Linear and Exponential Growth Practice

1. Jesse opened a burger restaurant 32 weeks ago. The table below shows the number of customers, *C*, during a particular week. Which of the following correctly explains the growth of *C* with respect to *w? (no calculator)*

Week	1	2	4	8	16	32
Customers	40	80	160	320	640	1280

   a. The number of customers per week grew linearly because the number of customers per week increased by approximately 40 every week.
   b. The number of customers per week grew exponentially because the number of customers per week increased by approximately 100 percent every week.
   c. The number of customers per week grew linearly because the number of customers per week increased by approximately 100 percent every week.
   d. The number of customers per week grew exponentially because the number of customers per week increased by approximately 40 every week.

2. 22 grams of a chemical are added to a metal. The amount *A,* in grams, of the chemical remaining during a reaction with a metal plate decreases by 0.4 grams per second. If instead the plate were dissolved, the amount A_1, in grams, of chemical remaining would decrease by half of itself every 5 seconds. How many grams greater is *A* than A_1 after 15 seconds? *(calculator)*
   a. 2.75
   b. 8.8
   c. 13.25
   d. 16

3. A computer program which computes up to the n^{th} digit in pi takes 0.1 milliseconds to compute the first digit. After this, each number takes twice as long as the previous number to compute. After an update on the program, the first digit takes 0.5 milliseconds to compute the first digit and each successive digit takes 0.3 milliseconds longer than the previous digit. How much longer in milliseconds does it take the old program to compute the 6^{th} digit in pi compared to the new program? *(no calculator)*
   a. 1.2
   b. 7.5
   c. 2.7
   d. 6.3

4. To approximate the relationship between a particular amount of hormone *t*, in micrograms per deciliter, $\frac{\mu g}{dl}$, in a wild giraffe's eyelash to the amount of hormone s, in $\frac{\mu g}{dl}$, in the giraffe's hoof, the following equation is used: $s = 200 + 135t$. Which of the following statements best describes the relationship between the amount of hormones in a giraffe's eyelash and a giraffe's hoof? *(no calculator)*
   a. It is linear because there is a $13.5\frac{\mu g}{dl}$ increase in s for every $0.1\frac{\mu g}{dl}$ increase in t.
   b. It is linear because there is a $20\frac{\mu g}{dl}$ increase in s for every $0.1\frac{\mu g}{dl}$ increase in t.
   c. It is exponential because there is a 67.5% increase in s for every 1% increase in t.
   d. It is exponential because there is a 148% increase in s for every 1% increase in t.

5. The following equation, $r = 25.4 + 1.59t$, relates the growth rate r, as a percent, of a particular ant colony to the number of weeks t since it was initially measured. Which of the following statements best describes the relationship between the weeks and the growth rate? *(no calculator)*
   a. It is linear because the growth rate increases by 25.4 each week.
   b. It is linear because the growth rate increases by 1.59 each week.
   c. It is exponential because the growth rate increases by 25% each week.
   d. It is exponential because the initial value is 1.59 and the growth rate increases by a factor of 25.4 each week.

Questions 6 and 7 refer to the following information.

6. The price of a new game console on the 1st of December is $150. After Christmas (the 25th of December), the manager estimates that the game console will drop in price by 14% each week for three weeks. The manager uses the equation $p = 150(r)^t$ to model the price, p, of the game console after t weeks. What value should the manager use for r? *(no calculator)*
   a. $r = 14$
   b. $r = 0.14$
   c. $r = 86$
   d. $r = 0.86$

7. What does the manager believe the price of the game console will be at the end of three weeks? (Round answer to nearest cent). *(calculator)*
   a. 147.42
   b. 108.20
   c. 95.41
   d. 64.0

Questions 8 and 9 refer to the following information.

8. A farmer is attempting to grow avocado trees. He bought 200 avocado trees for his farm and expects that the number of avocado trees his farm will have next year, $N_{next\ year}$, can be estimated from the number of avocado trees in his farm this year, $N_{this\ year}$, from the following equation.

$$N_{next\ year} = N_{this\ year} + 0.1\left(N_{this\ year}\right)\left(1 - \frac{N_{this\ year}}{K}\right)$$

Where the constant K is the number of trees his farm can support. According to the formula, what will be the number of avocado trees three years from now if $K = 300$? (Round your answer to the nearest whole number). *(calculator)*
   a. 200 trees
   b. 207 trees
   c. 213 trees
   d. 219 trees

9. The farmer realizes his initial equation was incorrect and comes up with the following new equation:

$$N_{next\ year} = N_{this\ year} + 0.3\left(N_{this\ year}\right)\left(1 - \frac{N_{this\ year}}{K}\right)$$

The farmer would like to increase the number of avocado trees that his farm can support so that the number of trees will increase more rapidly. If the farmer's goal is that the number of avocado trees will increase from 200 this year to 230 next year, approximately how many trees must the modified farmer be able to support? *(calculator)*
   a. 100
   b. 230
   c. 400
   d. 600

10. The following equation represents the population, $P(t)$, of a certain strain of bacteria in a petri dish measured after t hours. Which of the following best describes the relationship between population of bacteria and the number of hours that have passed? *(no calculator)*

$$P(t) = 219(2.1)^t$$

a. The relationship is linear because the population has 219 more bacteria than in the previous hour.
b. The relationship is linear because the population of bacteria has 2.1 more bacteria than in the previous hour.
c. The relationship is exponential since the population is 219 times larger than in the previous hour.
d. The relationship is exponential because the population of bacteria is 2.1 times larger than in the previous hour.