Name $\qquad$ Date $\qquad$ Period $\qquad$

## Worksheet 4.2—Exponential and Logistic Modeling

Show all work. All answers must be given as either simplified, exact answers or approximations with 3decimal 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 $R(t)=\frac{789}{1+16 e^{-0.8 t}}, R$ 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) $S(t)=12(0.9953)^{t}$
(D) $S(t)=47(0.0995)^{t}$
(E) $S(t)=(0.47)^{t}$
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) $S(t)=0.7(2)^{t / 3}$
(C) $S(t)=0.7(3)^{t / 7}$
(D) $S(t)=0.7(7)^{t}$
(E) $S(t)=0.7(2)^{3 t}$
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 $N(t)=A b^{t}$, 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
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 $f(x)=\frac{L}{1+C e^{-k x}}$ for the function whose graph is shown below.

