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

E 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

[handwritten: $g(x) = (2)^{3(x+1)} = 2^{3(x+1)}$ could be horizontal compression by 3 and shifts left one unit]

E 2. What is constant percentage decay **rate** (as a percentage) of $P(t) = 1.23(0.951)^t$?
[handwritten: $= 1.23(1 - 0.049)$]
(A) 95.1   (B) 9.51   (C) 1.23   (D) 23   (E) 4.9

A 3. What is the growth **factor** in the equation $M(t) = 3\left(\dfrac{5}{2}\right)^t$? *[handwritten: Growth "factor" is not percent!]*
(A) 2.5   (B) 1.667   (C) 250%   (D) 167%   (E) 3

E 4. What is the equation of the exponential model, $y = Ab^t$, t in <u>weeks</u>, for quantity that starts with an initial value of 5, and **decreases** by a factor of 5 every week?

(A) $y = 5\left(\dfrac{1}{5}\right)^{1/t}$ (B) $y = 5^{t-1}$ (C) $y = \left(\dfrac{1}{5}\right)5^t$ (D) $y = 5^{t+1}$ (E) $y = 5^{1-t}$

[handwritten: $y = 5\left(\frac{1}{5}\right)^t = 5(5)^{-t}$ $\}$ $y = 5^{1-t}$]

B 5. What is the equation of the exponential model, $y = Ab^t$, t in <u>hours</u>, for quantity that starts with an initial value of 3.4, and **increases** by 200% every day?
(A) $y = 3.4\left(3^t\right)$ (B) $y = 3.4\left(3^{t/24}\right)$ (C) $y = 3.4\left(2^t\right)$ (D) $y = 3.4\left(2^{t/24}\right)$ (E) $y = 3.4\left(200^{t/24}\right)$
[handwritten: $y = 3.4(1+2)^{t/24}$]

D 6. Which of the following is equivalent to the function $f(x) = 7^x$?

(A) $g(x) = -\left(\dfrac{1}{7}\right)^{-x}$ (B) $g(x) = \left(\dfrac{1}{7}\right)^x$ (C) $g(x) = -\left(\dfrac{1}{7}\right)^x$ (D) $g(x) = \left(\dfrac{1}{7}\right)^{-x}$ (E) $g(x) = -7^{-x}$
[handwritten: $= 7^x$]

C 7. A single cell amoeba triples every 4 days. About how long will amoeba to produce a population of 5000? *[handwritten: $y = 1(3)^{t/4}$]*
(A) 11 days   (B) 21 days   (C) 31 days   (D) 41 days   (E) 51 days

A 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? *[handwritten: $y = 250(2)^{t/7.5}$]*
(A) 300.8 g   (B) 8192000 g   (C) 468750 g   (D) 14062.5 g   (E) 8333.3 g

B 9. For $x > 0$, which of the following is true?

(A) $3^x > 4^x$ (B) $7^x > 5^x$ (C) $\left(\dfrac{1}{6}\right)^x > \left(\dfrac{1}{2}\right)^x$ (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
$$W(t) = \frac{12456}{1+56e^{-0.7t}}$$

(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 5000? 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 a 15 minutes? (**round** to the nearest person)
(e) According the model, how many people attended Wassailfest?
(f) 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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a) $w(0) = 218.526$
   ≈ 219 Wassailers

b) $w(t) = 5000$
   $t = 5.179$
   ≈ 5 minutes

c) $w(t) = 12456/2 = 6228$
   $t = 5.750$
   $t \approx 6$ min

d) $w(15) = 12436.822$
   ≈ 12437 wassailers

e) 12456 wassailers

f) $w(t) = (0.75)(12456) = 9342$
   $t = 7.319$
   $t \approx 7$ min