

POLYMATH · STUDY GUIDE

HOW TO WORK OUT WHAT EACH SHAPE IS WORTH

Play at edu.games. This guide won't give you answers — it can't, because the numbers change every time you play. What it gives you is better: the **moves** that solve every puzzle.

HOW A PUZZLE WORKS

- The **clues** are equations made of shapes. Every shape stands for one number, and the same shape is always the same number *within a puzzle*.
- In the **Shape Lab**, set what you think each shape is worth. Then work out the **target** and press **SOLVE** ().
- **The game will not warn you while you work.** It only checks when you press SOLVE — so check your values against *every clue* yourself first. That's not a limitation; that's the skill.
- Made a mess? is undo, is redo.
- The shape's look never tells you its value. A hexagon might be 3 in one puzzle and 9 in the next. Only the clues count.

Using hints well: Hint 1 points at the strategy — using it is smart, not cheating. Hint 2 does the first step for you. Hint 3 gives the whole answer, and it costs you the **INSIGHT** ♦ spark. If you're about to press hint 3, better plan: leave the puzzle, come back later, beat it fresh.

THE FIVE BIG MOVES

Every puzzle in the game falls to one or more of these. When you're stuck, run down this list.

1

FIND THE CLUE YOU CAN SOLVE ALONE

Look for a clue with only **one kind of shape** in it, or with a value given straight up. Solve that one first, then carry its value into the others. Never start with the hardest clue.

2

TAKE AWAY WHAT YOU ALREADY KNOW

If a clue says **shape + shape + 4 = 16**, remove the 4 first: the shapes make 12 on their own. Undo additions before you divide. To undo a two-step machine, undo the **last** step first.

3

MULTIPLY AND DIVIDE BEFORE ADD AND SUBTRACT

In **P + P × 3**, the × happens first. Reading left to right is the single most common way to lose a spark in Worlds 2 and beyond. Brackets beat everything.

4

COMPARE TWO CLUES

When two clues look almost the same, **subtract one from the other** – whatever they don't share is the difference. Two weigh-ins that differ by one pod tell you exactly what that pod weighs.

5

TEST YOUR RULE ON EVERY ROW

In rule-finding puzzles, a rule that fits **one** row proves nothing. Check it against every row – especially a row with **0** in it, which shows you the fixed part with nothing multiplied.

WORLD BY WORLD**WORLD 1 · LANTERN MARKET – ADD AND SHARE**

Moves 1 and 2 · beat 1:30 for the Swift spark

- Three copies of the same shape making a total? That's a **division**, not a subtraction: split the total into equal parts.
- Two shapes can have the same outline but different colours – treat them as **different unknowns**.
- From 1.4 on, the order you attack the clues matters. Move 1 is your friend.

WORLD 2 · TESSELLATION WORKS – MULTIPLY AND DIVIDE

Move 3 everywhere · beat 2:00 for the Swift spark

- Say the target out loud with "first" in it: "P, plus P-times-m **first**."
- A clue like $L = S + S$ isn't asking you to add – it's telling you L is **double** S.
- 2.4 runs a machine backwards: the machine did $\times$ then $+$, so you undo the $+$ **then** the $\times$.

WORLD 3 · SYMMETRY VAULT – FIND THE RULE

Move 5 is the whole game here · beat 2:30 for the Swift spark

- When a sequence grows fast, ask "**times** what?" before "plus what?".
- For input→output tables: how much does the output grow when the input grows by 1? That growth is your multiplier. Then use any single row to find the fixed part.
- Outputs growing faster and faster? Try subtracting the **square numbers** 1, 4, 9, 16... and see what's left.
- In 3.5, more than one rule fits the first rows on purpose. The 0-row settles it.

WORLD 4 · VECTOR NEXUS – LINKED CLUES AND NEGATIVES

Move 4 unlocks everything · beat 3:00 for the Swift spark

- No clue here solves alone – **pairs** of clues do. Subtract the smaller clue from the bigger one.
- If something plus 7 makes only 3, the something is **below zero**. Negative values are allowed – the minus button is there for a reason.
- 4.4 is a search, not an equation: list the few possible values for one shape and test each. Being **organised** is what makes it fast.
- 4.5 gives three pair-sums for three shapes. Adding two clues and subtracting the third leaves exactly **two copies of one shape**. Try it on paper once – it feels like a magic trick.

WORLD 5 · POLYHEDRON CORE – EVERYTHING AT ONCE

All five moves · beat 3:30 for the Swift spark · finish 5.5 for the finale

- 5.1 invents a brand-new symbol and tells you exactly what it does. Don't panic at notation you've never seen – **read the definition, then follow it like a recipe, twice.**
- Know a difference like $X - Y = 2$? Rewrite one shape using the other (Y is $X - 2$) and substitute it into the sum clue.
- Know a sum **and** a product? List the factor pairs of the product, then pick the pair with the right sum.
- A chain of gaps: write every cell in terms of the **first one**, then use the total.
- The last targets are long expressions. Brackets first, write down each part, then combine. No shortcuts – just tidy work.

BEFORE YOU PRESS SOLVE

The game checks you once. Check yourself first:

1. Put your values back into **every clue** – not just the one you used last. Do they *all* work?
2. Re-read the target. Did you do $\times$ and $\div$ before $+$ and $-$? Brackets first?
3. Does the answer make sense? (Bigger than the parts if you added, smaller if you subtracted...)

Thirty seconds of checking is the whole difference between two sparks and three.

CHASING ALL 75 SPARKS

SPARK	HOW TO EARN IT	HOW TO GET IT BACK IF YOU MISSED IT
◆ INSIGHT	Solve without the full-answer hint	Replay the puzzle – new numbers, and this time stop at hint 2
◆ PRECISION	Correct on your first SOLVE press	Replay, and use the checklist above before pressing

◆ SWIFT

Beat the world's bonus time
[the timer turns gold]

Replay a puzzle you already understand – speed comes
from knowing the move, not rushing

Sparks stick: replaying can only ever add sparks, never lose them. Solved every puzzle? The real completion is 75 / 75.

WORDS WORTH KNOWING

Unknown

A value you don't know yet – in PolyMath, a shape. In algebra next year, a letter. Same idea exactly.

Substitute

Swap a shape for its value [or for another expression, like " $X - 2$ "] inside a clue.

Inverse operation

The undo: subtraction undoes addition, division undoes multiplication. Undo a chain backwards, last step first.

Rule (function)

A machine that turns every input into an output the same way. Find the rule, and you can predict any input – that's why World 3 asks for the rule, not one answer.

Eliminate

Subtract one clue from another so a shape disappears, leaving something you can solve.

Factor pair

Two numbers that multiply to make a target: 24 has 1×24 , 2×12 , 3×8 , 4×6 .

The big secret: PolyMath is algebra with the fear removed. Every move in this guide – substitution, inverse operations, elimination, finding rules – is exactly what x and y equations will ask of you later. You're not preparing for algebra. You're already doing it.