# Building Sequences from the Real World

Three moves: decide the type (equal differences or equal ratios), write the rule, answer the question. Ask what n counts and where it starts.

## 1 THE VOCABULARY
### Words we use

Arithmetic adds d; equal differences; start + d(steps).

Geometric multiplies by r; equal ratios; start · $r^{steps}$.

Steps n – 1 if counting starts at 1; n if it starts at 0.

Zeroth term one step before the first; sometimes a real thing, like a plain pizza.

Model a rule standing in for a real situation.

- Watch out for these.
- Writing a rule before deciding adds or multiplies.
- Using n – 1 when the story starts at 0, or n when it starts at 1.
- Swapping the start and the step: 4n + 6 for an orchard that starts at 4.
- Forgetting to say what n counts.

## 2 THE METHOD
### Story to answer

1. TYPE subtract: equal differences, arithmetic. Divide: equal ratios, geometric.
2. START AND STEP the first value; d or r.
3. WHERE DOES n START at 1: n – 1 steps. At 0: n steps.
4. RULE start + d(steps), or start · $r^{steps}$.
5. ANSWER put in n; or set equal to the target, or build a table.

**WHY THE START OF THE COUNTING MATTERS**
The rule counts steps from the start. Numbering from 1 means the nth value is n – 1 steps away; numbering from 0 means it is n steps away.

## 3 FOUR SITUATIONS
### Pizza, orchard, cups, bacteria

| | |
|---|---|
| pizza: 12 + 1.50(n – 1) = 10.50 + 1.50n | 10.50 is a plain pizza |
| orchard: (178 – 4) ÷ 29 = 6; t(n) = 6n + 4 | starts at year 0 |
| cups: 7.5 + 1.5(n – 1) = 6 + 1.5n | 20 cups: 36 inches |
| bacteria: $2^n$ | starts at minute 0; 5 minutes: 32 |
| interest: simple is arithmetic, compound is geometric | Unit 8 as sequences |

**ELIMINATION**
Orchard choices: 4n + 6 starts at 6 (wrong start); 4 · $6^n$ multiplies (the story adds); 29n + 4 gives 845 in year 29. Only 6n + 4 survives.

**SAY IT OUT LOUD**
Adding gives arithmetic, multiplying gives geometric. Ask what n counts and where it starts.