



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)  $S(t) = 12(0.9953)^t$   
(D)  $S(t) = 47(0.0995)^t$       (E)  $S(t) = (0.47)^t$

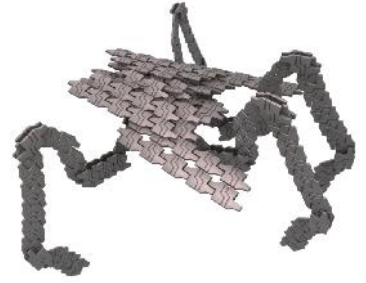
6. Which exponential function models growth with an initial value of 0.7 g, doubling every 3 days.

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

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.

