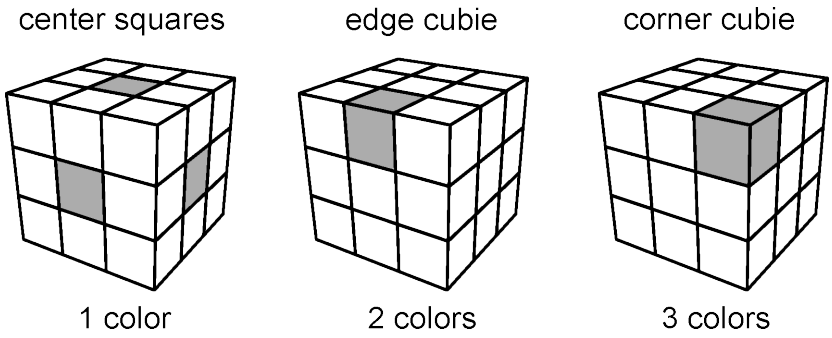
MATH 103 – Rubik's Cube Algorithms – Intro

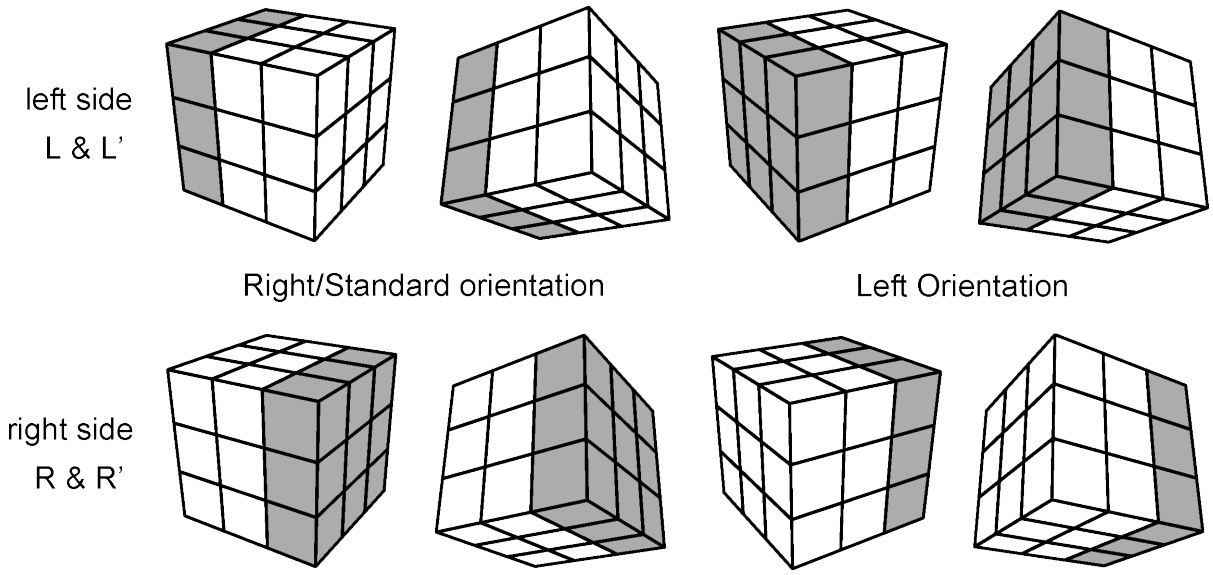
Introduction: Getting Oriented and Terminology.

First, you must become familiar with the terminology and the different ways we will view the cube in these instructions.

Cubies: There are 3 different types of 'cubies' on your cube:



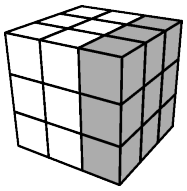
Orientations: There are four basic views we will see in these instructions. The different orientations will be called: 'right orientation' and 'left orientation' depending on whether we are emphasizing the right or left sides. We will also view these tilted upwards or downwards to emphasize either the upper of lower face:

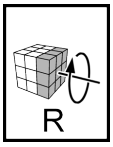


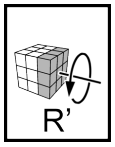
Normally, we'll being viewing the cube from the right/standard orientation (above, lower-left picture).

Cube faces and moves: The cube has distinct faces which we will turn individually. Here are the 6 faces plus 1 middle layer that we need to know along with the moves:

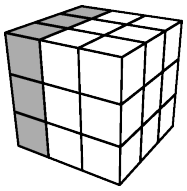
Right face, R:

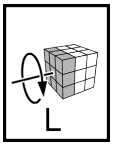


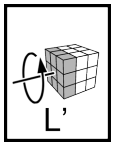
Clockwise turn: 

Counter-clockwise turn: 

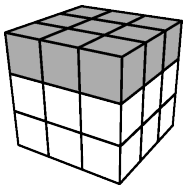
Left face, L:

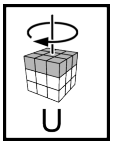


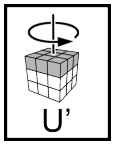
Clockwise turn: 

Counter-clockwise turn: 

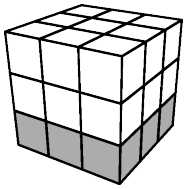
Upper face, U:

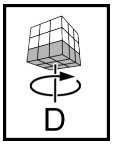


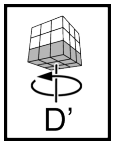
Clockwise turn: 

Counter-clockwise turn: 

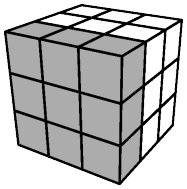
Down (bottom) face, D:

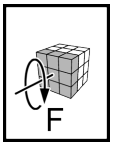


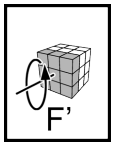
Clockwise turn: 

Counter-clockwise turn: 

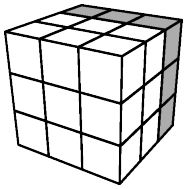
Front face, F:

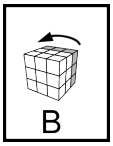


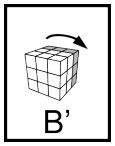
Clockwise turn: 

Counter-clockwise turn: 

Back face, B:

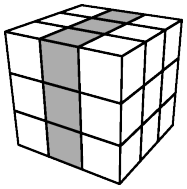


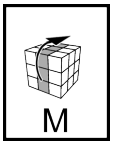
Clockwise turn: 

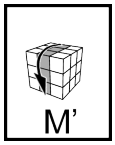
Counter-clockwise turn: 

And then finally the only middle layer move we'll need:

Middle layer, M:



Up turn: 

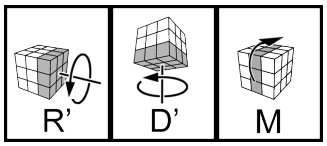
Down turn: 

(Note that whether a turn in clockwise or counter-clockwise is determine by how it would be perceived if you were looking at that face as if it were the front face.)

Solving & Algorithms: We are going to solve the cube in layers. First, the bottom layer, then the middle and then the top.

Solving the Rubik's Cube requires the use of *algorithms*. An algorithm is a specific sequence of moves (turns of cube faces) which will change the position or orientation of one or more cubies.

For example, turning the right face counter-clockwise, then the down (bottom) face counter-clockwise, and then the middle layer upwards will be given as follows:



(Note: We'll use this particular sequence quite often, actually.)

We'll first start by solving the upper layer. Making sure to orient all the edges and corners correctly. Then we will rotate the cube so that the solved layer is on bottom, and then we will solve the middle layer. Finally, we will solve the upper layer.

Solving Process Summary:

I. Solve 1st layer:
   A. Solve 4 edges.
   B. Solve 4 corners

II. Solve 2nd layer:
   A. Solve 4 edges.

III. Solve 3rd layer:
   A. Permute corners.
   B. Orient corners.
   C. Orient edges.
   D. Permute edges.