LESSON MAKER PRO

Sequence Rule Quest

Find the pattern, then write the rule.

GRADE 8 · 8A.AF.H.24

8A.AF.H.24 "Define sequences as functions, including recursive definitions, whose domain is a subset of the integers. a. Write explicit and recursive formulas for arithmetic and geometric sequences and connect them to linear and exponential functions."

NAME _____ DATE _____

TWO WAYS TO WRITE A SEQUENCE

A sequence is a function whose term numbers are integers, such as 1, 2, 3, and so on. Adding the same amount each time gives a linear rule, $f(n)=a+(n-1)d$; multiplying by the same factor gives an exponential rule, $f(n)=a\cdot r^{n-1}$. A recursive rule gives the first term and uses the previous term to find the next.

WORKED EXAMPLE

Write explicit and recursive rules for the sequence in the table.

n	f(n)
1	19
2	30
3	41

1. 30-19=11 and 41-30=11, so add 11 each time.
2. Explicit: f(n)=19+11(n-1).
3. Recursive: f(1)=19; f(n)=f(n-1)+11 for n=2, 3, ...

Answer: f(n)=19+11(n-1); f(1)=19 and f(n)=f(n-1)+11 for n=2, 3, ...

PRACTICE 4 problems

1 The first three terms are 2, 7, 12. Write explicit and recursive rules.

ANSWER _____

2 The first three terms are 3, 9, 27. Write explicit and recursive rules.

ANSWER _____

3 For f(n)=6+7(n-1), find f(4). Is the function linear or exponential?

ANSWER _____

4 For g(1)=5 and g(n)=2g(n-1), find g(4). Is the function linear or exponential?

ANSWER _____

APPLY IT Show your work

1 A game awards 12 coins on day 1. Each day, it awards 5 more coins than the day before. Write explicit and recursive rules for coins awarded on day n. How many coins does it award on day 6?

WORK SPACE

ANSWER _____

2 A video gets 4 shares in hour 1. The number of shares each hour doubles. Write an explicit rule for shares in hour n. How many shares does it get in hour 5?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Club A gains 4 members on day 1 and 4 more members each day than on the day before. Club B gains 2 members on day 1 and doubles its daily gain each day. Write an explicit rule for each club's daily gain. On which day does Club B first gain more members than Club A?

WORK SPACE AND ANSWER

ANSWER KEY

Sequence Rule Quest

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	The first three terms are 2, 7, 12. Write explicit and recursive rules.	**f(n)=2+5(n-1); f(1)=2 and f(n)=f(n-1)+5 for n=2, 3, …**
2	The first three terms are 3, 9, 27. Write explicit and recursive rules.	**$f(n)=3\cdot3^{n-1}$; f(1)=3 and f(n)=3f(n-1) for n=2, 3, …**
3	For f(n)=6+7(n-1), find f(4). Is the function linear or exponential?	**f(4)=27; linear.**
4	For g(1)=5 and g(n)=2g(n-1), find g(4). Is the function linear or exponential?	**g(4)=40; exponential.**

PART 2 · APPLY IT

1. **c(n)=12+5(n-1); c(1)=12 and c(n)=c(n-1)+5 for n=2, 3, …; 37 coins on day 6.** The daily award increases by 5. Substitute n=6 into the explicit rule: 12+5(5)=37.
2. **$s(n)=4\cdot2^{n-1}$; 64 shares in hour 5.** The first term is 4 and the factor is 2. For hour 5, calculate $4\cdot2^4=64$.

CHALLENGE

Club A: a(n)=4+4(n-1), or 4n. Club B: $b(n)=2\cdot2^{n-1}$. Day 5: Club B gains 32 members and Club A gains 20. On day 4, both gain 16, so day 5 is the first day Club B gains more.

Accept equivalent simplified explicit rules. Recursive rules must state the first term and how each later term follows from the previous one.