Name______ Date_____ Period_____

Worksheet 4.2—Exponential and Logistic Modeling

Show all work. All answers must be given as either simplified, exact answers or approximations with 3-decimal accuracy. Calculators ARE permitted.

Multiple Choice

- 1. What is the percent growth rate of $M(t) = 1.25 \cdot 1.049^{t}$
 - (A) 49%
- (B) 23%
- (C) 4.9%
- (D) 2.3%
- (E) 1.23%

- 2. What is the percent decay rate of $q(k) = 22.9 \cdot 0.834^{k}$
 - (A) 22.7%
- (B) 16.6%
- (C) 8.34%
- (D) 2.27%
- (E) 0.834%

- 3. A single-cell amoeba doubles every 4 days. About how long will it take one amoeba to produce a population of 1000?
 - (A) 10 days
- (B) 20 days
- (C) 30 days
- (D) 40 days
- (E) 50 days

- 4. The number of children infected with typhoid in a small village is modeled by the logistic equation $R(t) = \frac{789}{1 + 16e^{-0.8t}}$, R is the number of children infected after t days. Based on this model, which of the following is true?
 - (A) After 0 days, 16 children are infected
- (B) After 2 days, 439 children are infected
- (C) After 4 days, 590 children are infected
- (D) After 6 days, 612 children are infected
- (E) After 8 days, 769 children are infected

5. Which exponential function models decay with an initial value of 12, decreasing at a rate of 0.47% per week?

(A)
$$S(t) = 47(0.0012)^t$$
 (B) $S(t) = 12(0.0047)^t$ (C) $S(t) = 12(0.9953)^t$

(B)
$$S(t) = 12(0.0047)^{t}$$

(C)
$$S(t) = 12(0.9953)^t$$

(D)
$$S(t) = 47(0.0995)^t$$
 (E) $S(t) = (0.47)^t$

(E)
$$S(t) = (0.47)$$

6. Which exponential function models growth with an initial value of 0.7 g, doubling every 3 days.

(A)
$$S(t) = 0.7(2)^{t}$$

(B)
$$S(t) = 0.7(2)^{t/3}$$

(A)
$$S(t) = 0.7(2)^{t}$$
 (B) $S(t) = 0.7(2)^{t/3}$ (C) $S(t) = 0.7(3)^{t/7}$

(D)
$$S(t) = 0.7(7)$$

(D)
$$S(t) = 0.7(7)^t$$
 (E) $S(t) = 0.7(2)^{3t}$

- 7. A quantity Q grows exponentially over time t. At time t = 2, Q = 16 grams, and time t = 5, Q = 128 grams. How much is Q at t = 3?
 - (A) 60 grams
- (B) 16 grams (C) 106 grams
- (D) 32 grams (E) 38 grams

- 8. A substance grows exponentially as $N(t) = Ab^t$, where N(t) is the quantity of the substance after t hours and N is the original quantity of the substance. If the substance grows from 700 grams to 2100 grams in 3 hours, find the weight/mass of the substance after 9 hours.

 - (A) 18903 grams (B) 18900 grams (C) 18927 grams
- (D) 700 grams
- (E) 700.632 grams

Short Answer

- 9. A evil cloning replicator reproduces itself at a rate that the population of replicators quadruples every 3 hours. At t = 0, there are 6 evil cloning replicators.
 - (a) Write an equation for the number of replicators R(t) at time t hours.



(b) How many replicators are there after 48 hours?

(c) After how many hours will the number of replicators reach 1,000,000? How many days is this?

10. The half-life of a radioactive isotope describes the amount of time that it takes half of the isotope in a sample to decay. In the case of radiocarbon dating, the half-life of carbon 14 is 5,730 years. A fossil is found that has 35% carbon 14 compared to the living sample. How old is the fossil?

11. Determine an equation of the form $f(x) = \frac{L}{1 + Ce^{-kx}}$ for the function whose graph is shown below.

