Systems in the Real World

Two facts (count and value) make two equations: solve and read back. Two limits (budget and time) make two inequalities: the overlap is every plan that obeys both. Whole things: only the dots.

THE VOCABULARY

1 Words we use

Count and value the usual two facts: how many, and what they add up to.

System from limits each limit is a constraint; two make a system of inequalities.

Feasible region the overlap: every plan that obeys every limit.

Read it back the answer in the story's words, with units, checked against the story.

Discrete whole things: only the whole-number points in the overlap are plans.

- Watch out for these.
- Mixing units: dollars and cents, hours and minutes. Pick one and stick to it.
- Writing one equation for two facts. Each fact is its own equation.
- Stopping at the numbers. Read them back into the story and check.
- Checking a plan against one limit only.

THE METHOD

2 Two directions

1. **NAME THE UNKNOWNS** one letter each, with what it counts.
2. **TWO FACTS: TWO EQUATIONS** count equation, value equation. Solve by the method that fits; read back; check.
3. **TWO LIMITS: TWO INEQUALITIES** each limit is a constraint. Shade both; the overlap is the feasible region.
4. **WHOLE THINGS?** if so, only the whole-number points in the overlap are plans. Find one and say what it means.

> WHY THE SAME THREAD
> Whether facts or limits, the answer must satisfy every one at once. Equations meet at a point; inequalities meet in an overlap.

COUNT AND VALUE

3 40 tickets, adults $8 and kids $5, $260 in all

$a + k = 40$	the count
$8a + 5k = 260$	the money
$a = 40 - k$	substitution: a is easy to free
$8(40 - k) + 5k = 260$, so $320 - 3k = 260$, so $k = 20$	solve the one-variable equation
$a = 20$	back-substitute
20 adult and 20 kid tickets: 40 tickets, $160 + $100 = $260	read it back and check in the story

> TWO LIMITS
> Bracelets $2 and 45 min, keychains $1 and 15 min, at most $20 and 360 min: $2x + y \le 20$ and $3x + y \le 24$. (5, 8): $18 and 23 units, feasible. (7, 5): $19 but 26 units, not feasible.

> SAY IT OUT LOUD
> Name the unknowns. Two facts, two equations; two limits, two inequalities. Solve or shade, then read it back into the story.