# Recursive and Explicit, Both Ways

Recursive: the start and how to get the next term (the stairs). Explicit: any term from n (the elevator). Translate in three steps, either way.

## 1 THE VOCABULARY
### Words we use

Recursive rule $a_1$ and the next-from-now rule. Next = Now + 12.

Explicit rule any term from its term number.

Initial term $a_1$, the start a recursive rule needs.

$a_{n+1}$ the next term (a sub n plus 1); f(n + 1).

$a_{n-1}$ the previous term (a sub n minus 1); f(n – 1).

- Watch out for these.
- Leaving out $a_1$ in a recursive rule.
- Reading the y-intercept as the start: in 3n + 2 the start is 5, not 2.
- Writing $r^n$ instead of $r^{n-1}$.
- Mixing up add and multiply when reading the rule.

## 2 THE METHOD
### Translate

1. RECURSIVE TO EXPLICIT 1 read $a_1$.
2. 2 adds: arithmetic, d. Multiplies: geometric, r.
3. 3 $a_1 + d(n - 1)$, or $a_1 \cdot r^{n-1}$.
4. EXPLICIT TO RECURSIVE 1 put in n = 1 for $a_1$.
5. 2 AND 3 read d or r; write $a_1$ and $a_{n+1} = a_n + d$, or $r \cdot a_n$.

**WHY TWO RULES**
Recursive is easy to read and good for the next few terms. Explicit reaches a far term in one step. Fibonacci has only the recursive kind at our level.

## 3 BOTH DIRECTIONS
### $a_{n+1} = a_n + 12$, $a_1 = 4$

| | |
|---|---|
| start 4; adds 12 | arithmetic, d = 12 |
| $a_n = 4 + 12(n - 1)$ | explicit |
| $= 12n - 8$ | y-intercept –8, not 4 |
| $a_n = 6 \cdot 2^{n-1}$ | now the other way |
| n = 1 gives 6; base 2 | $a_1 = 6$, $a_{n+1} = 2 \cdot a_n$ |

**THE 40TH TERM**
Stairs: 39 steps of + 12. Elevator: 4 + 12 × 39 = 472, one calculation.

**SAY IT OUT LOUD**
Stairs for recursive, elevator for explicit. Find the start, find d or r, write the other form.