LESSON MAKER PRO

Sequence Signals

Build rules and identify function patterns

HIGH SCHOOL · A1P.AF.G.22.a

A1P.AF.G.22.a "Write explicit and recursive formulas for arithmetic and geometric sequences and connect them to linear and exponential functions."

NAME _____ **DATE** _____

TWO KINDS OF CHANGE

An arithmetic sequence adds the same difference each time, so its explicit rule is a linear function of n. A geometric sequence multiplies by the same ratio each time, so its explicit rule is an exponential function of n. A recursive rule gives the first term and tells how to find each next term.

WORKED EXAMPLE

Use the table to write explicit and recursive rules. Is the function of n linear or exponential?

n	1	2	3
a_n	8	14	20

1. 14 - 8 = 6, and 20 - 14 = 6. The difference is constant.
2. Explicit: $a_n = 8 + 6(n - 1) = 6n + 2$.
3. Recursive: $a_1 = 8$; $a_n = a_{n-1} + 6$ for $n \geq 2$.

Answer: $a_n = 6n + 2$; $a_1 = 8$ and $a_n = a_{n-1} + 6$ for $n \geq 2$. Linear.

PRACTICE 4 problems

1 For 4, 13, 22, ... write explicit and recursive rules. Is the function of n linear or exponential?

ANSWER _____

2 For 10, 7, 4, ... write explicit and recursive rules. Is the function of n linear or exponential?

ANSWER _____

3 For 2, 10, 50, ... write explicit and recursive rules. Is the function of n linear or exponential?

ANSWER _____

4 For 81, 27, 9, ... write explicit and recursive rules. Is the function of n linear or exponential?

ANSWER _____

APPLY IT Show your work

1 You put $19 in a concert fund in week 1 and add $4 each week. Write explicit and recursive rules for the total after week n. How much is in the fund after week 5?

WORK SPACE

ANSWER _____

2 A video gets 15 views on day 1. Its daily views triple each day. Write explicit and recursive rules for views on day n. How many views does it get on day 4?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A geometric sequence has $a_1 = 48$ and $a_3 = 12$. Its ratio is positive. Write explicit and recursive rules. If f(x) follows the same pattern and $f(n) = a_n$ for positive integers n, find f(0).

WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For 4, 13, 22, ... write explicit and recursive rules. Is the function of n linear or exponential?	**$a_n = 9n - 5$; $a_1 = 4$ and $a_n = a_{n-1} + 9$ for $n \geq 2$. Linear.**
2	For 10, 7, 4, ... write explicit and recursive rules. Is the function of n linear or exponential?	**$a_n = 13 - 3n$; $a_1 = 10$ and $a_n = a_{n-1} - 3$ for $n \geq 2$. Linear.**
3	For 2, 10, 50, ... write explicit and recursive rules. Is the function of n linear or exponential?	**$a_n = 2 \cdot 5^{n-1}$; $a_1 = 2$ and $a_n = 5a_{n-1}$ for $n \geq 2$. Exponential.**
4	For 81, 27, 9, ... write explicit and recursive rules. Is the function of n linear or exponential?	**$a_n = 81(1/3)^{n-1}$; $a_1 = 81$ and $a_n = (1/3)a_{n-1}$ for $n \geq 2$. Exponential.**

PART 2 · APPLY IT

1. **$a_n = 19 + 4(n - 1)$; $a_1 = 19$ and $a_n = a_{n-1} + 4$ for $n \geq 2$. Week 5: \$35.** The total grows by \$4 each week, so it is linear. At week 5, $19 + 4(5 - 1) = 35$.
2. **$a_n = 15 \cdot 3^{n-1}$; $a_1 = 15$ and $a_n = 3a_{n-1}$ for $n \geq 2$. Day 4: 405 views.** The daily count has a ratio of 3, so it is exponential. On day 4, the count is $15 \cdot 3^3 = 405$.

CHALLENGE

$48r^2 = 12$, so the positive ratio is $r = 1/2$. Explicit: $a_n = 48(1/2)^{n-1}$. Recursive: $a_1 = 48$ and $a_n = (1/2)a_{n-1}$ for $n \geq 2$. Since $f(x) = 96(1/2)^x$, $f(0) = 96$.

Accept equivalent explicit rules and recursive rules that clearly state the first term. In the challenge, the positive-ratio condition rules out -1/2.