

- 1) Let  $f(x)$  be the solution of the following differential equation:  $f'(x) = .1f(x)$ ,  $f(0) = .5$ .  
What is  $f(20)$ , approximately?
- 2) In a certain country, the rate of increase of the population is proportional to the population  $P(t)$ . In fact,  $P'(t) = .23P(t)$ . Suppose that initially the country's population is 50,000, and that 10 years later there are 500,000 people. Which of the following equations expresses this information mathematically?
- 3) Let  $P(t)$  be the quantity of strontium-90 remaining after  $t$  years. Suppose the half-life of strontium-90 is 28 years. Which of the following equations expresses the half-life information?
- 4) A bacterial culture grows exponentially; that is,  $P(t) = 100e^{kt}$ , where  $P(t)$  is the size of the culture at time  $t$  hours. Suppose that after 2 hours the size of the culture is 400. What is  $k$  (approximately)?
- 5) A colony of bacteria is growing at a rate proportional to the number of bacteria present. At the beginning of an experiment there were about  $10^3$  bacteria present. In two hours, the count rose to  $3 \times 10^3$  bacteria.
  - (a) Find the specific growth law for this colony of bacteria.
  - (b) At what time will there be  $6 \times 10^3$  bacteria present?
- 6) A function  $P(t)$  satisfies  $P'(t) = -\frac{1}{3}P(t)$ ,  $P(0) = 20$ . Solve for  $P(t)$ .
- 7) It is observed that the sales of a certain recording fall to 75% of their original level one month after advertising stops. If this continues, what will be the sales after 4 months?
- 8) \$1000 is invested at 6% interest compounded continuously. What is the value of the investment after 5 years?
- 9) How much money has to be invested now at 8% continuous interest in order to have \$1000 after 5 years?
- 10) What rate of interest will make an investment triple in 8 years if the interest is compounded continuously?
- 11) How long will it take for an investment of \$500 to triple if the interest is 7.3% compounded continuously?  
What will the investment be worth after 15 yrs?
- 12) Suppose that the value of a certain investment after  $t$  years can be approximated by the function  $f(t) = 100,000e^{.12t^{2/3}}$ .
  - (a) Find the percentage rate of increase in the value of the investment when  $t = 8$  years.
  - (b) What is the dollar value of the investment after 8 years?
- 13) Mr. Jones has two investments. The first is currently worth \$50,000 and has an annual yield of 10% compounded continuously. The second is currently worth \$70,000 and has an annual yield of 8% compounded continuously. Assuming that all earnings are reinvested at the same, respective rates, in how many years will the two investments be worth the same amount?

14) Suppose that the value in billions of dollars of a company is determined to be  $f(t) = .5t + .2e^{-t}$  where  $t$  is measured in years. What is the percentage rate of growth of the company at time  $t = 0$ ?

15) Find:  $\int (2 - \frac{1}{x}) dx$

16) Calculate:  $\int (x^5 + 2x^3 - 3x^2 + 6) dx$

17) Find:  $\int (2x + 1)^2 dx$

18) Find:  $\int e^{-x/2} dx$

19) If  $\frac{dy}{dx} = x^6 + \frac{x^4}{3} - x^3 + \frac{5}{3}x^2$  and  $f(0) = e$ , then the function  $y = f(x)$  is given by:

20) What is  $\int \left( \frac{x^2}{4} - 4 \right) dx$ ?

21)  $\int \left( \frac{6}{5}x^5 + 4e^{-2x} \right) dx$  is equal to:

A)  $6x^6 - 2e^{-3x} + C$

B)  $6x^6 - 2e^{-2x} + C$

C)  $\frac{1}{5}x^6 - 2e^{-2x} + C$

D)  $6x^4 - 8e^{-2x} + C$

22) What is  $\int \frac{3}{x} dx$ ?

23) Suppose  $F(x)$  is an antiderivative of  $\frac{2}{\sqrt{x}}$  and  $F(0) = 1$ . What is  $F(9)$ ?

## Answer Key

Testname: 5-1-3.6-1

- 1) 3.7
- 2)  $500,000 = 50,000e^{2.3}$
- 3)  $P(28) = \frac{1}{2}P_0$
- 4)  $\frac{1.39}{2}$
- 5) (a)  $P(t) = 10^3e^{.55t}$   
(b) 3.26 hours
- 6)  $P(t) = 20e^{-(1/3)t}$
- 7) 31.64%
- 8)  $1000e^3$
- 9)  $1000e^{-.08(5)}$
- 10) 13.73%
- 11) 15 yrs.; \$1500
- 12) (a) 4% per yr  
(b)  $100,000e^{.48} = \$161,607.44$
- 13) 16.82 years
- 14) 150%
- 15)  $2x - \ln|x| + C$
- 16)  $\frac{x^6}{6} + \frac{x^4}{2} - x^3 + 6x + C$
- 17)  $\frac{4x^3}{3} + 2x^2 + x + C$
- 18)  $-2e^{-x/2} + C$
- 19)  $y = \frac{x^7}{7} + \frac{x^5}{15} - \frac{x^4}{4} + \frac{5}{9}x^3 + e$
- 20)  $\frac{x^3}{12} - 4x + C$
- 21) C
- 22)  $\ln|x| + C$
- 23) 13