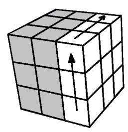
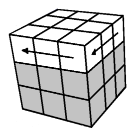
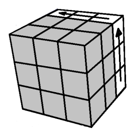
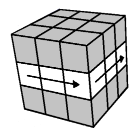
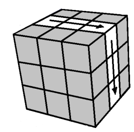
A Solution to Rubik’s Cube

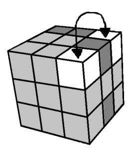
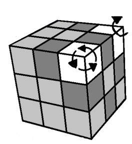
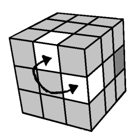
Notation

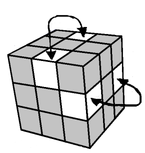
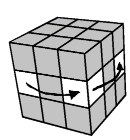
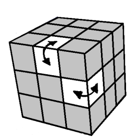
The basic notation in the table is standard. Primes and exponents used in the algorithms are also standard.

R (right)	**U** (up)	**B** (back)	**E** (equator)	**S** (standing)
				

Algorithms

Dark squares indicate collateral changes that are unimportant at the time the algorithm is used.

Step 1	**Step 2**	**Step 3a**
$RUR'U'B'R'B$	$(RU')^3(R'U)^3$	$R'U'R'E'RURE$
		

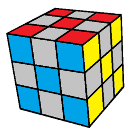
Step 3b		**Step 4**
$(R^2U^2)^3$	R^2ER^2E'	$(RS')^4(S'U)^4$
		

Step 1: Position Corners

Put all 8 corners in their correct positions, but not necessarily with correct orientations.

Step 2: Orient Corners

Fix the orientation of all 8 corners. This makes a correct 'X' on each side.



Step 3a: Sort Edges Into Slices

This step and the next will put all 12 edges in their correct positions, but not necessarily with correct orientations.

In this step, put each edge into its correct *slice*, but not necessarily in the correct position within the slice. The red-orange slice, for example consists of the 4 edge positions that do not border on the red or orange centers. An edge belongs to this slice if neither of its colours are red or orange.

Pick two edges from different slices that should be swapped. If they are not adjacent, do a temporary double turn (such as R^2) to make them adjacent so the algorithm can be applied. (A double turn does not move edges between slices.)

Step 3b: Position Edges Within Slices

The two algorithms provided do not move edges between slices, but only within slices.

Step 4: Orient Edges

Fix the orientation of all 12 edges.

Proof

Step 1 There is nothing to prove.

Step 2 It must be shown that when two adjacent corners are the only ones with incorrect orientations, one requires a clockwise twist, and the other requires a counterclockwise twist. Each corner has one sticker that is red or orange, and one of its nearby face centers is red or orange. Define the corner's twist count to be the number of clockwise twists it would take to line up the red or orange sticker with the red or orange center. It may be shown that the sum of the 8 twist counts is always a multiple of 3.

Step 3a There is nothing to prove.

Step 3b It must be shown that when one slice is solved, the permutation of the remaining 8 edges is even, for then either the permutations within the two remaining slices are both even, or can be made so by one application of the first of the two algorithms. The permutations of the 12 edges and of the 8 corners always have the same parity.

Step 4 It must be shown that there cannot be just one edge with the wrong orientation. The permutation of all 24 edge stickers is always even.