

Name: \_\_\_\_\_ Academic Integrity Signature: \_\_\_\_\_

*I have abided by the UNCG Academic Integrity Policy.***Read all of the following information before starting the exam:**

- It is to your advantage to answer ALL of the 20 questions.
- It is your responsibility to make sure that you have all of the problems.
- There is no need to complete the test in order. The problems are independent.
- *Budget your time!*

Page:	1	2	3	4	Total
Points:	25	25	25	25	100
Score:					

- (5 points) The annual revenue and cost functions for a manufacturer of toaster ovens are approximately  $R(x) = 610x - 0.02x^2$  and  $C(x) = 100x + 90000$ , where  $x$  denotes the number of toasters made. What is the maximum annual profit? Round to the nearest dollar.  
A. \$15,334    B. \$3,341,250    C. \$12,750    D. \$1,547,324    **E. None of the above.**
- (5 points) Determine the interval(s) over which  $f(x) = x^3 - 6x^2 + 9x + 1$  is concave upward.  
**A.  $(2, \infty)$**     B.  $(-\infty, 2)$     C.  $(-\infty, 1) \cup (3, \infty)$     D.  $(1, 3)$     E. None of the above.
- (5 points) Find the domain and  $x$ -intercepts of  $f(x) = \sqrt{9+x}$ .  
**A. The domain is the interval  $[-9, \infty)$ . The  $x$ -intercept is  $-9$ .**  
B. The domain is the interval  $[-9, \infty)$ . There is no  $x$ -intercept.  
C. The domain is  $(-\infty, -9) \cup (-9, \infty)$ . The  $x$ -intercept is 3.  
D. The domain is the interval  $[-9, 9]$ . The  $x$ -intercept is 0.  
E. None of the above.
- (5 points) The average cost per electric wok  $\bar{C}(x)$  if  $x$  woks are produced each day is

$$\bar{C}(x) = \frac{900}{x} + 60 + 0.16x, \quad \text{for } 0 < x < 200.$$

Find the *minimum average cost*.

- The minimum average cost is \$126 when production level is 28 woks.  
B. The minimum average cost is \$160 when production level is 28 woks.  
**C. The minimum average cost is \$84 when production level is 75 woks.**  
D. The minimum average cost is \$6300 when production level is 75 woks.  
E. None of the above.
- (5 points) Find  $f'(x)$  for  $f(x) = \frac{1}{(2x-4)^5}$ .  
**A.  $f'(x) = \frac{-10}{(2x-4)^6}$**   
B.  $f'(x) = \frac{1}{10(2x-4)^4}$   
C.  $f'(x) = 5 \ln(2x-4)$   
D.  $f'(x) = 5(2x-4)^4$   
E. None of the above.

6. (5 points) Let  $f(x) = (2x + 1)e^x$ . Where does the graph  $y = f(x)$  have a horizontal tangent line?  
**A.  $x = -\frac{3}{2}$**     B. never    C.  $x = 0$     D.  $x = -\frac{1}{2}$     E. None of the above.

7. (5 points) A company estimates that it will sell  $N(t)$  large-screen television sets after spending  $t$  thousand dollars on advertising, where

$$N(t) = 8t^3 - 0.5t^4 + 1000, \quad 0 < t < 12.$$

For which values of  $t$  is the rate of change of sales  $\frac{dN}{dt}$  increasing? (Note: This is NOT asking when the sales are increasing.)

- A.  $8 < t < 10$   
 B.  $6 < t < 12$   
 C.  $0 < t < 12$   
**D.  $0 < t < 8$**   
 E. None of the above.
8. (5 points) Find  $f''(x)$  for  $f(x) = x + 3x^5 + \frac{1}{x} + 12$ . (Note: I am asking for  $f''(x)$  NOT  $f'(x)$ .)  
 A.  $f''(x) = 1 + 15x^4 - x^{-2}$   
**B.  $f''(x) = 60x^3 + 2x^{-3}$**   
 C.  $f''(x) = 1 + 15x^4 + \ln(x)$   
 D.  $f''(x) = 60x^3 + 2x^{-3} + \ln(x)$   
 E. None of the above.
9. (5 points) Use your calculator to find  $t$  to 4 decimal places, where  $e^{-0.05t} = 0.07$ .  
 A. 42.7962    B. 99.8577    **C. 53.1852**    D. -2.6953    E. None of the above.
10. (5 points) The sales (\$) of a new type of product are given by

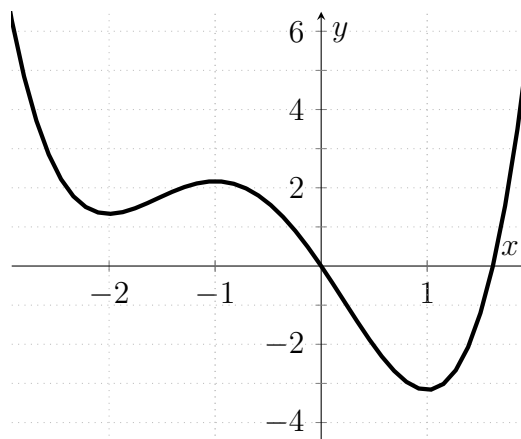
$$S(t) = 3000 - 6000e^{-0.5t},$$

where  $t$  represents time in years for  $1 < t < 10$ . How fast are sales changing at time  $t = 7$ .

- A. increasing approximately \$119.11 per year  
 B. decreasing \$19,909 per year  
**C. increasing approximately \$90.59 per year**  
 D. increasing approximately \$99.53 per year  
 E. decreasing approximately \$49.59 per year

11. (5 points) Find the inflection points of  $f(x) = xe^{3x}$ .
- A.  $(-\frac{2}{3}, -\frac{2}{3}e^{-2})$    B.  $(-\frac{1}{3}, -\frac{1}{3}e^{-1})$    C.  $(0, 0)$    D.  $(1, e^3)$    E. None of the above.
12. (5 points) Where is the function  $f(x) = 20e^x - e^{2x}$  increasing?
- A.  $f$  is never increasing.  
B.  $f$  is always increasing.  
**C.  $f$  is increasing on the interval  $(-\infty, \ln(10))$ .**  
D.  $f$  is increasing on the interval  $(-\infty, 20)$ .  
E. None of the above.
13. (5 points) Given  $f(x) = x + \frac{9}{x}$ , find the local extrema of  $f$ .
- A. local minimum of 6 at  $x = 3$  and a local maximum  $-6$  at  $x = -3$**   
B. local minimum of  $-6$  at  $x = -3$  and a local maximum of 6 at  $x = 3$   
C. local minimum of  $-6$  at  $x = -3$  and no local maximum  
D. no local maximum or minimum  
E. None of the above.
14. (5 points) For the function
- $$f(x) = x^3 + 3x^2 - 24x + 6,$$
- find the values of  $x$  corresponding to local maxima and local minima.
- A. local maximum at  $x = 2$  and a local minimum at  $x = 3$   
B. local maximum at  $x = 3$  and a local minimum at  $x = 2$   
C. local maximum at  $x = 2$  and a local minimum at  $x = -4$   
**D. local maximum at  $x = -4$  and a local minimum at  $x = 2$**   
E. None of the above.
15. (5 points) How many years will it take an investment of \$7000 to grow to \$9000 if it is invested at 8% compounded continuously? Round to 2 decimal places.
- A. 0.84 years   **B. 3.14 years**   C. 7.45 years   D. 6.28 years   E. 2.71 years

16. (5 points) Find the derivative of the function  $f(x) = \frac{3x - 5}{3x - 4}$  at  $x = 2$ .
- A. 1    **B.  $\frac{3}{4}$**     C. 8    D.  $\frac{7}{2}$     E. None of the above.
17. (5 points) When a management training company prices its seminar on management techniques at \$400 per person, 1,000 people will attend the seminar. The company estimates that for each \$5 reduction in the price, an additional 20 people will attend the seminar. How much should the company charge for the seminar in order to maximize revenue? Round to the nearest dollar.
- A. \$375    B. \$15    C. \$125    **D. \$325**    E. None of the above.
18. (5 points) Compute  $f'(x)$ , where  $f(x) = \ln(9x^3 - x^2)$ .
- A.  $f'(x) = \frac{1}{9x^3 - x^2}$
- B.  $f'(x) = e^{9x^3 - x^2}$
- C.  $f'(x) = \frac{1}{27x^2 - 2x}$
- D.  $f'(x) = \frac{27x^2 - 2x}{9x^3 - x^2}$**
- E. None of the above.
19. (5 points) Find 2 real numbers whose sum is 20 and whose product is a maximum.
- A. 7, 13
- B. 12, 8
- C. 12.8375, 8.1625
- D. 10, 10**
- E. None of the above.
20. (5 points) The graph  $y = f(x)$  is shown below. Find the intervals on which  $f'(x) > 0$ .



- A.  $(-2, -1) \cup (1, \infty)$**     B.  $(-\infty, -2) \cup (-1, 1)$     C.  $(0, 1.5)$     D.  $(-\infty, 0) \cup (1.5, \infty)$
- E. None of the above.