Name ____________ Date _____________

Mr. Schlansky Algebra II

Modeling Sequences

1. The formula below can be used to model which scenario?

$$a_1 = 3000$$
$$a_n = 0.80a_{n-1}$$

1) The first row of a stadium has 3000 seats, and each row thereafter has 80 more seats than the row in front of it.
2) The last row of a stadium has 3000 seats, and each row before it has 80 fewer seats than the row behind it.
3) A bank account starts with a deposit of $3000, and each year it grows by 80%.
4) The initial value of a specialty toy is $3000, and its value each of the following years is 20% less.

2. The sequence defined by $r_1 = 15$ and $r_n = 0.75r_{n-1}$ best models which scenario?

1) Gerry's $15 allowance is increased by $0.75 each week.
2) A store that has not sold a $15 item reduces the price by $0.25 each week until someone purchases it.
3) A 15-gram sample of a chemical compound decays at a rate of 75% per hour.
4) A picture with an area of 15 square inches is reduced by 25% over and over again to make a proportionally smaller picture.

3. Which situation *cannot* be modeled by the formula $f(n) = f(n-1) + 20$ with $f(1) = 10$?

1) Nancy put $10 in her piggy bank on the first day and then added $20 daily to her piggy bank.
2) Jay has a box of ten crayons and his teacher gives him twenty new crayons each month for good behavior.
3) Buzz has ten apples and that number increases by 20% per week.
4) Teresa has a block of metal that is 10°F and she heats it up at a rate of 20°F per minute.

4. The height of Jenny's sunflower when she planted it was 6 inches. The sunflower grows by 0.25 inches per day. Which formula can be used to determine the height, in inches, of Jenny's sunflower on day *n*?

(1) $h_0 = 6$, $h_n = 0.25a_{n-1}$

(2) $h_0 = 6$, $h_n = 6 + 0.25h_{n-1}$

(3) $h_0 = 6$, $h_n = h_{n-1} + 0.25$

(4) $h_0 = 6$, $h_n = 6h_{n-1} + 0.25$

5. A lumber yard has 1500 2” by 4” pieces of wood that need to be transported to a construction site. A truck can take 100 pieces of wood per trip. Which sequence can be used to determine the number of pieces of wood left at the lumberyard after *n* trips?

(1) $a_0 = 1500$
$a_n = a_{n-1} - 100$

(3) $a_0 = 1500$
$a_n = 1500 - 100a_{n-1}$

(2) $a_0 = 1500$
$a_n = 100 - a_{n-1}$

(4) $a_0 = 1500$
$a_n = 100 - 1500a_{n-1}$

6. The average depreciation rate of a new boat is approximately 8% per year. If a new boat is purchased at a price of $75,000, which model is a recursive formula representing the value of the boat *n* years after it was purchased?

1) $a_n = 75,000(0.08)^n$

3) $a_n = 75,000(1.08)^n$

2) $a_0 = 75,000$
$a_n = (0.92)^n$

4) $a_0 = 75,000$
$a_n = 0.92(a_{n-1})$

7. A population of bacteria triples every day. If on the first day there are 300 bacteria in a Petri dish, which recursive sequence can be used to determine the population on day *n*?

(1) $b_1 = 300$
$b_n = 3b_{n-1}$

(3) $b_1 = 300$
$b_n = 300(3b_{n-1})$

(2) $b_1 = 300$
$b_n = b_{n-1} + 3$

(4) $b_1 = 300$
$b_n = \frac{1}{3}b_{n-1}$

8. The values below represent the cost of an ice cream sundae with one through four toppings.

$4.75 $5.50 $6.25 $7.00

Write an explicit and recursive function that can be used to determine the cost of an ice cream cone with *n* toppings.

9. A theater with 15 rows has 10 seats in the first row, 12 seats in the second row, 14 seats in the third row, and so on. Write an explicit and recursive formula that can be used to determine the number of seats in the *n*th row of the theater.

10. Dana began an exercise program using a FitBit to measure her distance walked on her treadmill, in miles, per week. The following table shows her progress over three weeks.

Week	1	2	3
Distance Walked on Treadmill (miles)	9	11.7	15.21

If she continues to progress in this manner, which of the listed statements could model the number of miles Dana walks on her treadmill, a_n, in terms of n, the number of weeks?

(1) $a_n = 9(1.3)^n$

(3) $a_1 = 9$
$a_n = 1.3a_{n-1}$

(2) $a_n = 9 + 2.7(n-1)$

(4) $a_1 = 9$
$a_n = 2.7 + a_{n-1}$

11. The population of Jamesburg for the years 2010-2013, respectively, was reported as follows:
250,000 250,937 251,878 252,822
How can this sequence be recursively modeled?

1) $j_n = 250,000(1.00375)^{n-1}$

3) $j_1 = 250,000$
$j_n = 1.00375j_{n-1}$

2) $j_n = 250,000 + 937^{(n-1)}$

4) $j_1 = 250,000$
$j_n = j_{n-1} + 937$

12. In 2010, the population of New York State was approximately 19,378,000 with an annual growth rate of 1.5%. Assuming the growth rate is maintained for a large number of years, which equation can be used to predict the population of New York State t years after 2010?

1) $P_t = 19,378,000(1.5)^t$

2) $P_0 = 19,378,000$
$P_t = 19,378,000 + 1.015P_{t-1}$

3) $P_t = 19,378,000(1.015)^{t-1}$

4) $P_0 = 19,378,000$
$P_t = 1.015P_{t-1}$

13. The Rickerts decided to set up an account for their daughter to pay for her college education. The day their daughter was born, they deposited \$1000 in an account that pays 1.8% compounded annually. Beginning with her first birthday, they deposit an additional \$750 into the account on each of her birthdays. Which expression correctly represents the amount of money in the account *n* years after their daughter was born?

1) $a_n = 1000(1.018)^n + 750$

2) $a_n = 1000(1.018)^n + 750n$

3) $a_0 = 1000$
$a_n = a_{n-1}(1.018) + 750$

4) $a_0 = 1000$
$a_n = a_{n-1}(1.018) + 750n$

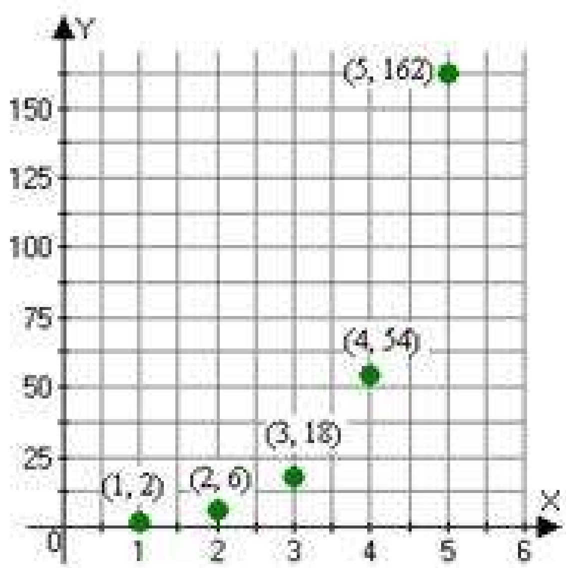
14. The owners of an alligator farm in Florida started with 20 alligators the first month. The second month they had 30 alligators and the third month they had 45 alligators. Assuming this pattern continues, write an explicit and recursive formula to represent the number of alligators on the farm after *n* months.

15. A bouncy ball rebounds to 90% of the height of its previous bounce. Craig drops a bouncy ball from a height of 20 feet above the ground. Write an explicit and recursive formula for the rebound height of a bouncy ball h_n.

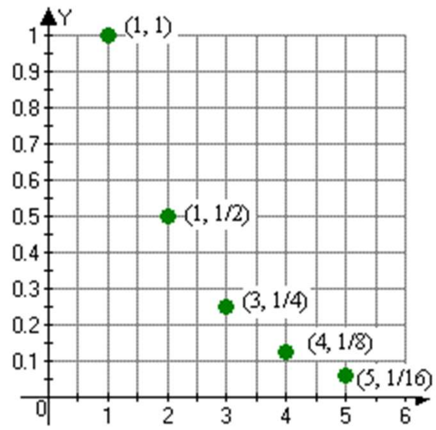
16. A laboratory culture begins with 1,000 bacteria at the beginning of the experiment, which we denote by time 0 hours. By time 2 hours, there are 2,890 bacteria. Find the explicit formula for term P_n of the sequence in this case. Write a recursive formula for P_n in terms of P_{n-1}.

17. Simon lost his library card and has an overdue library book. When the book was 5 days late, he owed \$2.25 to replace his library card and pay the fine for the overdue book. When the book was 21 days late, he owed \$6.25 to replace his library card and pay the fine for the overdue book. Suppose the total amount Simon owes when the book is n days late can be determined by an arithmetic sequence. Determine a formula for a_n, the nth term of this sequence. Use the formula to determine the amount of money, in dollars, Simon needs to pay when the book is 60 days late.

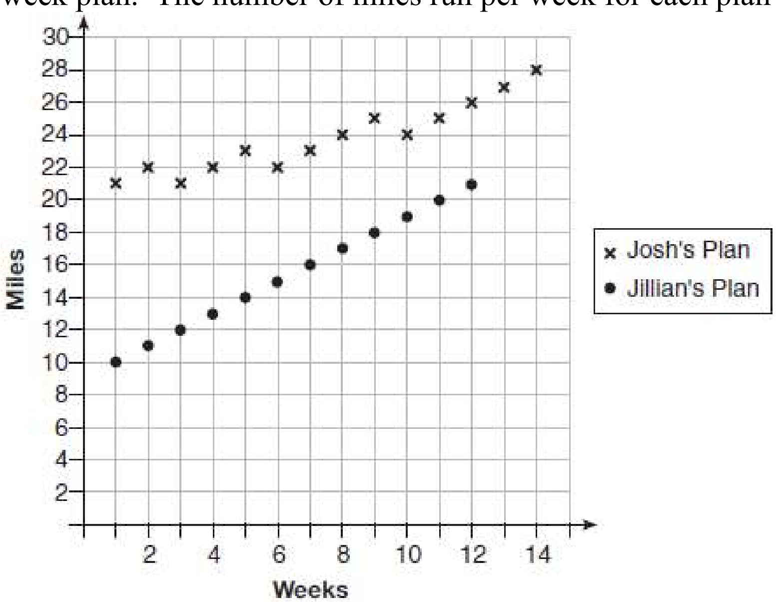
18. Does the graph below represent a geometric sequence? Explain your answer. Write a recursive function that can be used to represent y in terms of x.



19. The following graph shows the amount of a substance remaining after t hours. Write a recursive and explicit formula to represent the amount of the substance remaining after t hours.



20. Elaina has decided to run the Buffalo half-marathon in May. She researched training plans on the Internet and is looking at two possible plans: Jillian's 12-week plan and Josh's 14-week plan. The number of miles run per week for each plan is plotted below.



Which one of the plans follows an arithmetic pattern? Explain how you arrived at your answer. Write a recursive definition to represent the number of miles run each week for the duration of the plan you chose. Jillian's plan has an alternative if Elaina wanted to train instead for a full 26-mile marathon. Week one would start at 13 miles and follow the same pattern for the half-marathon, but it would continue for 14 weeks. Write an explicit formula, in *simplest form*, to represent the number of miles run each week for the full-marathon training plan.