9.4 Sequences

Sequence Vocab.

#68

sequence - an ordered progression of numbers

finite - A Sequence that ends

infinite - A sequence that doesn't end

5, 10, 15, 20, 25

Finite

2, 4, 8, 16, 32,…,2^k, ...

Infinite

#68 - back

explicit - each term is defined independently

$9, 14, 19, \ldots$

$\{a_n\}$

rule: $a_n = \underline{4 + 5n}$

$a_1 = 4+5(1) = 9$ $a_2 = 4+5(2) = 14$ $a_3 = 19$ $a_{100} = 504$

recursive - use the previous term to define the following terms

$5, 1, -3, -7$

rule: $\boxed{a^1 = 5}$ $\boxed{a^{n+1} = a^n - 4}$

$a_3 = \boxed{a_2}{}_{+1} = a_2 - 4$

$1 - 4$

-3

$a_1 = 5$

$a_2 = a_{1+1} = a_1 - 4 = 5 - 4 = 1$

Arithmetic Sequence

#69

arithmetic - sequence with common difference between successive terms (repeated addition)

Memorize for test! * explicit rule: $\boxed{a_n = a_1 + (n-1)d}$

d = common difference

n = term number

a = term

Memorize for test! * recursive rule: $a_n = a_{n-1} + d \quad n \geq 2$

a_1

Find the common difference, a recursive rule, and an explicit rule for the following sequences:

-6, -2, 2, 6, 10, ... $d=4$

4 4 4 4

$\boxed{a_1=-6}$ $a_n=a_{n-1}+d$

$\boxed{a_n=a_{n-1}+4}$

$a_n=a_1+(n-1)d$

$=-6+(n-1)4$

$=-6+4n-4$

$\boxed{a_n=4n-10}$

5, 2, -1, -4, -7, ... $d=-3$

-3

$\boxed{a_1=5 \quad a_n=a_{n-1}-3}$

$a_n=5+(n-1)(-3)$

$=5-3n+3$

$\boxed{a_n=-3n+8}$

$a_{10}=-3(10)+8$

$=-30+8=\boxed{-22}$

Geometric Sequence

#70

geometric - sequence with a common ratio (quotient) between successive terms (repeated multiplication)

Memorize for Test! * explicit rule: $\boxed{a_n = a_1 \bullet r^{(n-1)}}$

r = common ratio

n = term number

a = term

* recursive rule: $\boxed{a_n = a_{n-1} \bullet r \qquad n \geq 2}$

Memorize For Test!

Find the common ratio, a recursive rule, and an explicit rule for the following sequences:

2, 6, 18, 54, ... $r=3$

$3 \quad 3 \quad 3$

$a_n = a_1 \cdot r^{n-1}$

$\boxed{a_n = 2 \cdot 3^{n-1}}$

$a_{10} = 2 \cdot 3^{(10-1)}$

$= 2 \cdot 3^9$

$a_1 \qquad a_n = a_{n-1} \cdot r$

$\boxed{a_1 = 2 \quad a_n = 3a_{n-1}}$

4, -2, 1, $-\frac{1}{2}$, ...

$-\frac{1}{2} \quad -\frac{1}{2} \quad -\frac{1}{2}$

$r = -\frac{1}{2}$

$\boxed{a_1 = 4 \quad a_n = -\frac{1}{2} a_{n-1}}$

$\boxed{a_n = 4 \cdot \left(-\frac{1}{2}\right)^{n-1}}$

Find the first 5 terms of the recursive sequence:

$$b_1 = -1 \textit{ and } b_{k+1} = b_k + 10 \quad \text{for} \quad k \geq 1$$

$b_2 = 9$

$b_3 = 19$

$b_4 = 29$

$b_5 = 39$

$a_n = a_1 + (n-1)d$

$= -1 + (n-1)(10)$

$=$