THE CLEVER THINKING TOOLKIT

Stuck? Pick a thinking tool.

Eight ways to crack a tricky problem.

1 Break it down
DECOMPOSITION

What smaller jobs is this made of?

2 Spot the pattern
PATTERN RECOGNITION

What repeats? What is the rule?

3 Keep what matters
ABSTRACTION

Which details do I really need?

4 Make a plan
ALGORITHM

What are the steps, in order?

5 Do it again
LOOP

Which steps can I repeat?

6 If this, then that
CONDITIONAL

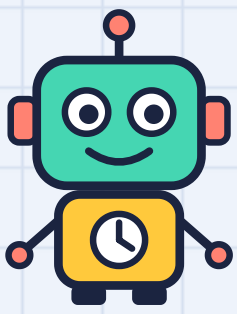
What yes-or-no question decides?

7 Bug hunt
DEBUGGING

Where does it first go wrong?

8 Find it faster
EFFICIENT

Is there a way with fewer steps?



You don't need a computer to think like a computer scientist. You need a plan.

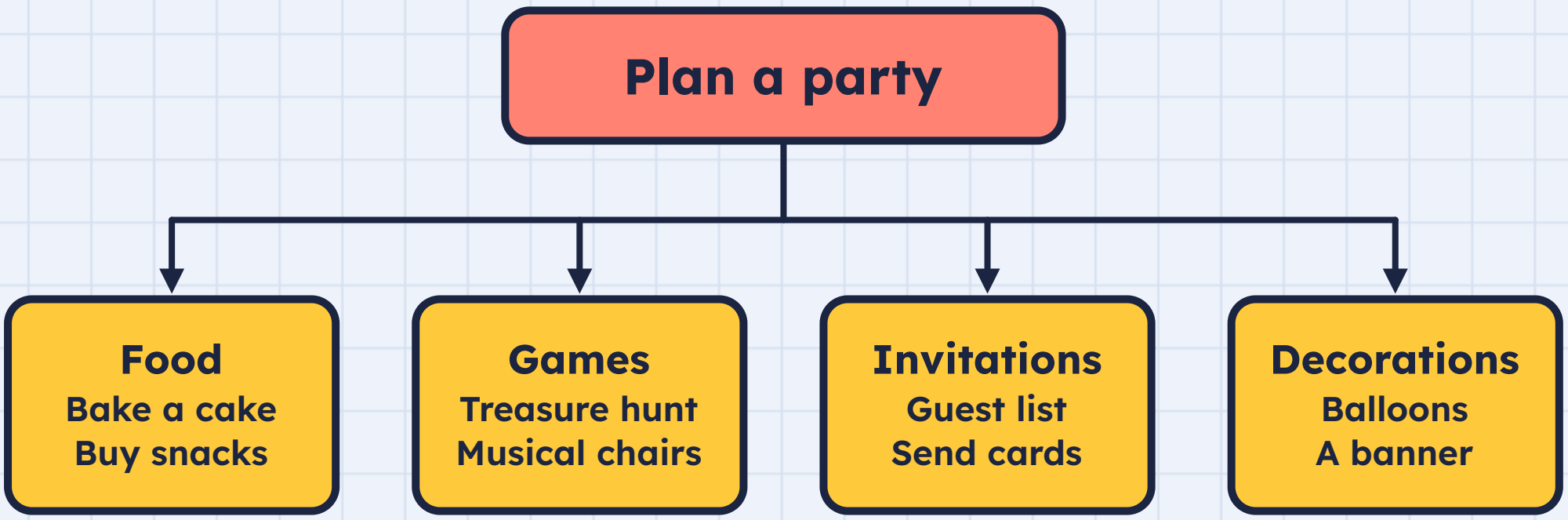
1 THINKING TOOL ONE

Break it down

Decomposition

say: dee-com-puh-ZISH-un

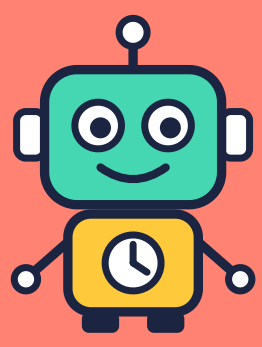
Breaking a big problem into smaller parts that are easier to solve.



IN MATHS

6 × 14 looks hard. Split 14 into 10 and 4.

$6 \times 10 + 6 \times 4 = 60 + 24 = 84$



ASK YOURSELF

What smaller jobs is this made of?

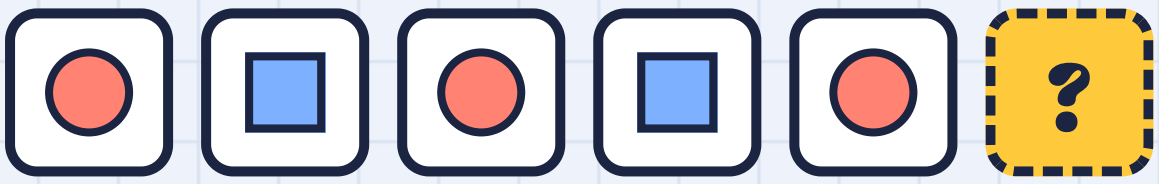
2 THINKING TOOL TWO

Spot the pattern

Pattern recognition say: PAT-urn rek-ug-NISH-un

Noticing what repeats, or what changes in the same way each time.

SOME PATTERNS REPEAT



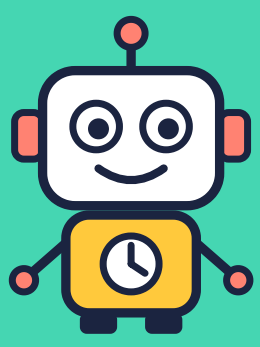
SOME GROW BY THE SAME JUMP



SOMETIMES THE JUMP GROWS TOO



Find the jump from each one to the next. Then you can predict what comes after.



ASK YOURSELF

What repeats? What is the rule?

3 THINKING TOOL THREE

Keep what matters

Abstraction say: ab-STRAK-shun

Keeping the details that matter and leaving out the ones that don't.

THE WHOLE STORY

~~Mia has a red backpack.~~ **She has 12 stickers.** ~~Her dog is called Biscuit.~~ **She gives 5 stickers to Sam.** ~~It is a sunny Tuesday.~~

How many stickers does Mia have left?

→

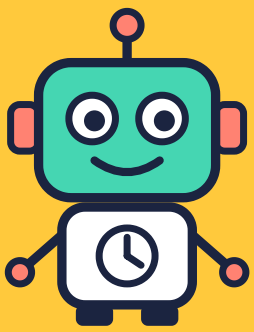
WHAT MATTERS

12 - 5

= 7

IN MATHS

A word problem is a story. Keep only the numbers the question asks about.



ASK YOURSELF

Which details do I really need?

4 THINKING TOOL FOUR

Make a plan

Algorithm say: AL-guh-rith-um

A list of clear steps, in order, for getting a job done.

AN ALGORITHM FOR BRUSHING YOUR TEETH

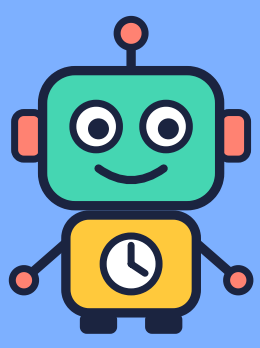
1. Squeeze paste onto the brush
2. Brush every tooth
3. Spit, then rinse your mouth
4. Wash the brush

Good steps are **clear** **small** **in the right order**

IN MATHS

Column addition is an algorithm: add the ones, carry, add the tens.

47 + 38 = 85



ASK YOURSELF

What are the steps, in order?

HELPER ONE

Do it again

Loop rhymes with hoop

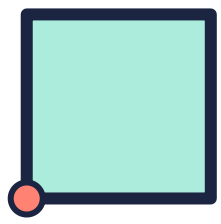
A way to repeat steps without writing them out again and again.

THE LONG WAY: 8 STEPS

- move forward
- turn right
- move forward
- turn right
- move forward
- turn right
- move forward
- turn right

WITH A LOOP: 3 LINES

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repeat 4 times:
    move forward
    turn right
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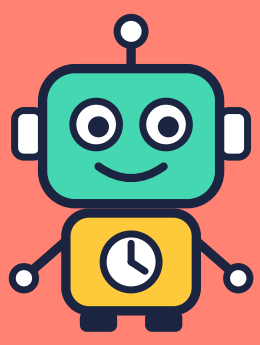


IN MATHS

4 × 3 means "repeat 4 times: add 3".

3 + 3 + 3 + 3 = 12

Both programs draw the same square. The loop says it in fewer lines.



ASK YOURSELF

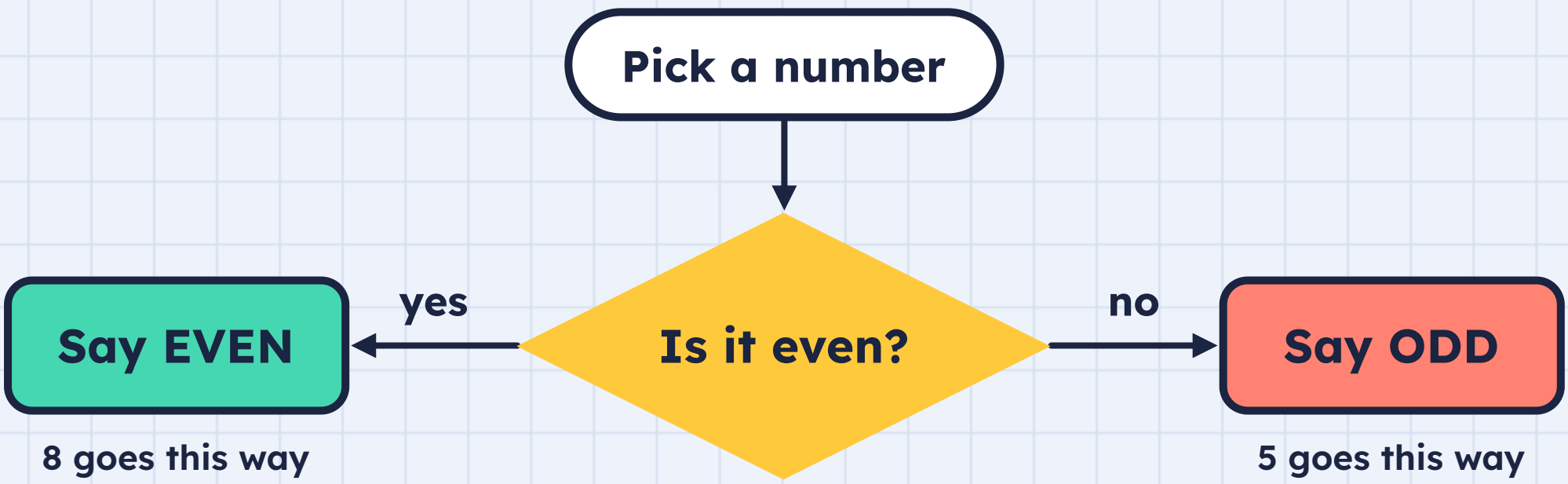
Which steps can I repeat?

6 HELPER TWO

If this, then that

Conditional say: kun-DISH-un-ul

A step that asks a yes-or-no question, then chooses what to do next.

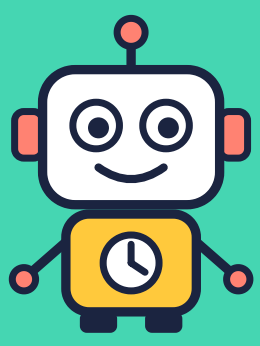


AND

Both must be true. "Even AND bigger than 10" lets in 12, but not 8 or 13.

OR

At least one must be true. "Even OR bigger than 10" lets in 8, 12 and 13.



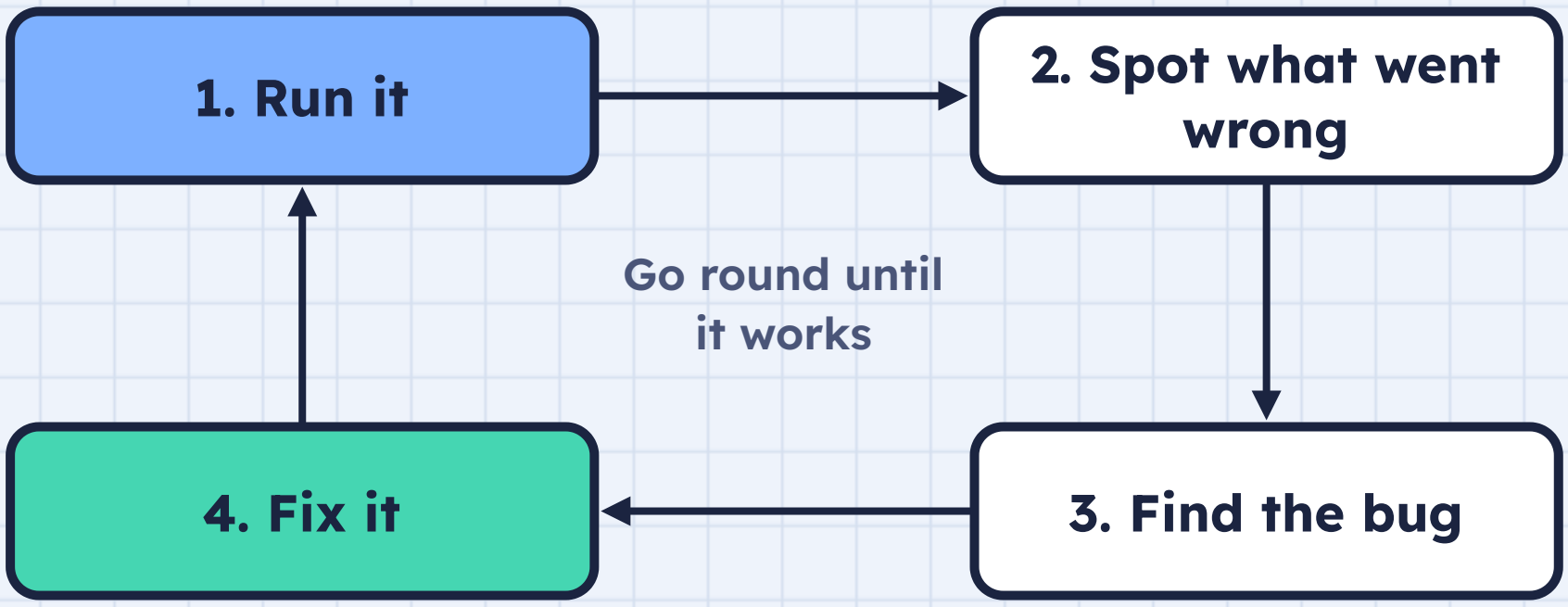
ASK YOURSELF

What yes-or-no question decides?

7 HELPER THREE

Bug hunt

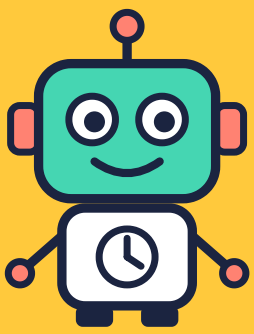
Debugging say: dee-BUG-ing
Finding and fixing mistakes in a set of steps.



Step by step
Pretend you are the computer.

Compare
What did you want?
What did you get?

One change
Fix one thing, then test again.



ASK YOURSELF

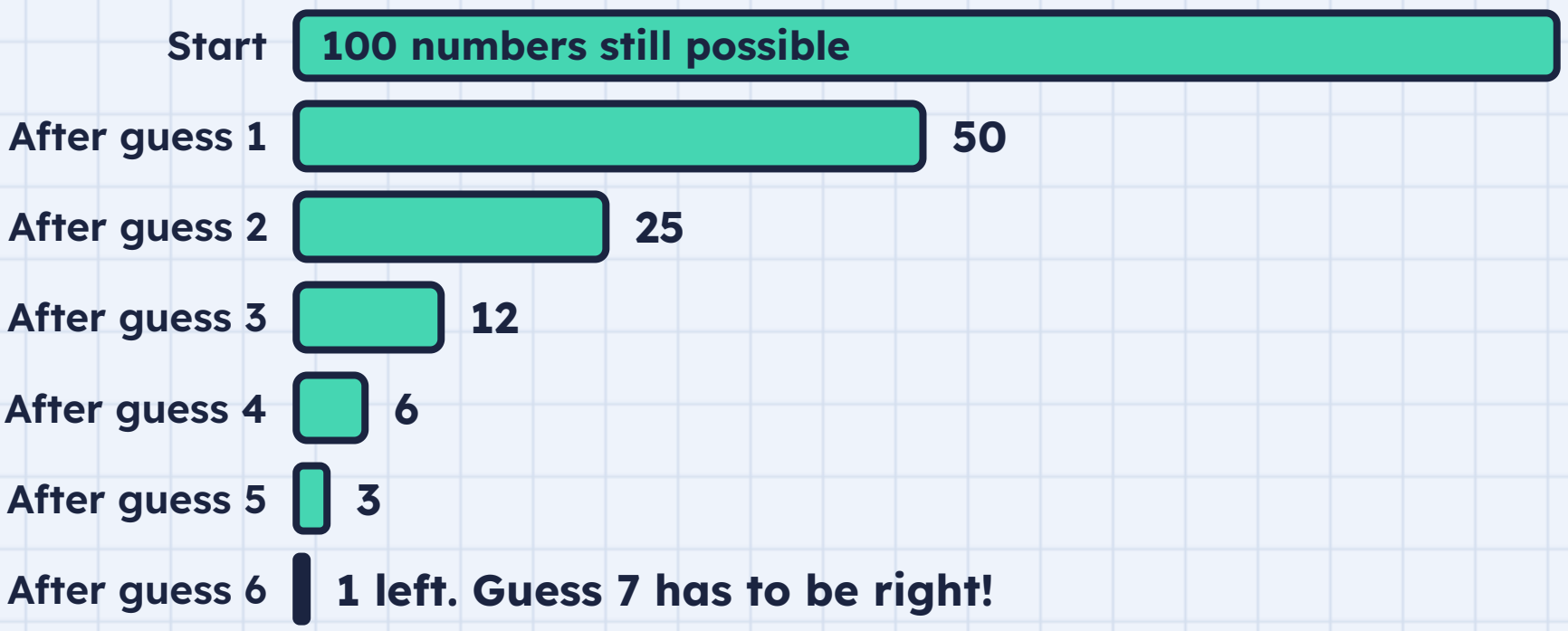
Where does it first go wrong?

8 HELPER FOUR

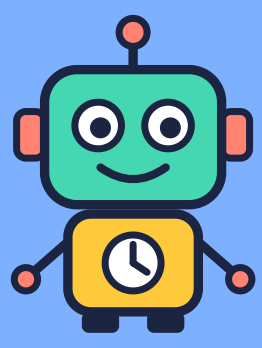
Find it faster

Efficient say: ih-FISH-unt
Getting the job done in fewer steps.

GUESS A NUMBER FROM 1 TO 100. ALWAYS GUESS THE MIDDLE.



IN MATHS Halving shrinks things fast. 7 smart guesses beat 100 guesses made one at a time.



ASK YOURSELF

Is there a way with fewer steps?