Name: _____ Date: _____

1. 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

2. How much money should be invested today at an annual interest rate of 5% compounded continuously so that 40 years from now it will be worth $14000?
   A) $ 13317.21
   B) $ 1988.64
   C) $ 103446.79
   D) $ 1894.69

3. At what interest rate, compounded continuously, should $2500 be invested today so that 12 years from now the account will be worth $5000.
   A) $11.55%
   B) $0.06%
   C) $2.89%
   D) $5.78%

4. 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 10 weeks. Compute the fraction of the bulbs that remains burning after 28 weeks.
   A) $\dfrac{1}{15}$
   B) $\dfrac{1}{16}$
   C) $\dfrac{1}{4}$
   D) $\dfrac{1}{32}$

5. Find $f(3)$ if $f(x) = e^{kx}$ and $f(1) = 10$.
A) 1000
B) 59049
C) $\frac{1}{59049}$
D) $\frac{1}{1000}$

6. The total number of hot dogs sold by a fast food chain is growing exponentially. If 2 billion have been sold by 1998 and 5 billion by 2000, how many will be sold in the year 2010?

7. True or false: A sum of money, A_0, is invested at a certain fixed interest rate, and this interest is compounded continuously. After 7 years, the money has doubled. The balance at the end of 14 years is $4A_0$.

8. True or false: If $f(x) = 20 - Ae^{kx}$, $f(0) = 5$, and $f(2) = 3$, then $f(4) = 0.733.3$.

9. True or false: A sum of money, A_0, is invested at a certain fixed interest rate, and this interest is compounded continuously. After 6 years, the money has doubled. The balance at the end of 12 years is $2A_0$.

10. 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

11. Solve for x: $a^{2x-1} = b$

A) $x = \dfrac{\ln b}{2\ln a}$

B) $x = \dfrac{1 + (\ln b / \ln a)}{2}$

C) $x = \left(1 + \dfrac{\ln b}{\ln a}\right)^2$

D) $x = 1 + \dfrac{\ln b}{2\ln a}$

12. Solve for x: $2\ln x - \dfrac{1}{3}\ln x^2 = 4$

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

13. The fraction of television sets manufactured by a certain company that are still in working condition after t years of use is approximately $f(t) = e^{-0.25t}$. What fraction can be expected to fail before 2 years of use?

A) 0.61
B) 1.65
C) 0.39
D) 0.92

14. The equation of the tangent line to $f(x) = xe^x$ at $x = 1$ is

15. Find $\dfrac{df(x)}{dx}$, where $f(x) = x^3 e^{-3x}$.

16. The equation of the tangent line to $f(x) = e^{x^2}$ at $x = 2$ is

A) $y = 4e^{4x}$
B) $y = 3e^4 x$
C) $y = 3e^4$
D) $y = 4e^4 x - 7e^4$

17. Find $\dfrac{df(x)}{dx}$, where $f(x) = \ln x^5$.

A) $\dfrac{5}{x}$

B) $5x$

C) $\dfrac{x}{5}$

D) $\dfrac{1}{5x}$

18. A manufacturer can produce radios at a cost of $10 apiece and estimates that if they are sold for x dollars apiece, consumers will buy approximately $200e^{-0.2x}$ radios per month. The price the manufacturer should sell the radios to maximize the profit is

A) $10
B) $15
C) $18
D) $20

19. A manufacturer estimates that when x units of a particular commodity are produced, the total cost will be C(x) = 190 + 36ln(6x – 3) dollars. Use marginal cost analysis to estimate the cost of producing the 14th unit.

A) $345.43
B) $348.2
C) $2.88
D) $3.13

20. Find $\frac{df(x)}{dx}$, where $f(x) = e^{-8x}$.

A) $x = -8e^{-8x}$

B) $x = -8xe^{-8x}$

C) $x = e^{-8x}$

D) $x = -8e^{-8x-1}$

21. Money is deposited in a bank that offers interest at 7 percent compounded continuously. Find the percentage rate of change of the balance with respect to time, as a percent.

22. Money is deposited in a bank that offers interest at 12 percent compounded continuously. Find the percentage rate of change of the balance with respect to time.

23. True or false: If $f(x) = e^{-3/(x+1)}$, then $\dfrac{df(x)}{dx} = e^{-3/(x+1)}$.

24. True or false: If $f(x) = x^x$, then $\dfrac{df(x)}{dx} = x^x \ln x$.

25. Let $f(x) = 4x^4 - 80 \ln x$, for $x > 0$. Find the minimum value of f for $x > 0$.
A) $2(5^4 - 20\ln(5))$
B) $4(5^4 - 20\ln(5))$
C) 0
D) $20(1 - \ln(5))$

26. True or false: The function $f(x) = e^x$ is increasing everywhere.

27. True or false: The function $y = \ln 2x$ is concave downward everywhere.

28. True or false: The function $y = e^{2x}$ is increasing everywhere.

Answer Key

1. B
2. D
3. D
4. B
5. A
6. 488.3 billion
7. True
8. True
9. False
10. D
11. B
12. B
13. C
14. y = 2 * e * x - e
15. `e^(-3 * x) * (3 * x^2 - 3 * x^3)`
16. D
17. A
18. B
19. C
20. A
21. 7
22. 12 percent
23. False
24. False
25. D
26. True
27. True
28. True