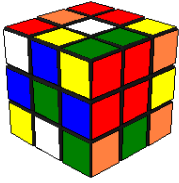
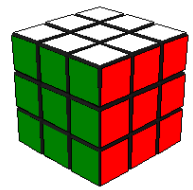


From This



To This!



Ryan's Guide to Speed Cubing

By Ryan Goessl

Before you start learning to solve the Rubik's cube, there are a few things you need to have and know:

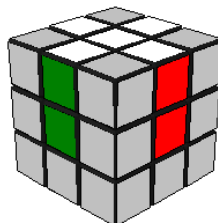
- For one, you will need a Rubik's cube or else there would be nothing to solve. If you are heading towards solving the cube fast, a newer cube is encouraged because they turn a lot faster than the old 60's ones.
- Another thing you'll need to solve the cube fast is lubricant for your cube. The best kind of lube for your cube is any brand of silicone lube (ex. Jig-A-Loo). It provides a long lasting smooth movement for your cube. Another type of lubricant, that doesn't work as well as silicone lube, is Vaseline (Petroleum Jelly). Vaseline will also make the cube turn smoothly, but not as smooth as silicone lube.
- You will have to understand that the center pieces of a Rubik's cube never move out of their position. All the edge and corner pieces just rotate around the centers. Taking apart your cube completely will help you understand this and how the cube works more easily.
- Solving the cube does involve some memorization skills. You will be required to memorize certain sequences of moves (called algorithms) and their effects on the cube. If this worries you, don't get discouraged because with lots of practice, you'll never forget the algs (short for algorithms) you've learned.

After you've looked after those points above, it's time to start scrambling your cube and get ready to learn. This tutorial has a beginner method first and then more ways you can add to your method afterward to get even faster. For this method, you will first learn to solve the cross, insert the first layer corner pieces, insert the second layer edge pieces, solve the last layer cross, orient last layer corners, permute last layer corners, then permute last layer edges. If this all sounds confusing to you, don't worry, you will understand it all as you read on.

Beginner Method

Step 1: Solving the white cross

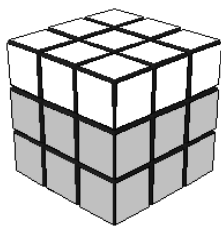
The white cross consists of the white center piece, and all four white edge pieces with both sides of the edge pieces touching the centers of corresponding colours. For example, if you are inserting the white and green edge piece, the white part of the edge piece must be touching the white center and the green part of the edge piece must be touching the green center. This is what a solved cross looks like; now lets learn how to get there.



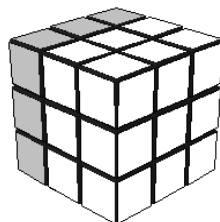
One more thing you need to know before you get into solving the cube is cube notation. Cube notation is sort of like the language of algorithms. An example of a written algorithm is $R U R' U R U^2 R'$ (you don't have to learn this one yet so don't get ahead of yourself). In algorithm notation, there are 6 main letters used, R, L, U, D, F, and B. Each of those letters stands for the name of a face (side) on the cube. If you hold the cube straight in front of you the F face stands for the Front face of the cube, which is directly in front of you. The R face stands for the Right face on the cube, which is the face on the right side of the cube. The U face is the Up face (face on top of cube), L face is the Left face (face on the left side of the cube), the B face is the Back face (on the back of the cube, opposite the front face), and the final face on the cube is the D face for Down side of the cube (opposite up face). An important thing to remember is not to mistake the B face for the Bottom face. Just remember that D can't stand for Back.

Now you know what each face is called you have to learn how to turn the face. In most cases, you will see a letter in 6 different forms. It will either be just capital, capital with an apostrophe after it, capital with a 2 after it, lower case, lower case with an apostrophe, or lower case with a 2. For visual learners, you will see ones like R, R', R2, r, r', or r2. A plain upper case letter means you turn that face 90° clockwise. A capital letter with an apostrophe after it means you turn that face 90° counterclockwise. If a capital letter has a 2 beside it that means that your turn that face 180° . The nothing, apostrophe, and 2 rules apply the same way to lower case letters, except you not only turn the face stated, you also turn the middle slice next to it. In the drawings below, you'll see examples of faces that need to be turned in white.

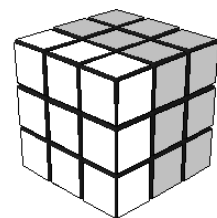
A U turn turns the top face clockwise



An r turn turns both the right face and the middle slice beside it in the same direction

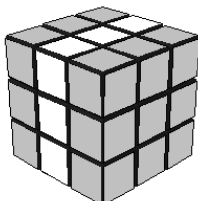


An F' turn turns the front face counterclockwise

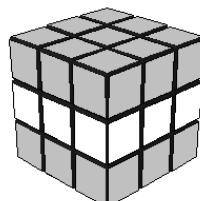


I bet you're probably tired about learning cube notations but there's one more short thing I must teach you before we move on. It is the M, E, and S turns. These are a bit harder to remember than R, L, U, etc. turns but they don't appear too often. M, E, and S all maintain the rules of blank, apostrophe, and 2 but they don't have lower case. A way to remember them is M as Middle, E as Equator, and S as side. M goes down the middle, E runs along the equator and S runs through the side of the cube.

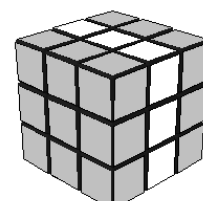
M



E



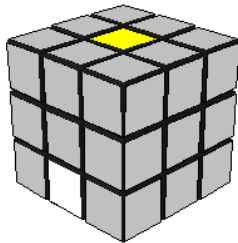
S



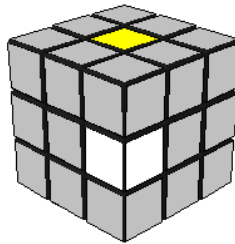
Now back to the fun part, solving the cube. The cross is by far the easiest part of the solve because you don't really have to worry about breaking anything up and it's mostly intuitive. When I say intuitive I mean that how the cross is made is usually figured out by yourself and you can only get faster by practicing and figuring out faster ways yourself. That doesn't mean I won't be telling you anything about solving the cross, it just means that you should be able to solve it by yourself without much help. You should use the face that opposes white as your top face (In my examples I'll use yellow opposite white). The reason most people solve white first is because white sticks out from all the other colours best. Find a white cross piece and twist the face it's on so it ends up beside the yellow center. In this example, a white and white edge piece represents an edge piece with white as one colour and either green, red, blue, or orange as the other colour.

There are 3 cross piece cases

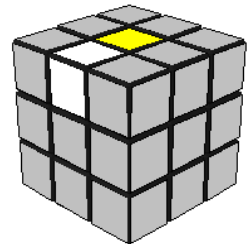
Case 1



Case 2



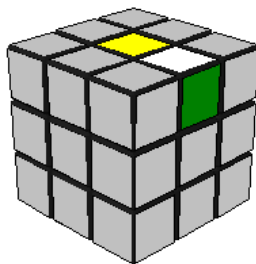
Case 3



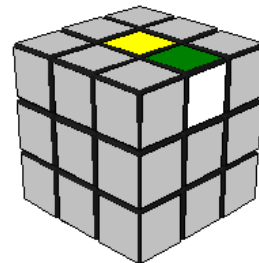
The end result you want to have is case 3 so if you end up with case 3 you can move on to the next step. If you have either case 1 or case 2, they're both a single turn away from case 3. Once you have case 3, you then have to insert the cross piece into the correct spot.

There are 2 cases for this step

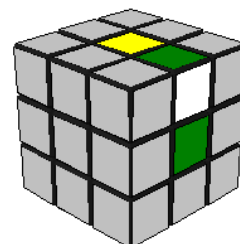
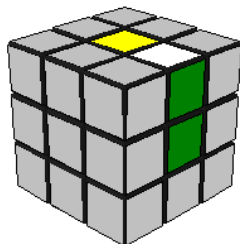
Case 1



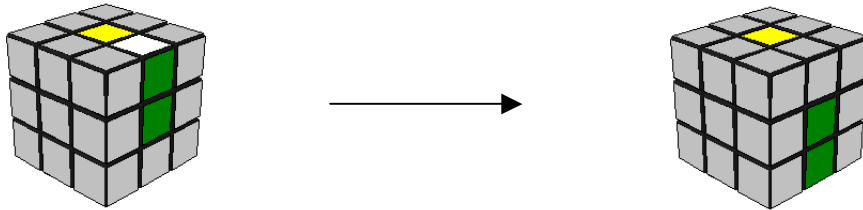
Case 2



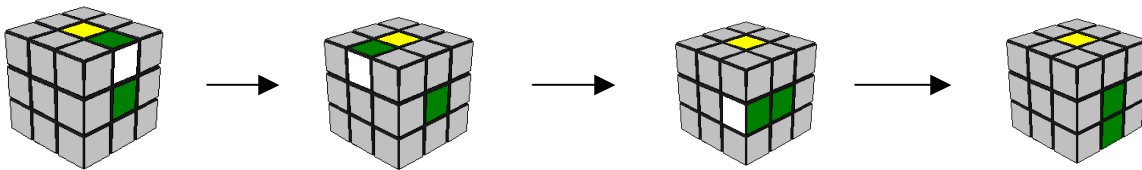
For either of these cases you have to rotate the top face until the cross piece is above the center piece of the colour other than white. In this example, it's green.



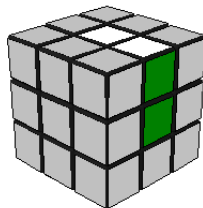
Now if you have case 1, all you have to do is turn the face with the cross piece on it 180° . R2



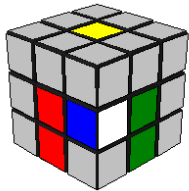
If you have case 2 then you have to do these four moves. U F R' F'



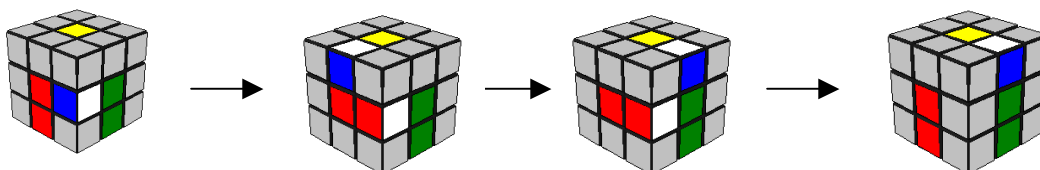
Now you should have this



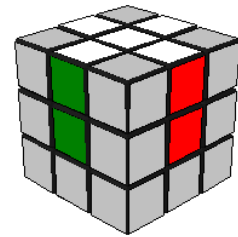
Now all you have to do to complete the cross is repeat those steps for all 4 cross pieces. However, you may run into a slight problem at the first step of cross piece 3 or 4. This is when you end up with something like this.



This is a very common occurrence and isn't very hard to figure out, but just incase you can't figure it out, this is how. F' U' F



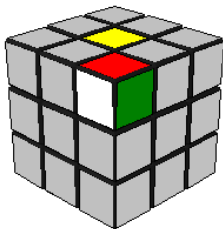
After all four cross pieces have been inserted, you have officially finished cross! Before you start the next step, it's a good idea to keep scrambling your cube and practice solving the cross over and over again until you can solve the cross easily without using this tutorial.



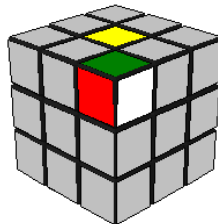
Step 2: solving the first layer corners

Like I said earlier, even though the whole cross is visible when it's on the top face, it's a lot faster to solve the cube with cross on the bottom so we're going to learn to solve the corners with the cross on the bottom as well. The first step to solving first layer corners is to find one to insert preferably on the top (yellow) face. It will look like one of these three cases.

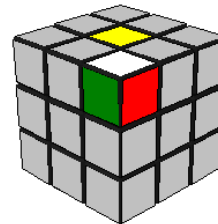
Case 1



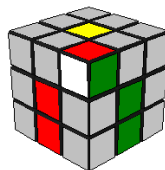
Case 2



Case 3

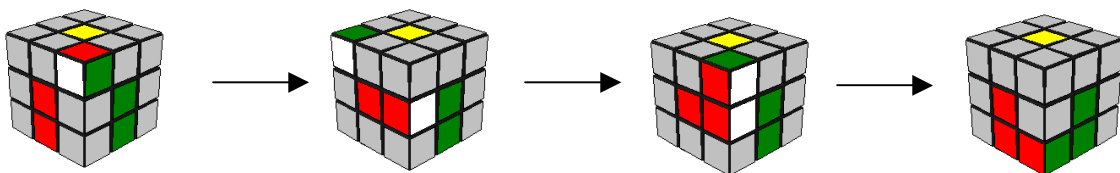


No matter which case you have the next step is the same. Rotate the top face until the corner is directly above the slot where it goes into. You can tell this when the two centers you see match the two on the corner piece that aren't white. I'll use case 1 as an example.

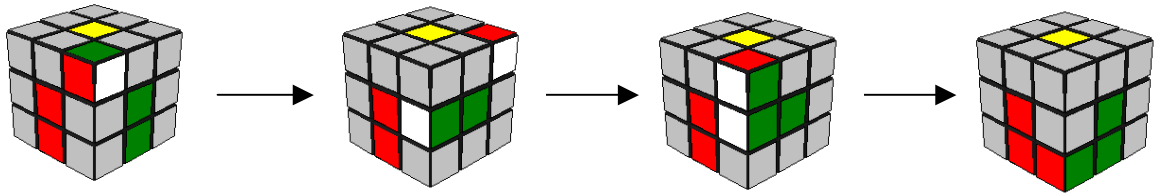


Once you have the corner above the correct slot, follow the correct sequence of moves to insert the corner.

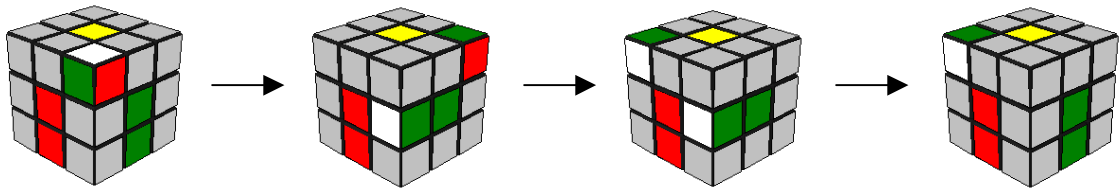
Case 1: $F' U' F$



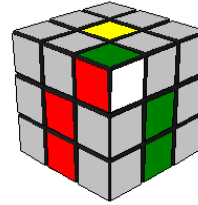
Case 2: R U R'



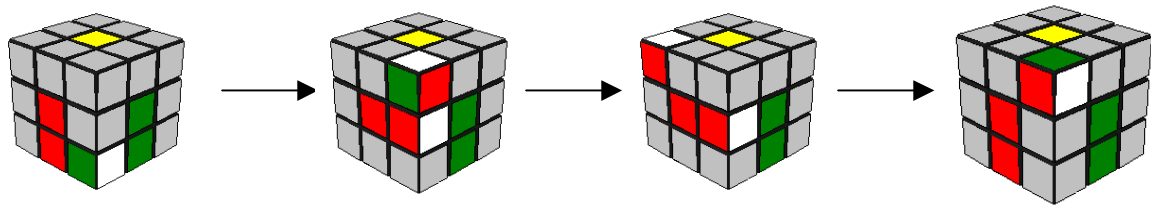
Case 3: R U² R' U'



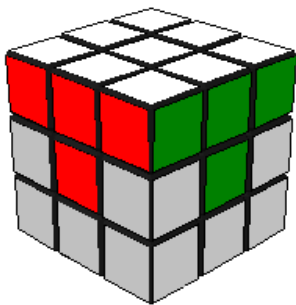
You have now gone from a case 3 to a Case 2, which you can solve.



From what you know now about first layer corners, you should be able to solve the first layer. Unless you can't figure out what to do if you come across one of these. F' U F



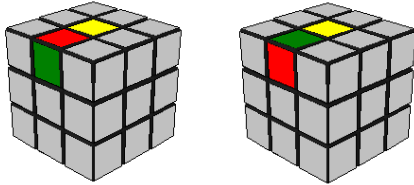
Voila! You now have a case 2!



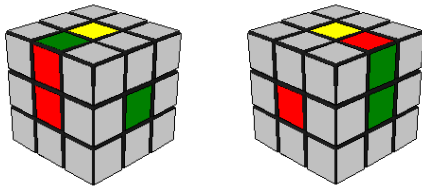
Now with all that I have taught you so far, you should be able to solve the complete first layer. Just so you don't forget, and to improve your speed, you should continuously scramble your cube and practice solving the first layer until you're ready to move on to the next step: Solving second layer edges. In this next step, you will learn your first algorithm.

Step 3: Second layer edges

This step doesn't take long to learn because all you have to do is memorize 2 algs and their effects to solve the second layer. You may also run into a problem on the second layer, which I will show you the solution to. The first thing you do to solve the second layer is to find a second layer edge piece on the top layer. Remember, white is on the bottom. Once you have found a piece, it will look like one of these 2 images.

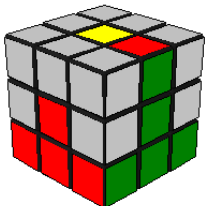


No matter which one you have, you want it to end up so that the colour of the edge piece, that is not on the yellow face, is touching its corresponding center piece on the second layer.



For each of these cases, there is a different algorithm to insert it into the second layer without ruining the rest of the cube.

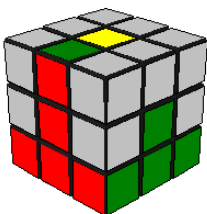
Case 1



Algorithm: $U' L' U L U F U' F'$

When executing this algorithm, you should have the face with edge piece as the front face. In this example, the front face would be green and red would be left face and yellow would be up face.

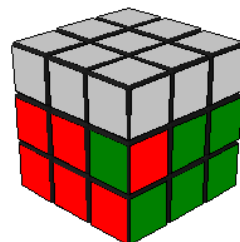
Case 2



Algorithm: $U R U' R' U' F' U F$

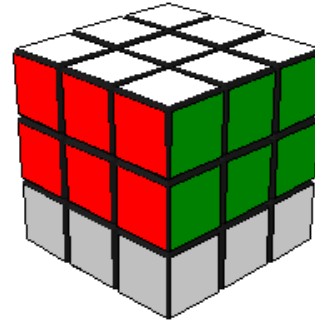
For this algorithm, the positioning of the cube is the same idea. Edge piece on front face. Red would be front, green right, yellow up. As you may notice, this alg is very similar to the previous one you learned. This is because this is a *mirror algorithm*. That just means that its same alg except its performed on the opposite side.

You should almost be able to solve layer 2 by now unless you run into something like this.



There's a simple way to take that piece out of that slot and to put it on the top layer so you can insert it properly. To do this, just use one of the algorithms you learned above to insert a different edge piece on the top layer into that slot. This will bump out the one inserted incorrectly onto the top layer so you can insert it properly.

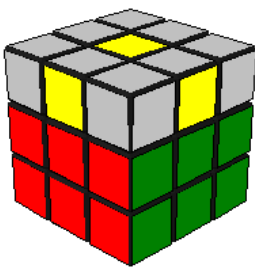
You should now be able to get your cube to look like this. If you can't get to here without instructions then you should practice, practice, practice, until you get it every time. Even if you can get to here without instructions, it's still good to practice. If you never practice, you'll never get faster. Also, if you practice enough, you won't forget how to solve the F2L (first 2 layers) after you learn the next step, solving yellow (bottom) cross.



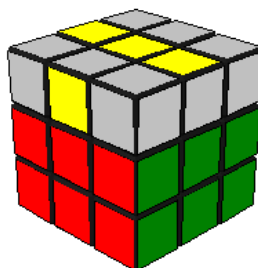
Step 4: Solving the Bottom cross

If you think that solving the bottom cross is anything like solving the white cross then you are wrong. Solving the yellow cross is completely different. It relies completely on algorithms. Even though there are 3 different cases for yellow cross, there is only one algorithm that is needed to complete this step. You just need to know where to execute the algorithm. Here are the three cases.

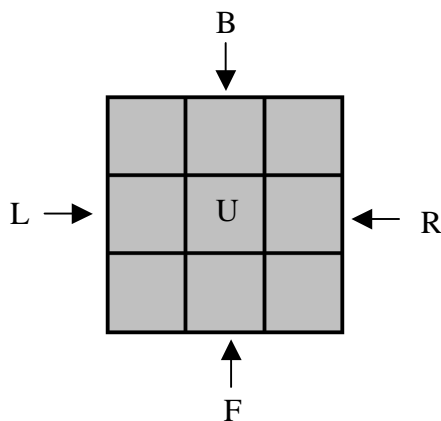
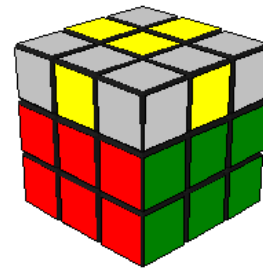
The Dot



The Line

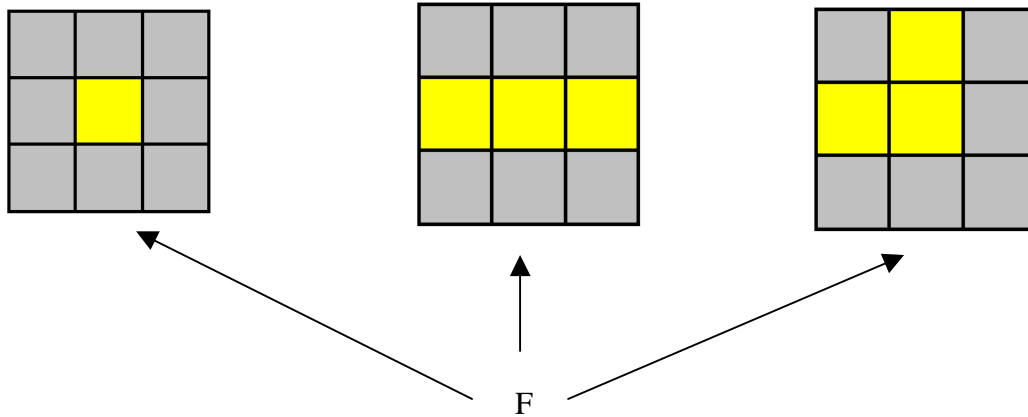


The Backwards L

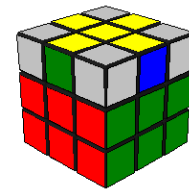


For top face algorithms, I will use a diagram like this one with these face names.

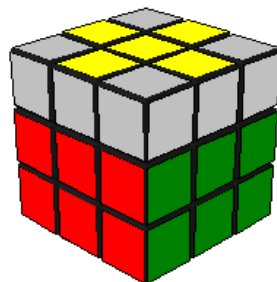
The algorithm for solving the bottom cross is: $F U R U' R' F'$. This alg is executed in the following spots for the cases shown above.



This algorithm doesn't completely solve the yellow cross for all three cases, it only solves the yellow cross from the backwards L. If you use this algorithm on the dot case, you will end up with the line case. Then, if you use this alg on the line case, you will end up with the backwards L case. There are algorithms that solve the yellow cross from all three cases but you'll learn about those later. Once you've finished the yellow cross, you may have noticed that the sides of yellow cross don't match up with the second layer centers. Don't worry about this, that step comes later. Keep practicing solving your cube up to the yellow cross because everyone knows that practice makes perfect. Here is what your cube should look like after the yellow cross.

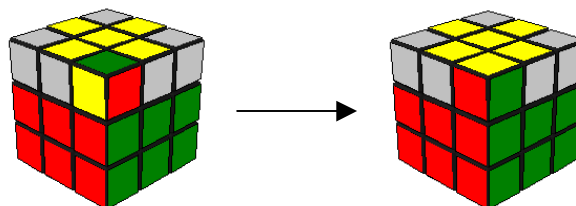


The colours don't have to match the second layer centers



Step 5: Orienting last layer corners

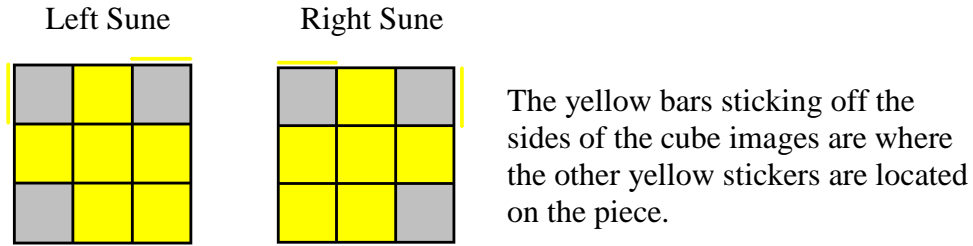
The term orienting means to twist so that the piece you're orienting ends up with the correct colour on the correct side. In other words, you are flipping all the corners so they are all yellow side up. This will make the top face of your cube all yellow. Here's an example of orientation.



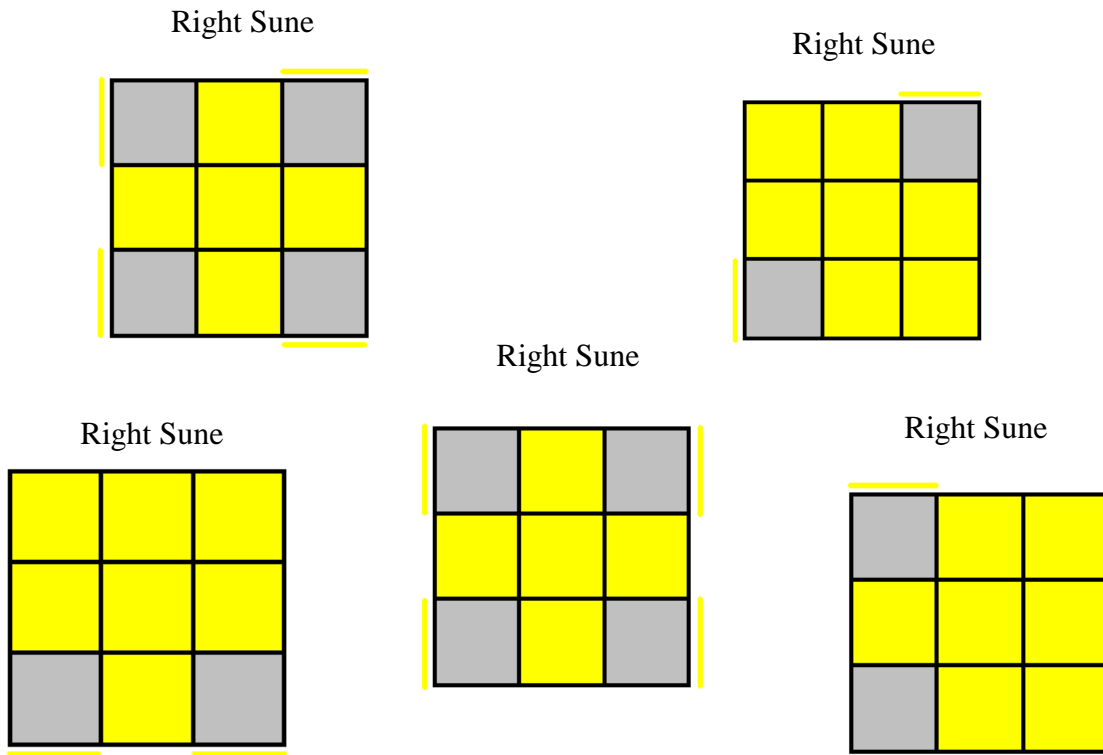
For this step, there are 7 cases to orient yellow corners each with their own algorithm. Since this is the beginner method however, you only need to learn 2 algs for this step.

The first algorithm is called the Sune algorithm. If you have a Left Sune, then you perform this alg: $L' U' L U' L' U^2 L$. If you have a Right Sune, then do this alg: $R U R' U R U^2 R'$.

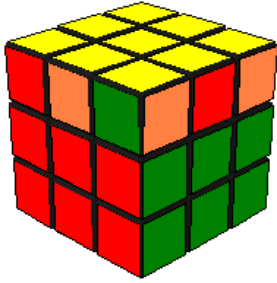
You may have noticed that these algs are similar. This is because they are mirror algs.



Now that you know what to do at 2 of the 7 LL (last layer) corner orientations, you need to know where to perform which Sune alg on which of the 5 other cases.

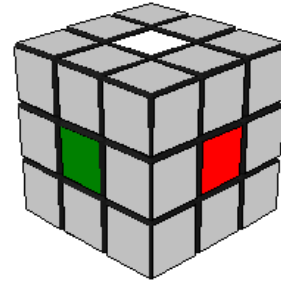


Using the algs suggested above these cases won't solve the yellow corners immediately; they will either take you to a sune or another one of these cases.



Now with what you have learned so far, your cube should look something alike this cube. The only thing left to do now is permuting the corners then permuting the edges. Before you move on, there are two more things you need to do. 1 is practice solving the cube. The other is learning one more thing about cube notation. You are now going to learn about x, y, and z rotations of the cube. The xyz rotations don't actually turn a face on the cube; they rotate the whole cube itself so that you are looking at a

different face than when you started. This will also change what is R, U, L, etc. Alike regular turns; xyz moves also turn clockwise unless there is an apostrophe after them; thus making them turn counterclockwise. Say the cube to the right is your cube and green is the front face. Now imagine a line running through the red and its opposing center. That would be the x-axis of the cube. So to rotate the cube along the x-axis, you would take hold of the right face and turn the cube clockwise as if you were only turning the right face clockwise. The y and z turns are very similar to the x turn. For a y turn, follow the same steps as an x turn except turn along the y-axis, which runs through the top and bottom of the cube. For a y' rotation, you would rotate the cube counterclockwise as if you were turning the up face. A z turn is the same as the others except instead of rotating the cube with the up face, rotate it with the front face.

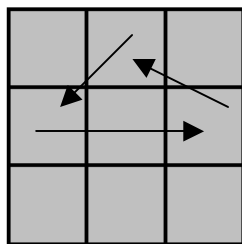


Now that you have learned how to make x, y, and z rotations, you are ready to move onto the next step, which will involve an algorithm with an x rotation.

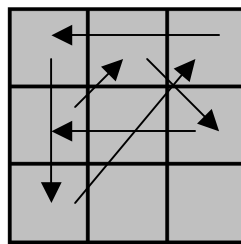
Step 6: Permuting last layer corners

If you're still unsure about the word permuting, permuting is just rotating piece into different spots without orienting them. These are examples of permutation cases.

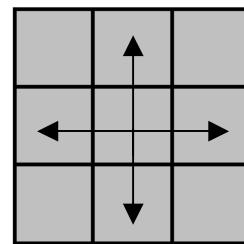
Three edge cycle



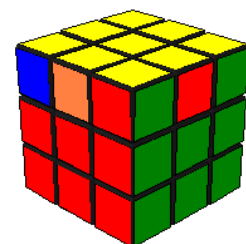
Three corner/three edge cycle



Opposing edge swap



At this step, you should notice that, on at least one face, you have two of the same colour on the same strip of 1x1x3 colours. Look at the diagram to the right. The green is an example of what I'm talking about. If you have a set of corners like that, match them up with the corresponding face (like I did with green) and put that

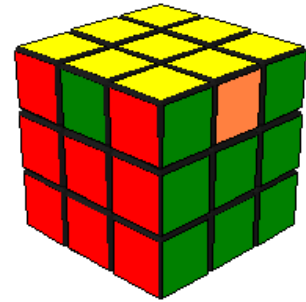


face as the back face. Even if you don't have a pair of corners like that, don't worry; just execute the next algorithm anywhere.

Corner Permutation alg: $x R' U R' D2 R U' R' D2 R2$

Make sure that if you have a pair of matching corners that it is held as the back face before you start the algorithm! If you don't have matching corners, perform this algorithm with any face (other than top or bottom) as the back face; it will then bring you to a case with matching corners.

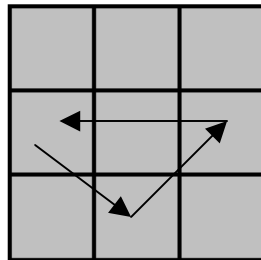
Your cube should now look something like this. Now all that's left is to permute the remaining edges and you've solved your first Rubik's cube! Before you move on to the final step, make sure your practice or you may forget something.



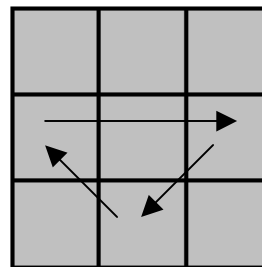
Step 7: Permute final edges

This is probably the shortest step in the whole tutorial because there's not much to explain. All you have to do is memorize two more algorithms and you can solve the cube. For this step there are 4 cases, so by now you will either have one of two 3 edge cycles, an opposing edge swap, or a diagonal edge swap. Here are the two algorithms and where to use them.

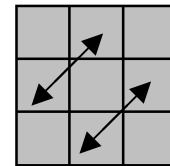
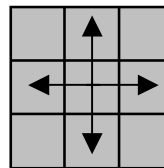
$F2 U' R' L F2 R L' U' F2$



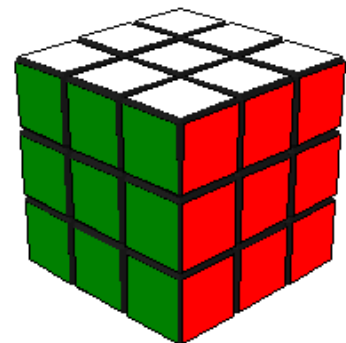
$F2 U R' L F2 R L' U F2$



If you end up with one of these two cases, just perform one of the algs above and you will end up with one of the cases above.



CONGRATULATIONS! You have just officially solved a Rubik's cube for the very first time! Keep practicing this method and you should be able to solve the cube in 1-2 minutes. Be sure to register for the next cube competition at canadianCUBING to show off your new skills and maybe win some prizes.



How to solve Faster

Step 1: estimated solve time: 55-100 sec.

Improve your beginner method by learning the key whole method for your F2L and learn the algs for the other 2 edge permutation cases. Also you should learn to use finger tricks instead of wrist turns.

Step 2: estimated solve time: 40-60 sec.

Move up to the advanced method. To do this, you should learn corner edge pairs for your F2L and learn the algs for all 9 cases of yellow edge orientation. You should also learn the algs for the line and dot cases in step 4.

[Corner edge pair site](#)

Step 3: estimated solve time: 25-45 sec.

Bump up your advanced method to the expert method by learning look ahead for your F2L and learn full PLL.

[PLL site](#)

Step 4: estimated solve time: 7-30 sec.

Learn the Master method by learning, and mastering full PLL and full OLL You should also get very good at look ahead.

[OLL site](#)