Recursive Sequences

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Recursion: a process in which each step of the pattern is **dependent on the previous term.**

Recursive Formulas

Arithmetic:
d = Common difference

$$\boxed{\begin{array}{c} a_n = a_{n-1} + d \\ a_1 = \_\_\_ \end{array}}$$

a_{n-1} = Previous term

Geometric:
r = Common ratio

$$\boxed{\begin{array}{c} a_n = r \cdot a^{n-1} \\ a_1 = \_\_\_ \end{array}}$$

Find the recursive equation given the following:

1. 2, -5, -12, -19, …. $a_n = a_{n-1} + d$, $a_1 = \_\_\_$

d = -7

$a_n = a_{n-1} + \cancel{d}^{-7}$, $a_1 = 2$

$$\boxed{\begin{array}{c} a_n = a_{n-1} - 7 \\ a_1 = 2 \end{array}}$$

2. 100, 50, 25, …. $a_n = r \cdot a^{n-1}$, $a_1 = \_\_\_$

r = ½

$$\boxed{\begin{array}{c} a_n = (\tfrac{1}{2}) \cdot a^{n-1} \\ a_1 = 100 \end{array}}$$

3. $a_n = 5 - 2(n-1)$

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

$a_1 = 5$ $d = -2$

$$\boxed{\begin{array}{c} a_n = a_{n-1} - 2 \\ a_1 = 5 \end{array}}$$

4. $a_n = 5(-2)^n$

$a_1 = 5(-2)^1 = -10$

r = -2

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

$$\boxed{\begin{array}{c} a_n = (-2)a^{n-1} \\ a_1 = -10 \end{array}}$$

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Find the first 3 terms of each arithmetic sequence and write the recursive formula:

1. $a_1 = 43 \quad d = 10$

$a_n = a_{n-1} + 10$

$a_1 = 43$

$a_2 = a_{2-1} + 10$

$a_2 = a_1 + 10 = 43 + 10 = 53$

$a_3 = a_{3-1} + 10 = 53 + 10 = 63$

2. $a_1 = -8 \quad r = -2$

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

$a_1 = -8$

$a_2 = (-2)a_{2-1}$

$= -2(-8) = 16$

$a_3 = -2 \cdot a_{3-1}$

$-2(16) = -32$

Find the first ~~five~~ 4 terms of the following sequences.

1. $a_1 = 2,\ a_n = (a_{n-1})^2 + 3$

2. $a_n = 2a_{n-1} + a_{n-2}$

$a_1 = 3,\ a_2 = 5$

3. $a_1 = 2,\ a_n = (-1)^{n-1} * 3a_{n-1}$

Find the first 3 terms of each arithmetic sequence and write the recursive formula:

1. $a_1 = 43 \quad d = 10$

$$\boxed{\begin{array}{c} a_n = a_{n-1} + 10 \\ a_1 = 43 \end{array}}$$

$a_2 = a_{2-1} + 10$

$a_2 = a_1 + 10$

$a_2 = 43 + 10 = \underline{\underline{53}}$

$a_3 = a_{3-1} + 10$

$a_3 = a_2 + 10$

$= 53 + 10 = \underline{63}$

2. $a_1 = -8 \quad r = -2$

$$\boxed{\begin{array}{c} a_n = r \cdot a_{n-1} \\ a_1 = -8 \end{array}}$$

$a_2 = r \cdot a_{2-1}$

$= (-2)(-8) = 16$

$a_3 = (-2)(16) = -32$

Find the first ~~five~~ 3 terms of the following sequences.

1. $a_1 = 2$, $a_n = (a_{n-1})^2 + 3$ $\quad a_2 = 7 \quad a_3 = 52$

$a_2 = (a_{2-1})^2 + 3$

$a_2 = (2)^2 + 3 = 7$

$a_3 = (a_{3-1})^2 + 3$

$= (7)^2 + 3 = 52$

$a_4 = (a_3)^2 + 3$

$(52)^2 + 3 = 2707$

2. $a_n = 2a_{n-1} + a_{n-2}$ $\quad a_3 = 13$

$a_1 = 3$, $a_2 = 5$

$a_3 = 2a_{3-1} + a_{3-2}$

$= 2a_2 + a_1$

$= 2(5) + 3 = 13$

$a_4 = 2a_3 + a_2$

$= 2(13) + 5$

$= 31$

3. $a_1 = 2$, $a_n = (-1)^{n-1} * 3a_{n-1}$

$a_2 = (-1)^{2-1} \cdot 3a_{2-1}$

$= -1 \cdot 3(2) = -6$

$a_3 = (-1)^{3-1} \cdot 3a_{3-1}$

$1 \cdot 3 \cdot (-6) = -18$

$a_4 = (-1)^3 \cdot 3(-18)$

$-1(-54) = 54$

Given the sequence $a_n = a_{n-1} + 4n$ and $a_5 = 487$, find the first term.

$a_5 = a_4 + 4(5)$

$487 = a_4 + 20$

$467 = a_4$

$a_4 = a_3 + 4(4)$

$467 = a_3 + 16$

$451 = a_3$

$a_3 = a_2 + 4(3)$

$451 = a_2 + 12$

$439 = a_2$

$a_2 = a_1 + 4(2)$

$439 = a_1 + 8$

$\boxed{431 = a_1}$