

6. [17 points] A scientist is studying the mass, in milligrams (mg), of several different bacterial colonies.
- Colony A's mass is 17 mg at the start of the experiment, and it grows at a rate of 7% per hour.
  - Colony B's mass in mg  $t$  hours after the experiment begins is given by  $B(t) = 3e^{0.11t}$ .
  - Colony C's mass in mg  $t$  hours after the experiment begins is given by  $C(t) = 22(1.04)^t$ .
  - Two hours into the experiment, Colony D has a mass of 21 mg, but by four hours into the experiment, only 18 mg remains.

For each part of this problem, you must **show every step** of any algebraic work that is required.

- a. [3 points] Find a formula for the function  $A(t)$ , which gives the mass, in mg, of colony A  $t$  hours after the experiment begins.

**Answer:**  $A(t) =$  \_\_\_\_\_

- b. [2 points] By what percent is colony B growing each hour? Give your answer in exact form or rounded to at least two decimal places.

**Answer:** \_\_\_\_\_ %

- c. [3 points] How many hours will it take for colony B's population to triple?  
*Give your answer in exact form, and circle your final answer.*

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*This problem continues from the previous page and is restated for your convenience.*

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- d. [5 points] At what time  $t$  will the size of colonies B and C be the same?  
*Give your answer in exact form, and circle your final answer.*

- e. [4 points] Assuming colony D's mass is decaying exponentially, what will its mass (in mg) be 12 hours after the start of the experiment? *Give your answer in exact form.*

**Answer:** \_\_\_\_\_