

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 $g(x) = 2^x$ can be obtained from the graph of $f(x) = 8^x$ by
 (A) Horizontally compressing f by a factor of 3 (B) Horizontally stretching f by a factor of 3
 (C) Vertically compressing f by a factor of 3 (D) Vertically stretching f by a factor of 3
 (E) None of these
- _____ 2. What is constant percentage decay **rate** of $P(t) = 4.7\left(\frac{1}{5}\right)^t$?
 (A) 80% (B) 2% (C) 20% (D) 0.8% (E) 0.2%
- _____ 3. What is the growth **factor** in the equation $M(t) = 3\left(\frac{6}{5}\right)^t$?
 (A) 3 (B) $\frac{1}{5}$ (C) 20% (D) 1.2 (E) 120%
- _____ 4. What is the equation of the exponential model, $y = Ab^t$, t in **days**, for a quantity that starts with an initial value of 4, and **increases** by a factor of 2 every week?
 (A) $y = 4(2)^t$ (B) $y = 2^{(t/7+2)}$ (C) $y = 4(3)^{t/7}$ (D) $y = 4\left(\frac{1}{3}\right)^{t/7}$ (E) $y = 4^{(t/7+2)}$
- _____ 5. What is the equation of the exponential model, $y = Ab^t$, t in hours, for a quantity that starts with an initial value of 3.4, and **decreases** by 34% every 5 hours?
 (A) $y = 3.4(0.66)^t$ (B) $y = 3.4(0.34)^t$ (C) $y = 3.4(1.34)^{t/5}$ (D) $y = 3.4(0.34)^{t/5}$ (E) $y = 3.4(0.66)^{t/5}$
- _____ 6. Which of the following is equivalent to the function $f(x) = 11^{-x}$?
 (A) $g(x) = -\left(\frac{1}{11}\right)^{-x}$ (B) $g(x) = \left(\frac{1}{11}\right)^{-x}$ (C) $g(x) = \frac{-1}{11^x}$ (D) $g(x) = -11^x$ (E) $g(x) = \frac{1}{11^x}$
- _____ 7. If a radioactive substance loses one-third of its mass every 26 days, to the nearest day, for what approximate value of t will 13 percent of the original amount of the substance remain?
 (A) 131 days (B) 48 days (C) 2 days (D) 5 days (E) 76 days
- _____ 8. A population grows according to an exponential model, $y = A \cdot b^t$. If the population grew from its original population of 4,000 at $t = 0$ to a population of 16,000 8 years later at $t = 8$. Predict the population at $t = 20$.
 (A) 100,000 (B) 128,000 (C) 132,000 (D) 145,000 (E) 88,000
- _____ 9. Which of the following are equations of asymptotes for the function $f(x) = \frac{x^2 + x^3 - 6x}{(x-3)(x+2)}$?
 I. $x = 3$
 II. $x = -2$
 III. $y = x + 2$
 IV. $y = 1$
 (A) I only (B) I & II (C) II & IV (D) I & IV (E) I, II, & III

II. Free Response: Show all work in the space provided below the horizontal line.

Use correct units where appropriate. **ROUND ALL ANSWERS.**

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

$$W(t) = \frac{3456}{1 + 56e^{-0.1t}}$$



- (a) What was the initial number of Wassailers infected with cheer? (**round** to the nearest person)
 - (b) After how many minutes will the number of infected Wassailers be 660? Give an approximation **rounded** to the nearest minute.
 - (c) After how many minutes is the holiday cheer spreading at the fastest rate? (**round** to the nearest minute)
 - (d) How many Wassailers are infected after 24 minutes? (**round** to the nearest person)
 - (e) According to the model, what is a reasonable estimation of the number of people who attended Wassailfest?
 - (f) If the Grinch has a plan to crash the Wassailfest festivities if at least 55% 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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