. A
20. B
21. C
22. C
23. B
24. D
25. B
26. A
27. A
28. D