Introduction. The solution uses just 4 permutations derived from this basic concept: “turn a vertical layer, double turn a horizontal layer, then un-turn the vertical layer,” and that fact that each variant is its own inverse.

The Permutations.

- \( C_R \) (Removes/Replaces top-front-right corner)
- \( E_R \) (Removes/Replaces top-right edge)
- \( C_F \) (Removes/Replaces top-front-right corner, mirror)
- \( E_F \) (Removes/Replaces top-front edge, mirror)

Also, \( U \) refers to the “upper” layer:

The Solution. In steps 2 and 4, you may turn the top layer freely before applying a permutation. The permutations given below must be applied several times to solve certain cases in steps 3-6.

1. Solve the bottom layer on your own.
2. Solve the 4 “equator” layer edges.
   a. \( E_R U^{-1} E_R \) puts the top-front edge in the back-left position (with its “top” color in back).
   b. \( E_F U E_F \) puts the top-right edge in the back-left position (with its “top” color on the left).
3. Get the 4 top corners all one color on top, ignoring their sides.
   a. \( C_R C_F U C_F C_R \) twists the top-front-right corner anti-clockwise, and the top-back-right one clockwise.
4. Put the 4 top corners in the right places.
   a. \( C_R U C_R U C_R U^2 C_R \) permutes top-front-right → top-back-right → top-back-left → top-front-right
5. Get the 4 top edges all one color on top, ignoring their sides.
   a. \( E_R U^{-1} E_F U E_F E_R \) twists the top-front and top-right edges.
6. Put the 4 top edges in the right places.
   a. \( E_R U E_R U E_R U^2 E_R \) permutes top-right → top-back → top-left → top-right

Improvements. You may also modify permutations as you begin to understand them. For example:

- in step 3, \( C_R C_F U^2 C_F C_R \) twists the top-front-right and top-back-left corners.
- in step 5, \( E_R E_F U^{-1} E_F U E_R \) twists the top-left and top-right edges.
- \( C_R U^2 C_R U^{-1} C_R U^4 C_R \) performs the inverse of the permutation in step 4 above.