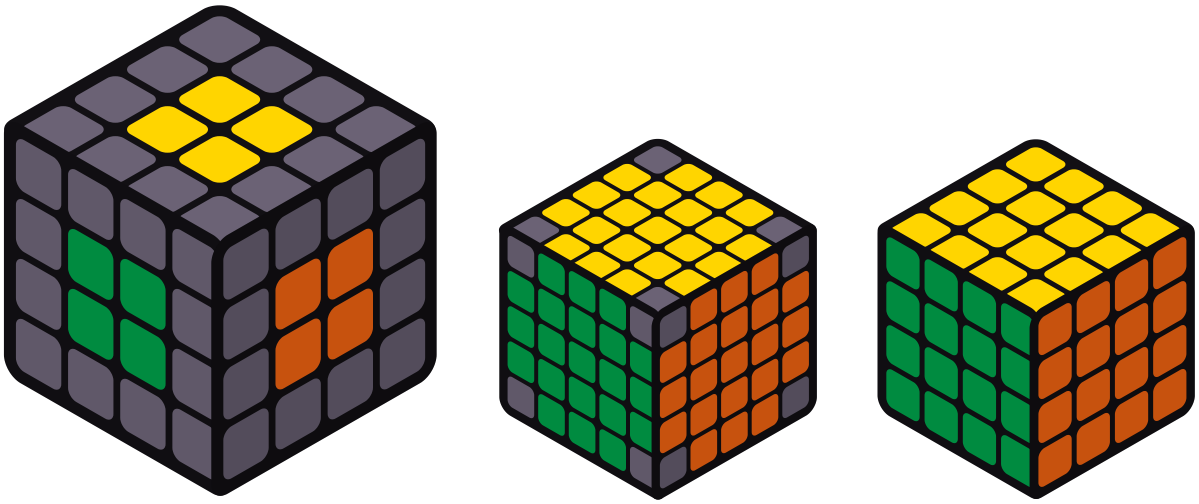
Cube Lab

PRINTABLE GUIDE

Big cubes: reduction & parity

4×4, 5×5 and beyond.



1. Reduction
2. Centres
3. Pairing edges
4. Parity (4×4)
5. 5×5 last two edges
6. 6×6 and 7×7

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BIG CUBES (4X4 AND UP)

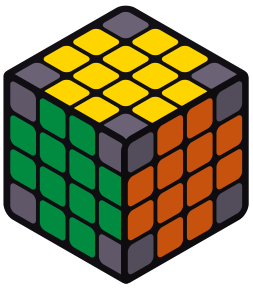
Reduction: the idea

A 4×4, 5×5 or bigger cube has more pieces, but the same idea works. You **reduce** it to a 3×3:

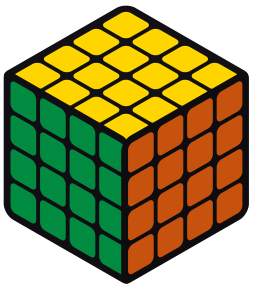
1. **Centres.** Build each face's centre block (2×2 on a 4×4, 3×3 on a 5×5).
2. **Edges.** Pair up the edge pieces of the same colours, so each edge acts like one big 3×3 edge.
3. **Solve it like a 3×3**, turning only the outer layers. Watch out for parity (later).



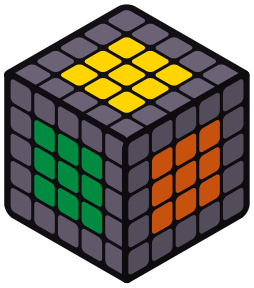
4×4 after step 1: centres



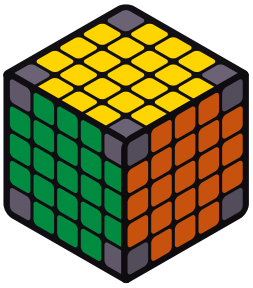
After step 2: edges paired



After step 3: solved



5×5: centres



5×5: edges paired

On an odd cube (5×5, 7×7) the very middle centre is fixed, like on a 3×3, so it tells you the colour of the face. On an even cube (4×4, 6×6) there's no fixed centre. Put the centres in the right scheme: white opposite yellow, and with white on top and green in front, red on the right.

BIG CUBES (4X4 AND UP)

Centres

Make the first centre (white) by feel: build a 1×2 bar of white, then another, and join them. Then do the opposite centre (yellow), using only the free layers so you don't break white.

For the last four centres, keep white on the bottom and yellow on top. Build bars and move them across with a wide turn, a top turn, and the wide turn back:



BEFORE

Move a bar into place (4×4)

Only the centres are coloured here.

Rw U Rw'



AFTER

TIP

Do the last two centres together: there's lots of freedom, and it's easy to break one while fixing the other if you rush.

COMMON MISTAKE

Building the four side centres in the wrong order. Check the colour scheme before you finish: with yellow on top, green, red, blue and orange go round in that order (or the reverse for your cube).

BIG CUBES (4X4 AND UP)

Pairing edges

Each edge of a 4×4 is made of two pieces. Find two that belong together and line them up on the left and right of the front, at the same height. Then:

1. Slice them together with a wide turn (`Uw'`): the two halves join, and the centres are broken for a moment.
2. Flip in a paired edge from the top with `R U R' F R' F' R`, so the slice can go back without unpairing it.
3. Slice back (`Uw`): the centres are fixed and the new edge stays paired.



BEFORE

Slice, flip, slice (4×4)

Uw' R U R' F R' F' R Uw



AFTER

Repeat until all twelve edges are paired. The last two can be tricky: line up both at the front, slice, flip, slice.

TIP

The same idea works on a 5×5: pair two outer pieces to the middle piece of an edge, then slice back.

BIG CUBES (4X4 AND UP)

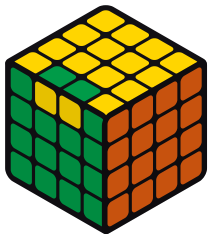
Parity

Once a 4×4 is reduced, you solve it like a 3×3. But sometimes you get a position a 3×3 **can't** have. This is called **parity**.

It happens because the centres and edge pieces on a 4×4 can move in ways that a 3×3's can't. When you pair edges, you might end up with the two halves of an edge swapped. It looks normal until the last layer.

OLL parity: one flipped edge

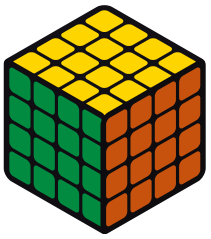
If you see one edge flipped on top (like an odd number of yellow edges in the cross), use this algorithm to flip it. Hold the flipped edge at the front.



BEFORE

OLL parity (4×4)

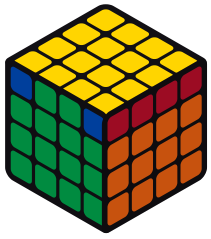
```
2R2 B2 U2 2L U2 2R' U2 2R U2 F2 2R F2
2L' B2 2R2
```



AFTER

PLL parity: two swapped edges

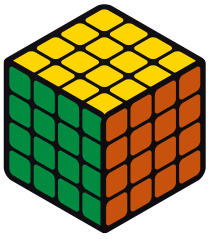
If, at the end, two edges need to swap (or two corners do, with everything else solved), this algorithm swaps two opposite top edges. It turns the top layer as well, so finish with a turn of the top.



BEFORE

PLL parity (4×4)

```
2R2 U2 2R2 Uw2 2R2 Uw2
```



AFTER

TIP

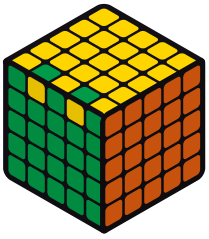
Parity can only happen on even cubes (4×4, 6×6…). On a 5×5 the fixed centres and middle edges keep the cube honest — but see the next lesson.

BIG CUBES (4X4 AND UP)

5×5: the last two edges

On a 5×5 each edge has three pieces: a middle one and two outer ones. You pair the outer ones to the middle one, like on a 4×4.

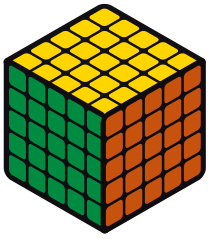
Sometimes the very last edge has its two outer pieces swapped: the middle is right, but both sides are the wrong way round. You can't fix it with slice-flip-slice. Hold it at the front top and do this:



BEFORE

Swap the two outer pieces of one edge (5×5)

```
2R2 B2 U2 2L U2 2R' U2 2R U2 F2 2R F2
2L' B2 2R2
```



AFTER

> **TIP**
>
> This is the same algorithm as the 4×4 edge flip, done with the second layer only (`2R`, `2L`). On a 7×7 use it with the layer that holds the bad pieces.

BIG CUBES (4X4 AND UP)

6×6 and 7×7

- **Centres:** build them one row at a time. Make a 1×4 strip (on a 6×6) and slide it in, just like the 4×4 bars.
- **Edges:** pair one edge orbit at a time: on a 6×6 there are two kinds of edge piece, each paired with its own slice.
- **Parity:** a 6×6 can have both kinds of 4×4 parity, once per orbit. A 7×7 can have the 5×5 problem, once per orbit. Use the same algorithms on the right inner layer (`2R` or `3R`).
- **Keep track of colours:** with so many centre pieces, check the colour scheme often.
- **Take breaks.** A 7×7 solve takes a while. That is part of the fun.