Recursive Formulas

Suppose you have a random sequence: $a = 4, 7, 10, 13, \ldots$ and you want to find the 55th term.

Explicit formulas let you calculate the value of the term by simply plugging in the number of the term.

$a_{n=}4 + 3(n - 1)$ » $a_n = 4 + 3(55 - 1) = 4 + 3(54) = 4 + 162 = 166$

For recursive formulas, you NEED to know the previous value in order to calculate the term you want.

In other word, to find the 55th term, you would have to find the 54th term first.

But the only way to find the 54th term would be to find the 53rd term, etc.

These formulas are not practical for hand calculations, but are easy for computers.

Computer routines require an initial value of a variable **and** a rule for computing future values.

Recursive formulas are easy to write, but NOTE: they have TWO components (you need both).

$a = 4, 7, 10, 13, \ldots$

$a_1 = 4$

$a_2 = 7 = 4 + 3 = a_1 + 3$

$a_3 = 10 = 7 + 3 = a_2 + 3$

$a_4 = 13 = 10 + 3 = a_3 + 3$

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

Recursive formula for arithmetic sequences:

$$a_1 = a\ number$$
$$a_n = a_{n-1} + d$$

Recursive formula for geometric sequences:

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

Ex: For each sequence, state what type it is, and then write BOTH the explicit and recursive formulas for the sequence.

$a = 5, 3, 1, -1, \ldots$ Arithmetic; $a_1 = 5,\ d = -2$ » Explicit: $a_n = 5 - 2(n - 1)$

Recursive: $a_1 = 5$, $a_n = a_{n-1} - 2$

$a = 1.5, 3, 6, 12, \ldots.$ Geometric; $a_1 = 1.5,\ r = 2$ » Explicit: $a_n = 1.5 \cdot 2^{n-1}$

Recursive: $a_1 = 1.5$, $a_n = 2 \cdot a_{n-1}$