# 7.5: Use Recursive Rules with Sequences

Explicit Rule: gives $a_n$ as a function of the term's position number n in the sequence $a_n = 2 - 5n$

Recursive rule: gives the beginning term or terms of a sequence and then a recursive equation that tells how $a_n$ is related to one or more preceding terms

$$a_1 = 4$$

$$a_n = a_{n-1} + 5$$

## Recursive Equations for Arithmetic and Geometric Sequences

Arithmetic Sequence

$a_n = a_{n-1} + d$ (d is the common difference)

Geometric Sequence

$a_n = r(a_{n-1})$ (r is the common ratio)

$a_1 = 4$

$a_n = a_{n-1} + 3$

$a_2 = a_{2-1} + 3$

$= 4 + 3 = 7$

$a_3 = a_2 + 3$

$= 7 + 3$

$= 10$

Write the first five terms of the sequence.

1) $a_1 = 2$ $\quad a_n = a_{n-1} - n^2$

$a_2 = a_{2-1} - 2^2 = a_1 - 4 = 2 - 4 = -2$

$a_3 = -11$

$a_4 = -27$

$a_5 = -52$

Write a recursive rule for the sequence.

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

2) 3, 12, 48, 192, 768, ...

$r = 4$

$a_2 = 4 \cdot a_1 = 4 \cdot 3 = 12$

$a_1 = 3$

$a_n = 4 \cdot a_{n-1}$

Write a recursive rule for the sequence.

3) 1, 8, 15, 22, 29, ...

$d = 7$

$a_1 = 1$

$a_n = a_{n-1} + 7$

Given an explicit rule, write a recursive rule.

4) $a_n = 5 - 3n$

Arithmetic
$d = -3$

$a_1 = 2$

$a_n = a_{n-1} - 3$

Given an explicit rule, write a recursive rule.

5) $a_n = 2(3)^{n-1}$

$a_1 = 2$

$a_n = 3 \cdot a_{n-1}$

$a_2 = 3 \cdot a_1 = 3 \cdot 2 = 6$

$a_3 = 3 \cdot a_2 = 3 \cdot 6 = 18$

$a_2 = 2 \cdot 3^1 = 6$

$a_3 = 2 \cdot 3^2 = 18$

Given a recursive rule, write an explicit rule.

6) $a_1 = 15 \quad a_n = a_{n-1} + 11$

Arithmetic $d = 11$

$a_n = 4 + 11n$

$a_2 = 4 + 11(2)$

$= 26$

$a_1 = 15$

$a_2 = a_1 + 11$

$= 15 + 11$

$= 26$

Given a recursive rule, write an explicit rule.

6) $a_1 = 324 \quad a_n = 1/3(a_{n-1})$

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

$$a_n = 324\left(\frac{1}{3}\right)^{n-1}$$