Geometric

$$S_n = \frac{a_1(1-r^n)}{1-r}$$

Arithmetic

$$S_n = \frac{n(a_1+a_n)}{2}$$

Name Schlansky Date ____________

Mr. Schlansky Algebra II

Modeling Series

1. Alexa earns $33,000 in her first year of teaching and earns a 4% increase in each successive year. Write a geometric series formula, S_n, for Alexa's total earnings over n years. Use this formula to find Alexa's total earnings for her first 15 years of teaching, to the *nearest cent*.

a_1 $r=1.04$ n

$a_1 = 33{,}000$

$r = 1.04$

$$S_n = \frac{a_1(1-r^n)}{1-r}$$

$$S_n = \frac{33000(1-1.04^n)}{1-1.04}$$

$$S_{15} = \frac{33000(1-1.04^{15})}{1-1.04}$$

~~$S_{15} = 660739$~~

$S_{15} = 660778.39$

2. Ross has a hobby of collecting comic books. He currently has 50 comic books and each year, he will increase his collection by 15%. Write a geometric series formula, S_n, for Ross' total amount of comic books after n years. Use this formula to find the total number of comic books Ross will have 12 years from now.

$r=1.15$ n

$a_1 = 50$

$r = 1.15$

$$S_n = \frac{a_1(1-r^n)}{1-r}$$

$$S_n = \frac{50(1-1.15^n)}{1-1.15}$$

$$S_{12} = \frac{50(1-1.15^{12})}{1-1.15}$$

$S_{12} \approx 1450$

3. Dee is planning on decreasing the amount of time she eats fast food per month. After the first month, she ate fast food 42 times. Each month, she eats at fast food restaurants 10% less than the previous month. Write a geometric series formula, S_n, for the total amount of fast food Dee eats after n months. Using your formula, how many total times does she eat fast food in the first four months? Round your answer to the nearest integer.

$1-.1$ $r=.9$ a_1 n

$a_1 = 42$

$r = .9$

$$S_n = \frac{a_1(1-r^n)}{1-r}$$

$$S_n = \frac{42(1-.9^n)}{1-.9}$$

$$S_4 = \frac{42(1-.9^4)}{1-.9}$$

$S_4 = 144$

4. Kina earns a $27,000 salary for the first year of work at her job. She earns annual increases of 2.5%. What is the total amount, to the *nearest cent*, that Kina will earn for the first eight years at this job?

a_1 $r=1.025$ S_n n

$a_1=27000$

$r=1.025$

$n=8$

$$S_n=\frac{a_1(1-r^n)}{1-r}$$

$$S_8=\frac{27000(1-1.025^8)}{1-1.025}$$

$$S_8=235875.13$$

5. Rowan is training to run in a race. He runs 15 miles in the first week, and each week following, he runs 3% more than the week before. Using a geometric series formula, find the total number of miles Rowan runs over the first ten weeks of training, rounded to the *nearest thousandth*.

$r=1.03$ a_1 S_n n

$a_1=15$

$r=1.03$

$n=10$

$$S_n=\frac{a_1(1-r^n)}{1-r}$$

$$S_{10}=\frac{15(1-1.03^{10})}{1-1.03}$$

$$S_{10}=171.958$$

6. A 7-year lease for office space states that the annual rent is $85,000 for the first year and will increase by 6% each additional year of the lease. What will the total rent expense be for the entire 7-year lease?

$r=1.06$ a_1 S_n n

$$S_n=\frac{a_1(1-r^n)}{1-r}$$

$a_1=85,000$

$r=1.06$

$n=7$

$$S_7=713476.20$$

$$S_7=\frac{85000(1-1.06^7)}{1-1.06}$$

7. A fisherman harvests 350 kilograms of crab on Monday. From Monday to Friday, the fisherman harvests 8% less kilograms of crab per day. To the *nearest tenth of a kilogram*, what is the total amount of crab harvested between Monday and Friday?

a_1 $r=.92$ S_n $n=5$

$a_1=350$

$r=.92$

$n=5$

$$S_n=\frac{a_1(1-r^n)}{1-r}$$

$$S_5=\frac{350(1-.92^5)}{1-.92}$$

$$S_5=1491.5$$

8. A ball is dropped from a height of 32 feet. It bounces and rebounds 80% of the height from which it was falling. What is the total downward distance, in feet, the ball traveled up to the 12th bounce?

a_1 $r=.8$ S_n n

$a_1=32$

$r=.8$

$n=12$

$$S_n=\frac{a_1(1-r^n)}{1-r}$$

$$S_{12}=149$$

$$S_{12}=\frac{32(1-.8^{12})}{1-.8}$$

$\cdot 2 \quad \cdot 2 \qquad r=2$

$.01, .02, .04$

9. Your parents want you to do some work around the house. You get them to agree to pay you \$.01 on the first day, \$.02 on the second day, \$.04 on the third day, and so on.
At the end of the 30-day month, what is the total amount of money your parents have paid you, to the *nearest cent*? n S_n

$a_1=.01$
$r=2$
$n=30$

$$S_n=\frac{a_1(1-r^n)}{1-r}$$

$$S_{30}=\frac{.01(1-2^{30})}{1-2}$$

$$S_{30}=10,737,418.23$$

10. On Sunday, the first day of the week, Tasha does 5 pushups. Each day, she increases the number of pushups she does by 6. How many total pushups will Tasha complete at the end of the 7 day week?

a_1 d anthmetic S_n n

$$a_n=a_1+d(n-1)$$
$$a_7=5+6(7-1)$$
$$a_7=41$$

$$S_n=\frac{n(a_1+a_n)}{2}$$

$a_1=5$
$a_n=41$
$n=7$

$$S_7=\frac{7(5+41)}{2}$$

$$S_7=161$$

11. Samantha logged her weekly running distances in the table below. If the continues increasing her distance at this rate, what is the total amount of miles Samantha will have ran after 10 weeks to the nearest tenth of a mile? n

Week	Distance (In Miles)
1	12
2	14.4
3	17.28
4	20.736

$\frac{14.4}{12}=1.2$

$\frac{17.28}{14.4}=1.2$

$$S_n=\frac{a_1(1-r^n)}{1-r}$$

$a_1=12$
$r=1.2$
$n=10$

$$S_{10}=\frac{12(1-1.2^{10})}{1-1.2}\approx 311.5$$

12. Brian deposited 1 cent into an empty non-interest bearing bank account on the first day of the month. He then additionally deposited 3 cents on the second day, 9 cents on the third day, and 27 cents on the fourth day. What would be the total amount of money in the account at the end of the 20th day if the pattern continued? S_n n

$\cdot 3 \quad \cdot 3$

$.01, .03, .09$

$$S_n=\frac{a_1(1-r^n)}{1-r}$$

$a_1=.01$
$r=3$
$n=20$

$$S_{20}=\frac{.01(1-3^{20})}{1-3}$$

$$S_{20}=17,433,922$$

13. Kristin wants to increase her running endurance. According to experts, a gradual mileage increase of 10% per week can reduce the risk of injury. If Kristin runs 8 miles in week one, which expression can help her find the total number of miles she will have run over the course of her 6-week training program?

$r = 1.1$ $\quad a_1$ $\quad S_n$

1) $\sum_{x=1}^{6} 8(1.10)^{x-1}$

2) $\sum_{x=1}^{6} 8(1.10)^{x}$

3) $\dfrac{8 - 8(1.10)^6}{0.90}$

4) $\dfrac{8 - 8(0.10)^x}{1.10}$

$S_n = \sum_{k=1}^{6} a_1(r)^{k-1}$ $\qquad S_n = \dfrac{a_1(1-r^n)}{1-r}$

$S_n = \sum_{k=1}^{6} 8(1.1)^{k-1}$ $\qquad S_6 = \dfrac{8(1-1.1^6)}{1-1.1}$

14. In his first year running track, Brendon earned 8 medals. He increases his amount of medals by 25% each year. Which of the following expressions can be used to determine how many total medals Brendon will have after four years of high school?

$r = 1.25$ $\quad a_1$ $\quad n$ $\quad a_1 = 8$ $\quad r = 1.25$

1) $\dfrac{8-8(0.25)^4}{-.25}$ $\qquad$ 3) $\dfrac{8-8(1.25)^4}{1-.25}$

2) $\sum_{n=1}^{4} 8(0.25)^{n-1}$ $\qquad$ 4) $\sum_{n=1}^{4} 8(1.25)^{n-1}$

$S_n = \sum_{k=1}^{4} a_1(r)^{k-1}$ $\qquad S_n = \dfrac{a_1(1-r^n)}{1-r}$

$S_4 = \sum_{k=1}^{4} 8(1.25)^{k-1}$ $\qquad S_4 = \dfrac{8(1-1.25^4)}{1-1.25}$

15. A company fired several employees in order to save money. The amount of money the company saved per year over five years following the loss of employees is shown in the table below.

Year	Amount Saved (in dollars)
1	59,000
2	64,900
3	71,390
4	78,529
5	86,381.9

Which expression determines the total amount of money saved by the company over 5 years?

1) $\dfrac{59,000 - 59,000(1.1)^5}{1 - 1.1}$ $\qquad$ 3) $\sum_{x=1}^{5} 59,000(1.1)^x$

2) $\dfrac{59,000 - 59,000(0.1)^5}{1 - 0.1}$ $\qquad$ 4) $\sum_{x=1}^{5} 59,000(0.1)^{x-1}$

$S_n = \sum_{k=1}^{n} a_1(r)^{k-1}$ $\qquad S_n = \dfrac{a_1(1-r^n)}{1-r}$

$S_5 = \sum_{k=1}^{5} 59,000(1.1)^{k-1}$ $\qquad S_5 = \dfrac{59000(1-1.1^5)}{1-1.1}$