3. [11 points] Three bacteria colonies, called A, B, and C, are established at the same time. The number of bacteria in these colonies are given by $A(t)$, $B(t)$, and $C(t)$, where t is measured in hours since the colonies were established. The formulas for these functions are

$$A(t) = 200 \cdot 2^t$$
$$B(t) = 500 \cdot 3^{t+1}$$
$$C(t) = 100 \cdot e^{2t}$$

a. [1 point] How many bacteria did Colony B start with?

Answer: _____

b. [1 point] Which, if any, colonies have a percent growth rate of 200% per hour? Circle **all** that are correct.

A   B   C   None

c. [6 points]

(i) Starting from the time the colonies were established, will colonies A and B ever have the same number of bacteria? If so, find the time when this happens, in exact form or rounded to at least two decimal places. If not, briefly explain why not.

Answer *(circle one):*   Yes: $t =$_____   No (explain below)

(ii) Starting from the time the colonies were established, will colonies A and C ever have the same number of bacteria? If so, find the time when this happens, in exact form or rounded to at least two decimal places. If not, briefly explain why not.

Answer *(circle one):*   Yes: $t =$_____   No (explain below)

Recall: A bacteria colony C has population $C(t)$, where t is measured in hours since the colony was established. The formulas for this function is

$$C(t) = 100 \cdot e^{2t}$$

   d. [3 points] Find a formula for $g(P)$, a function that gives the amount of time (in hours) it takes for colony C to reach P bacteria.

Answer: $g(P) = $ _____

4. [7 points] Let $g(x) = 2 \cdot (0.5)^{-3x} - 6$.

   a. [5 points] List the transformations you need to apply to the graph of $y = 0.5^x$ to transform it to that of $y = g(x)$. Fill each space with either a number or one of the phrases below, as appropriate. (Leave the second blank empty for reflections.)

   SHIFT IT TO THE LEFT   STRETCH IT HORIZONTALLY   REFLECT IT ACROSS THE y-AXIS

   SHIFT IT TO THE RIGHT   COMPRESS IT HORIZONTALLY   REFLECT IT ACROSS THE x-AXIS

   SHIFT IT UP   STRETCH IT VERTICALLY

   SHIFT IT DOWN   COMPRESS IT VERTICALLY

First,   _____ by _____

then,   _____ by _____

then,   _____ by _____

then,   _____ by _____

   b. [2 points] Give equations for all vertical and horizontal asymptotes of $g(x)$. If there are none, write None.

Answer: Vertical Asymptotes: _____

Answer: Horizontal Asymptotes: _____