

Name _____ Date _____ Period _____

Worksheet 4.2—Exponential and Logistic Modeling

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

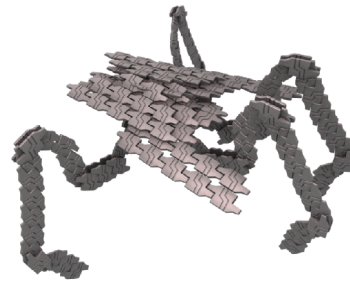
Multiple Choice

- 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%
- 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%
- 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
- 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
- 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) $S(t) = (0.47)^t$
- Which exponential function models decay 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) $S(t) = 0.7(2)^{3t}$
- 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
- 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.

- Write an equation for the number of replicators $R(t)$ at time t hours.
- How many replicators are there after 48 hours?
- 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.

