LESSON MAKER PRO

Step by Step

Build sequences and models with recursive rules.

HIGH SCHOOL · FM.R.A.13

FM.R.A.13 "Use the recursive process and difference equations to create fractals, population growth models, sequences, and series."

NAME _____ DATE _____

THE BIG IDEA

A recursive rule tells you how to get each term from the one before it. In $a_{n+1} = a_n + d$, add d each step. In $a_{n+1} = r\,a_n$, multiply by r each step.

WORKED EXAMPLE

Let $a_0 = 14$ and $a_{n+1} = a_n + 9$. Find a_3.

1. $a_1 = 14 + 9 = 23$
2. $a_2 = 23 + 9 = 32$
3. $a_3 = 32 + 9 = 41$

Answer: $a_3 = 41$

PRACTICE 6 problems

1 Let $a_0 = 5$ and $a_{n+1} = a_n + 3$. Find a_4.

ANSWER _____

2 Let $a_0 = 50$ and $a_{n+1} = a_n - 8$. Find a_3.

ANSWER _____

3 Let $a_0 = 2$ and $a_{n+1} = 3a_n$. Find a_4.

ANSWER _____

4 Use the table. Write a rule for a_{n+1} in terms of a_n, then find a_4.

SEQUENCE VALUES

n	a_n
0	1
1	5
2	25
3	125

ANSWER _____

5 Let $a_0 = 100$ and $a_{n+1} = a_n + d$. If $a_2 = 130$, find d.

ANSWER _____

6 Let $a_0 = 3$ and $a_{n+1} = 2a_n$. Find the sum $a_0 + a_1 + a_2 + a_3$.

ANSWER _____

APPLY IT Show your work

1 A video channel has 160 subscribers at the start of week 0. Its subscriber count grows by 25% each week. Let s_n be the count at the start of week n. Write a recursive rule and find s_2.

WORK SPACE

ANSWER _____

2 A phone battery is at 96% at hour 0. Each hour, it loses 25% of its remaining charge. Let b_n be the battery percentage after n hours. Write a recursive rule and find b_2.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Let $a_0 = 2$ and $a_{n+1} = a_n + 2n + 1$. Find a_4 and the sum of the first five terms. Explain which amounts you added to build the terms.

WORK SPACE AND ANSWER

Step by Step

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Let $a_0 = 5$ and $a_{n+1} = a_n + 3$. Find a_4.	**$a_4 = 17$**
2	Let $a_0 = 50$ and $a_{n+1} = a_n - 8$. Find a_3.	**$a_3 = 26$**
3	Let $a_0 = 2$ and $a_{n+1} = 3a_n$. Find a_4.	**$a_4 = 162$**
4	Use the table. Write a rule for a_{n+1} in terms of a_n, then find a_4.	**$a_{n+1} = 5a_n$; $a_4 = 625$**
5	Let $a_0 = 100$ and $a_{n+1} = a_n + d$. If $a_2 = 130$, find d.	**d = 15**
6	Let $a_0 = 3$ and $a_{n+1} = 2a_n$. Find the sum $a_0 + a_1 + a_2 + a_3$.	**45**

PART 2 · APPLY IT

1. **$s_0 = 160$; $s_{n+1} = (5/4)s_n$; $s_2 = 250$ subscribers** A 25% increase means multiplying by 5/4 each week. The counts are 160, 200, and 250.
2. **$b_0 = 96$; $b_{n+1} = (3/4)b_n$; $b_2 = 54\%$** After each hour, 3/4 of the charge remains. The percentages are 96%, 72%, and 54%.

CHALLENGE

$a_4 = 18$, and the sum is 40. Starting at 2, add 1, then 3, then 5, then 7 to get 2, 3, 6, 11, 18.

Accept equivalent recursive rules, such as multiplying by 1.25 instead of 5/4. In the challenge, the first five terms are a_0 through a_4.