Exponential Growth & Decay

Multiple Choice: *Identify the choice that best completes the statement or answers the question.*

____ 1. Identify the growth rate in the following algebraic model: $C(n) = 30(1.06)^{12}$.

a. 106% b. 30% c. 12% d. 6%

____ 2. The population of an island is growing at a rate of about 6% each year. The population this year is 214 659. Which of the following is an algebraic model that can be used to predict the population in the future?

a. $P_n = 214\,659(0.06)^n$
b. $P_n = (214\,659(0.06))^n$
c. $P_n = 214\,659(1.06)^n$
d. $P_n = 214\,659(6)^n$

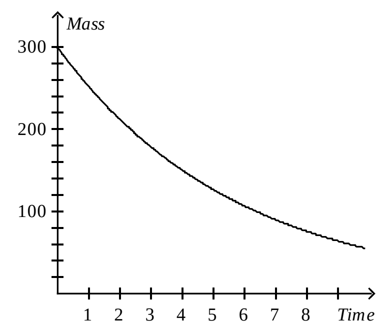
____ 3. What does the number 16 represent in the following algebraic model? $P(n) = 420(1 - 0.046)^{16}$

a. the initial amount
b. the decay rate
c. the number of decay periods
d. the half-life

____ 4. What does the number 3600 represent in the following decay model? $N(n) = 3600(1 - 0.4)^n$

a. the number of decay periods
b. the initial amount
c. the half-life
d. the decay rate

____ 5. A lab has 300 g of an unknown radioactive substance. The curve below shows the mass of the substance recorded each minute. Approximate the half-life of the substance.



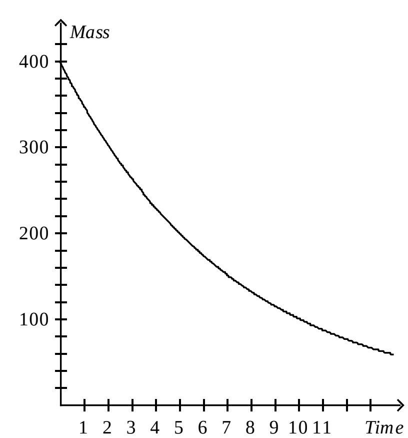
a. 6 min
b. 5 min
c. 4 min.
d. 3 min

____ 6. A cup of coffee cools according to the equation $T(t) = 65\left(\frac{1}{2}\right)^{\frac{t}{22}} + 19$, where *T* is the temperature in °C after *t* minutes. Determine the temperature of the coffee after 30 minutes, to the nearest degree.

a. 25 °C b. 19 °C c. 18 °C d. 33 °C

7. Amos invests 1800 in a bond that pays 7.25% per year. How much will the bond be worth in 8 years? Round your answer to the nearest whole number.

8. A lab has 400 grams of an unknown radioactive substance. The curve to the right shows the mass of the substance recorded each minute. Approximately how many grams of the substance remain after 9 minutes?



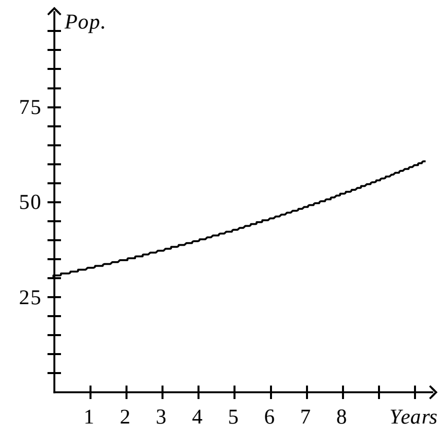
9. The population of a small industrial town was 11 980 in 2000. Each year, the population decreases by an average of 6%. Estimate the population in the year 2010.

10. The value of a car originally that originally cost $28 000 depreciates at a rate of 20% per year. Determine the value of the car after 7 years.

11. A yeast culture grows by quadrupling its number of cells every hour. There are 1000 cells at 9:00 a.m. At what time, on the hour, will there first be more than one million cells?

12. The number of franchises of a dance studio has been growing exponentially since the first studio opened in 1998. Since then the number of studios has grown at a rate of 14% each year. Determine the number of studios in 2022. Round your answer to the nearest whole number.

13. The population of deer that were introduced to a national park in 1980 can be modelled by the graph to the right.
    a) What was the initial population? How did you determine this?
    b) How long did it take for the population to double? Explain how you determined this.
    c) Approximate the population in 1988.



14. The number of guppies in an aquarium is modelled by $N(t) = 8(1 + 0.17)^t$, where t is measured in months.
    a) Describe what each part of the equation represents.
    b) Determine the number of guppies in the aquarium after 3 months.

15. The number of cells in a bacteria culture with an initial population of 300 doubles every 20 minutes. To figure out how many cells there were in the culture after 80 minutes, Jenna used the equation $P(t) = 300(2)^t$, with 80 for the value of t. She realized that the answer she got was disproportionately large.
    a) Explain what Jenna did wrong and how to correct it.
    b) Determine the correct number of cells in the population after 80 minutes.Round your answer to the nearest whole number.

16. A rubber ball is dropped from a height of 12 m. It bounces to a height that is 90% of its previous maximum height after each bounce.
    a) What is the height of the ball after the 5th bounce?
    b) Determine after how many bounces the maximum height of the ball will be about 5.7 m.

17. The deer population in a national wildlife refuge has been decreasing by 5% each year with the accidental introduction of an insect that has been destroying much of the plant life that the deer use for food. The deer population was 580 in 2007.
    a) Write an exponential function that models the population $P(n)$, of the deer in the refuge n years after 2007.
    b) Assuming that the plant destruction continues, estimate the deer population in 2015.

Answer Key

1. D	2. C	3. C	4. B	5. C	6. A
7. $3151	8. about 120 g	9. 6453	10. $5,872.03		

11. At 2:00 p.m. there will be 1 024 000 cells. 12. 23 studios

13. a) The initial population is the *y*-intercept of the graph, which is 30.
b) Double the initial population would be 60. Draw a horizontal line from 60 on the Population axis until you reach the graph. Then draw a vertical line down to the Years axis, which is closest to 10 years. c) The population in 1988 was about 53.

14. a) $N(t)$ is the number of guppies in the aquarium in t months. 8 is the initial population. 0.17 is the growth rate. b) 13 guppies.

15. a) Jenna incorrectly used 80 for the value of t. The population doubles every 20 minutes, so t is the number of 20-minute periods that have elapsed. After 80 minutes, the number of 20-minute periods that have elapsed is $80 \div 20 = 4$. So, she should have used $t = 4$. b) 4800 cells

16. a) 7.1 m b) 7th bounce

17. a) $P(n) = 580(0.95)^n$. b) approximately 385 deer.