

I. Multiple Choice: Place the capital letter of the answer choice in the blank to the left of the number.

- \_\_\_\_\_ 1. The graph of the function  $g(x) = 8^{x+1}$  can be obtained from the graph of  $f(x) = 2^x$  by  
(A) Horizontally compressing  $f$  by a factor of 3      (B) Horizontally stretching  $f$  by a factor of 3  
(C) Horizontally shifting  $f$  left one unit      (D) Horizontal shifting  $f$  right one unit      (E) None of these
- \_\_\_\_\_ 2. What is constant percentage decay **rate** (as a percentage) of  $P(t) = 1.23(0.951)^t$ ?  
(A) 95.1      (B) 9.51      (C) 1.23      (D) 23      (E) 4.9
- \_\_\_\_\_ 3. What is the growth **factor** in the equation  $M(t) = 3\left(\frac{5}{2}\right)^t$ ?  
(A) 2.5      (B) 1.667      (C) 250%      (D) 167%      (E) 3
- \_\_\_\_\_ 4. What is the equation of the exponential model,  $y = Ab^t$ ,  $t$  in weeks, for quantity that starts with an initial value of 5, and **decreases** by a factor of 5 every week?  
(A)  $y = 5\left(\frac{1}{5}\right)^{1/t}$       (B)  $y = 5^{t-1}$       (C)  $y = \left(\frac{1}{5}\right)5^t$       (D)  $y = 5^{t+1}$       (E)  $y = 5^{1-t}$
- \_\_\_\_\_ 5. What is the equation of the exponential model,  $y = Ab^t$ ,  $t$  in hours, for quantity that starts with an initial value of 3.4, and **increases** by 200% every day?  
(A)  $y = 3.4(3^t)$       (B)  $y = 3.4(3^{t/24})$       (C)  $y = 3.4(2^t)$       (D)  $y = 3.4(2^{t/24})$       (E)  $y = 3.4(200^{t/24})$
- \_\_\_\_\_ 6. Which of the following is equivalent to the function  $f(x) = 7^x$ ?  
(A)  $g(x) = -\left(\frac{1}{7}\right)^{-x}$       (B)  $g(x) = \left(\frac{1}{7}\right)^x$       (C)  $g(x) = -\left(\frac{1}{7}\right)^x$       (D)  $g(x) = \left(\frac{1}{7}\right)^{-x}$       (E)  $g(x) = -7^{-x}$
- \_\_\_\_\_ 7. A single cell amoeba triples every 4 days. About how long will amoeba to produce a population of 5000?  
(A) 11 days      (B) 21 days      (C) 31 days      (D) 41 days      (E) 51 days
- \_\_\_\_\_ 8. If a particle has an initial mass of 250 grams and doubles its mass every 7.5 hours, then what is the approximate mass of the particle at  $t = 2$  hours?  
(A) 300.8 g      (B) 8192000 g      (C) 468750 g      (D) 14062.5 g      (E) 8333.3 g
- \_\_\_\_\_ 9. For  $x > 0$ , which of the following is true?  
(A)  $3^x > 4^x$       (B)  $7^x > 5^x$       (C)  $\left(\frac{1}{6}\right)^x > \left(\frac{1}{2}\right)^x$       (D)  $9^{-x} > 8^{-x}$       (E)  $0.17^x > 0.32^x$



II. Free Response: Show all work in the space provided below the horizontal line. Use correct units where appropriate.

10. The number of people at Wassailfest infected with holiday cheer after  $t$  minutes is modeled by the function

$$W(t) = \frac{12456}{1 + 56e^{-0.7t}}$$



- What was the initial number of Wassailers infected with cheer? (**round** to the nearest person)
  - After how many minutes will the number of infected Wassailers be 5000? Give an approximation **rounded** to the nearest minute.
  - After how many minutes is the holiday cheer spreading at the fastest rate? (**round** to the nearest minute)
  - How many Wassailers are infected after a 15 minutes? (**round** to the nearest person)
  - According the model, how many people attended Wassailfest?
  - If the Grinch has a plan to crash the Wassailfest festivities if 75% of the Wassailers get infected with the holiday spirit, after how many minutes will he try to implement his sinister plan? (**round** to the nearest minute)
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