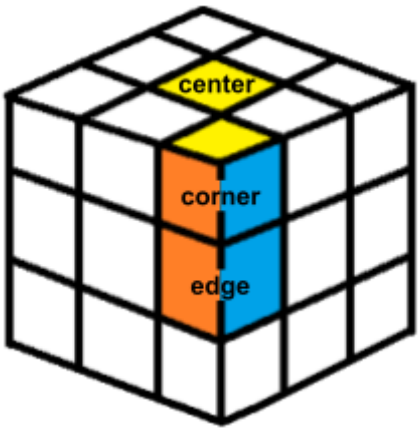
General Cubing Concepts

Anatomy of the cube

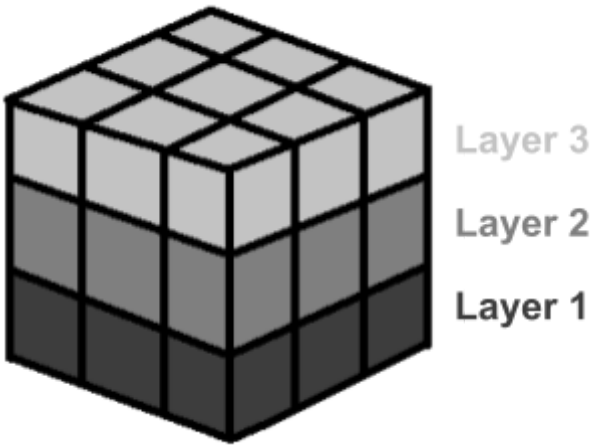
- The 3x3 cube has **6 centres**
- The **centres** are always **fixed** in place
- When you **scramble** or **solve** the cube, only the **edges** and the **corners move**
- Each **centre** has an **opposing colour** that will always be the same
- Knowing this will help you **navigate** the cube easier and make more **efficient turns**



This is the **standard colour scheme** that most cubes will follow. However, sometimes cubes have **different colours**. For example, the **Brain Cube** brand replaces white with purple. Also, **colour blind** cubers may get **custom stickers** with colours that they find easier to distinguish. If your cube has different colours, take some time to study where they are relative to each other.

Layers

- The cube is solved **layer-by-layer** as opposed to **face-by face**
- There are only **3 layers** but **6 faces**, so solving with this approach is **faster** and **easier**
- When you solve face-by-face, pieces may be oriented correctly to create the illusion that they are solved, but they will likely be out of place and will need to be solved later, which is time-consuming and tedious
- It is common for cubers to solve the cube with the **yellow centre** on the **top layer**



Algorithms vs Methods

- A **move** is a **rotation** of a **layer** around an axis (see cube notation below)
- An **algorithm** is a **sequence of moves** that **moves** a piece (or a selection of pieces) to a certain **position** on the cube, **relative** to its **previous position**. This means that after performing an algorithm, only **some pieces** will be **moved** and the **rest** of the cube will be **undisturbed**
- A **case** is a **specific pattern** (arrangement/orientation) of pieces that are **associated** with a **specific algorithm** or approach. Each case is **solved** in **isolation**, so you don't need to always worry about the entire cube as you solve it
- A **method** is an **approach** to **solving** the cube, which consists of a **collection** of **algorithms**.
    - the **beginners method** solves the cube **layer by layer**
    - the **CFOP** method solves the **first 2 layers at once**, followed by the top layer
    - the **Roux** method starts by solving two **2x3 blocks**

Beginners method

CFOP

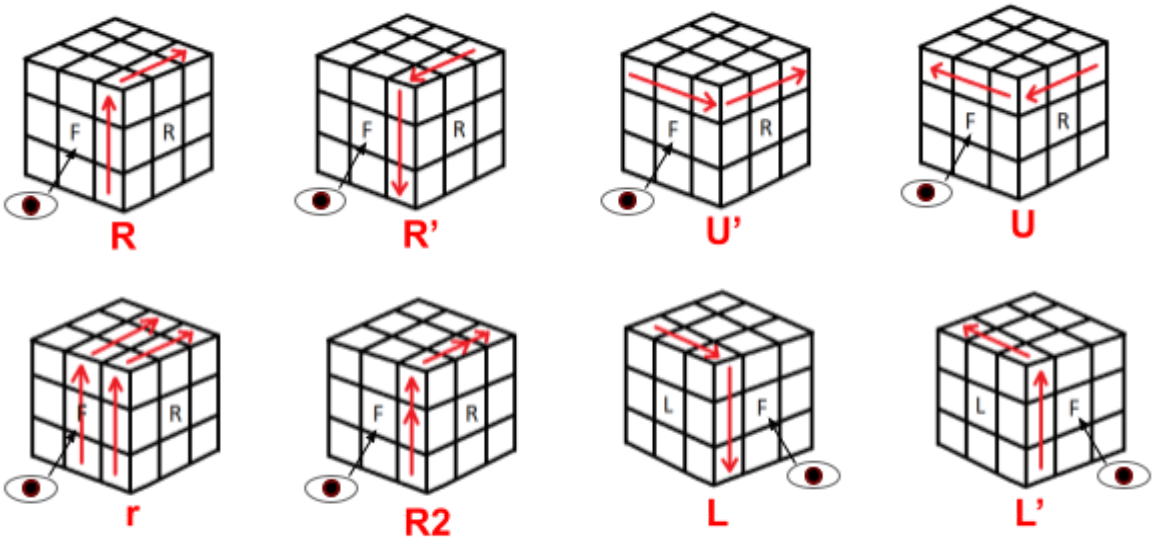
Roux

Cube notation (optional for this guide)

To make explaining algorithms easier, we use cube notation to say which **face** to **rotate** and in what **direction**:

F = front **U** = up
L = left **D** = down
R = right **B** = back

- The **capital letter** by itself tells you that if you were to **look** at that **face**, you would need to rotate it **clockwise**
  - e.g. **R** means you rotate the **right face clockwise**
- When the **letter** is followed by an **apostrophe**, you rotate that **face anticlockwise**
  - e.g. **R'** means you rotate the **right face anticlockwise**
  - you **read** that as "**R prime**"
- When the **letter** is followed by the **number 2**, you rotate it **two times** in **either direction**
  - e.g. **R2** means you rotate the **right face twice**, which would move the top edge to the bottom
- When the **letter** is **small**, that means you rotate **two layers** instead of just one
  - e.g. **r** means you **rotate** the **two rightmost layers**, i.e. the right and middle layer, **clockwise**
  - you **read** that as "**wide R**" or "**R wide**"
  - This can also be **written** as **Rw**



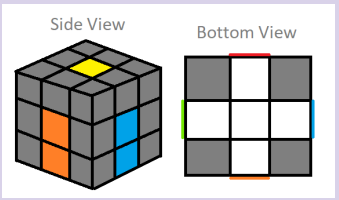
- Keep in mind that **R** and **L** rotate in **opposite directions** relative to each other despite both being clockwise
- I use **dashes** to **break up** an algorithm so it is **easier to follow** and remember, for example U R U' L' - U R' U' L. The dashes have **no actual meaning**

Solving the 3x3 cube: Beginner's method

- The **beginners method** is **slower** than more **advanced methods**
    - e.g you can **solve** the cube in **~1 minute** with it, compared to the 3 second world record set with CFOP because the beginners method requires **more moves** (~100)
- This method only has **4 algorithms**, compared to the 90+ algorithms of CFOP, making it easy to learn
- It is likely that you will mess up the first few times you try to solve a cube. Just re-scramble it and try again, because practise makes perfect
- For faster improvement, don't re-scramble the cube when you make a mistake and instead try to work back up from an earlier step. For example, if you messed up the final layer, you may still have the whole first layer and half of the second layer solved. Finish the second layer and attempt the top layer again. This will help you learn to navigate the cube and adapt to challenging situations

First Layer

Step 1: White Cross

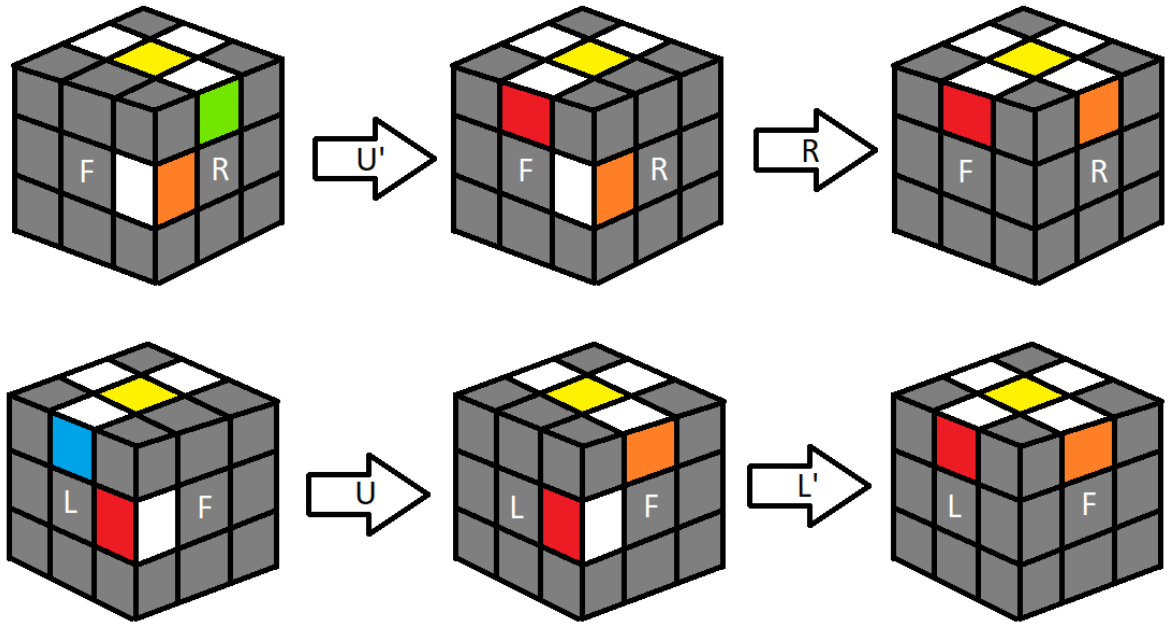


More **experienced** cubers can solve the **white cross straight away**, but complete **beginners** should start with the **daisy** to reduce the number of things they need to keep in mind during this step.

The **daisy** will help you get all the **white edges** on **one face**.

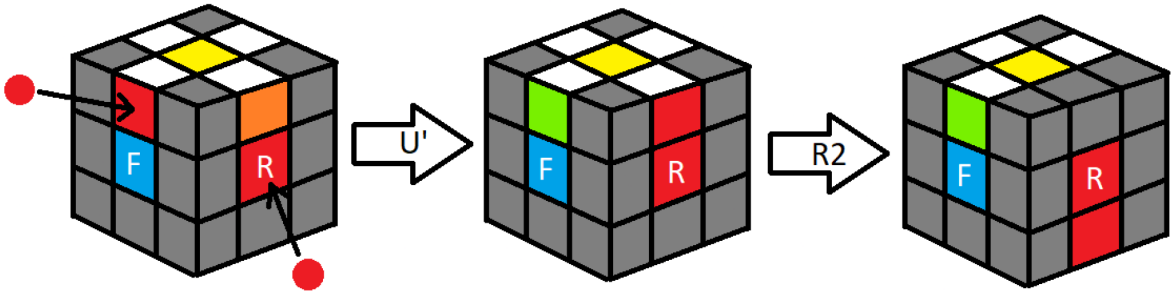
1. Hold the cube with the **yellow centre up**
2. Find any **white edges** and **move** them to the **top layer around** the **yellow centre**, creating a **daisy** with **4 petals** (**ignore** any white **corners**)

There are several ways to do this, depending on where your white edges are. Here are some tips for the trickiest cases:



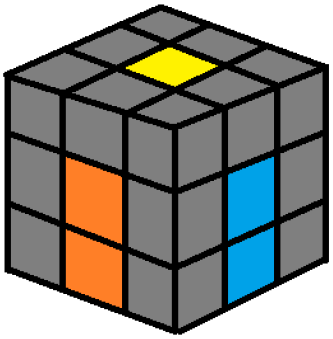
Once you have made the daisy, you can move on to the **white cross**, which **aligns** each **white edge** to its respective **centre** and adds it to the **white face** on the **bottom layer**.

3. Choose a **white edge** on the **daisy** (a petal) and **rotate** the **top layer** until the edge's **non-white** colour **matches** a **centre** of the **same colour**
4. **Rotate** that **edge** to the **bottom** of the cube so that it is **next to** the **white centre** (using an **R2** or **L2** move)
5. **Repeat** for all the **remaining petals**

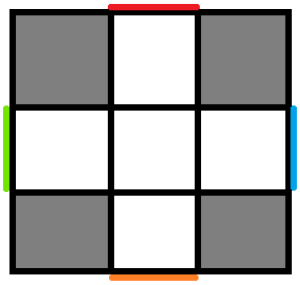


At the **end** of this step you should have a **white cross** on the **bottom face**, with each **edge** piece **matching** its **centre's colour**

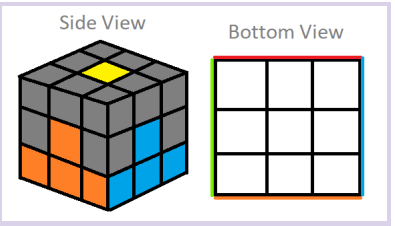
Side View



Bottom View



Step 2: First Layer

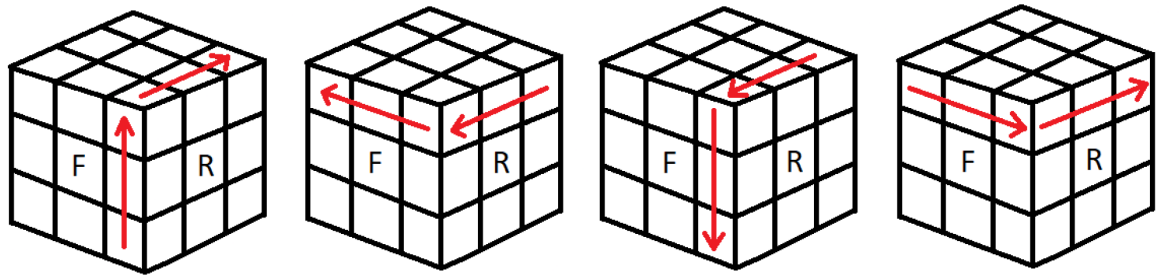


With the cross foundation done, you can now complete the **first layer** by moving the **white corners** into their correct positions.

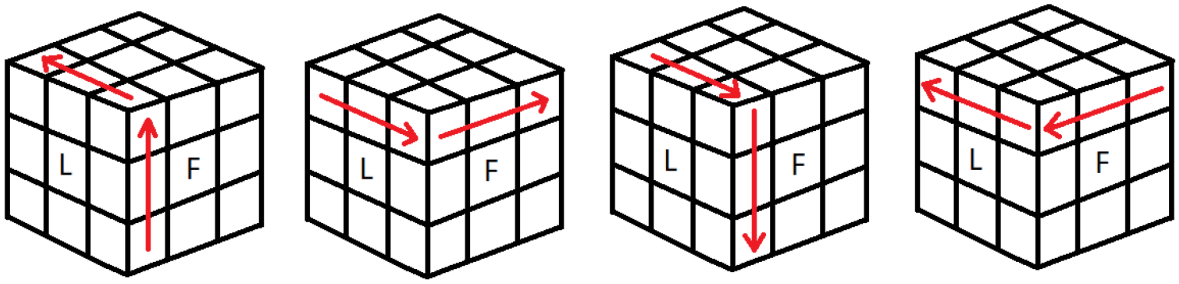
For this, you will need to learn your first algorithm. It's called the **Sexy Move** (yes, really!). It has 2 versions, **Left Sexy Move** and **Right Sexy Move**. It's the **same** algorithm, but **mirrored**. It goes like this (**relative** to your **hand**):

Up, Away, Down, Towards

Right Sexy Move - R U R' U'
Use the right hand to do the moves



Left Sexy Move - L' U' L U
Use the left hand to do the moves



Practise this algorithm a few times until you're familiar with it. The Sexy Move is of **order 6**, which means that if you **repeat it 6 times**, the pieces on your cube will **return** to the **same positions** they were in **before** you started doing the algorithm. Therefore, unless you mess up, you can practise this algorithm in multiples of 6 times.

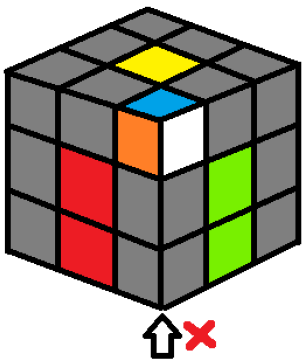
The **sexy move** can be used to **rotate** a **corner piece**, which is what we will use it for in this step.

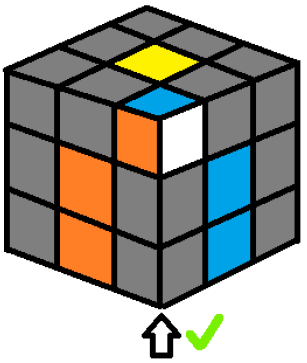
(Generally, when you hear the words "Sexy Move" without a direction, it means the right sexy move)

Now **compare** each of the 4 **white corners** on your cube to these **cases**, and **solve** them **one by one** until all **4 corners** are in the **bottom layer** and are **oriented correctly**. The colours of your white corners will vary depending on the corner, but the cases will look the same. To simplify the process, try to look for corners that match case 1, and only do cases 2 and 3 when there aren't any that match case 1.

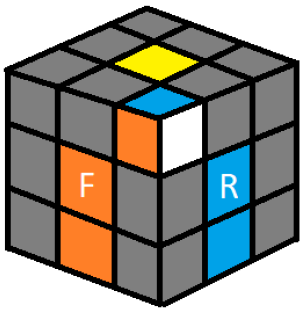
Case 1: WHITE CORNER is on the SIDE of the TOP LAYER

1. **Rotate** the **top layer** until the **white corner** piece is **above** where it needs to go - in the **column** between the **centres** of the same **colours** as its sides

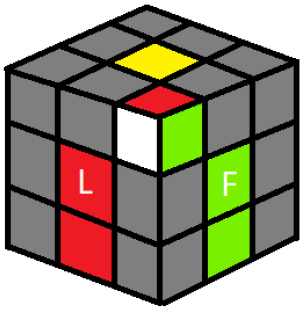




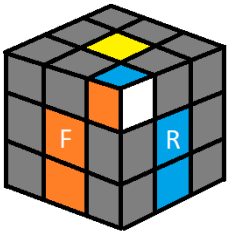
2. Hold the cube so the the **white corner** piece is on the **top front** and the **white side** is pointing **into** one of your **hands**



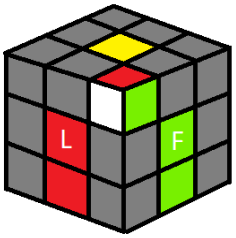
OR



3. Take note of **which hand** the white is pointing into and do the associated **sexy move**

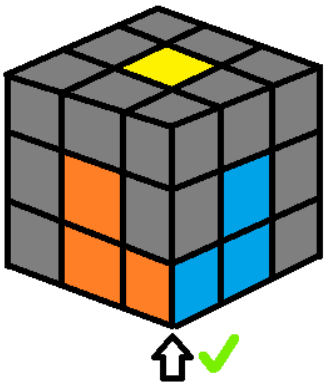


right hand = do the **right** sexy move



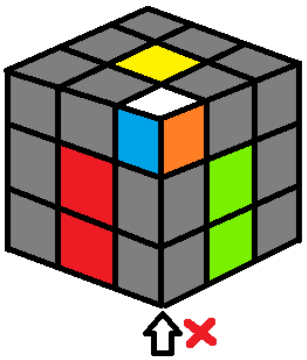
left hand = do the **left** sexy move

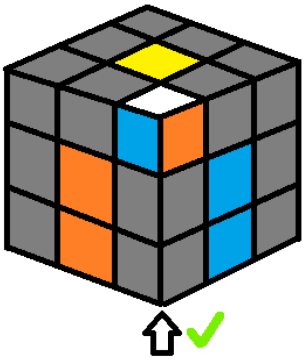
The **corner** will now be in the **correct position**



Case 2: WHITE CORNER is on the TOP of the TOP LAYER 

1. **Rotate** the **top layer** until the piece is **above** where it needs to go - in the **column** between the **centres** of the same **colours** as its sides

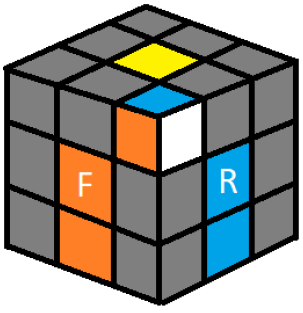




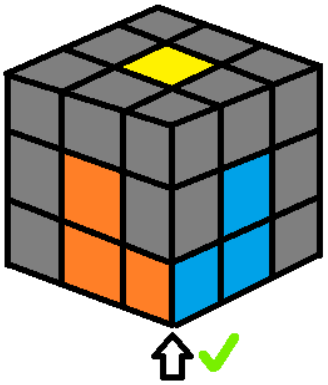
2. Hold the cube so the the **white corner** piece is on the **front right**

3. Do the **right sexy move**, but do the "**away**" move **twice**: R U2 R' U' (alternatively, you can do the right sexy move twice)

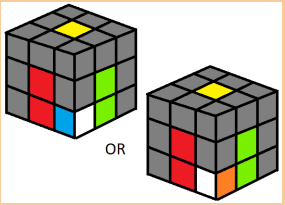
This will rotate the corner so that the **white** is **facing** your **right hand**



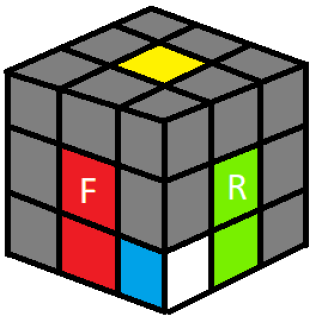
4. Do the **right sexy move** to **insert** the **corner** into place

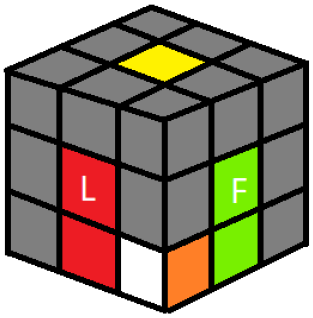


Case 3: WHITE CORNER is on the BOTTOM LAYER

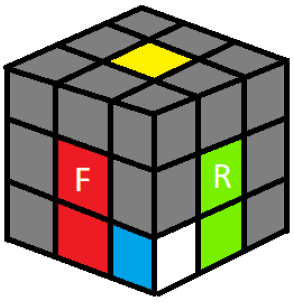


1. Hold the cube so that the **white corner** piece is on the **front** and the **white** side is pointing **into** one of your **hands**

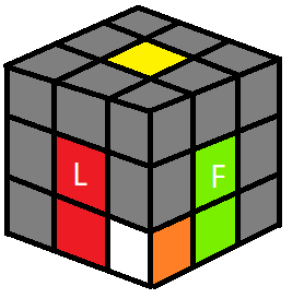




2. Take note of **which hand** the white is pointing into and do the associated **sexy move**

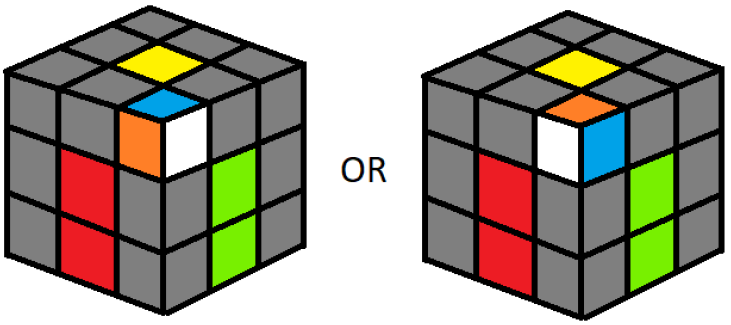


right hand = do the **right** sexy move



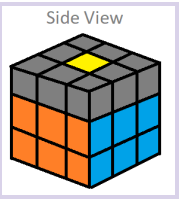
left hand = do the **left** sexy move

The **corner** will now be on the **top layer**.



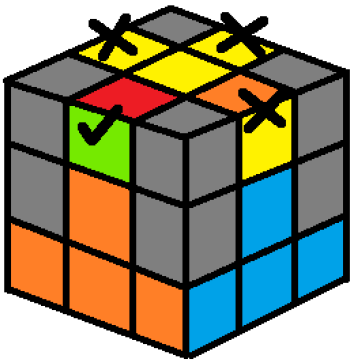
4. **Follow Case 1** to finish inserting the corner.

Step 3: Second Layer

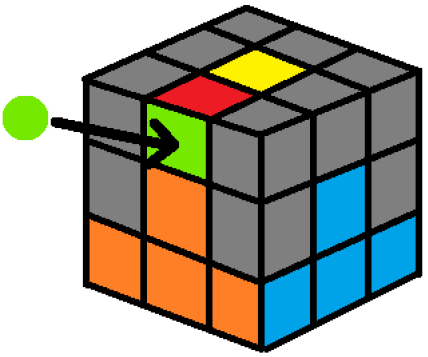


Now we will use the left and right sexy move to **fill** in the **4 edges** of the **second layer**.

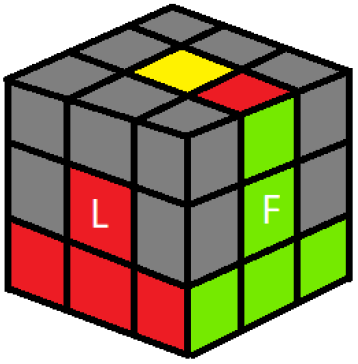
1. Look at the **top layer** and select an **edge** piece that **doesn't** have **yellow** on it.



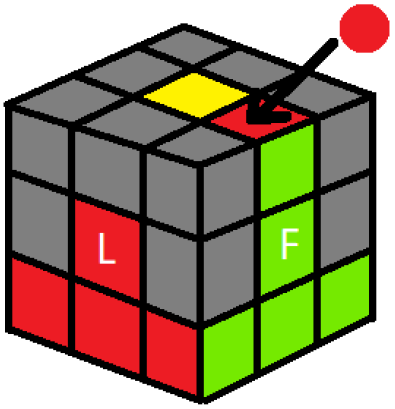
2. Make note of the **side colour** of the **edge** piece



3. **Rotate** the **top layer** to **match** the **centre** colour of the **edge side**. Face that centre until step 7

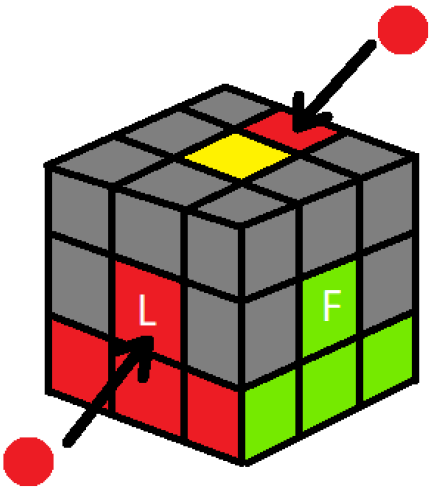


4. Make note of the **top colour** of the **edge** piece

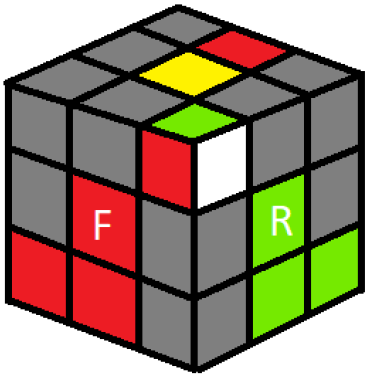


5. **rotate** the **top layer** so that the **edge piece** is **opposite** its **top colour centre**. Make sure you are still facing the centre of the side colour

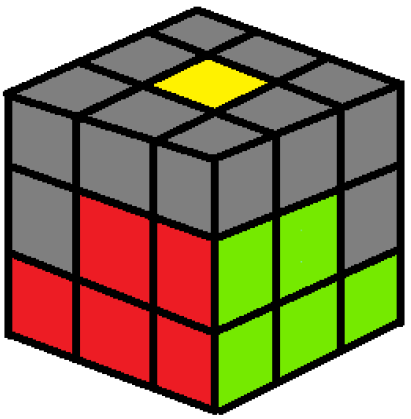
6. Do the **sexy move** of the **hand** that **holds** the **top colour centre** (in this example, red = left sexy move)



7. Your **corner** will pop out. You will need to **fix** it with the **opposite hand**, so change what hand you hold the cube in, now **facing** the **centre** of the **top colour** and holding the **centre** of the **side colour** with the **other hand**

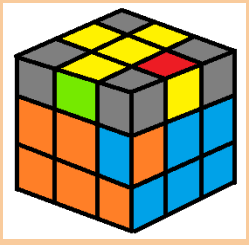


8. Do the **sexy move** of the **new hand**. This will **join** the **corner** and **edge** pieces together and **insert** them into the **column between** their **centres**
    a. It’s the same thing you would do in step 2 to insert the white corner into the correct slot on the bottom layer, just this time along with the edge

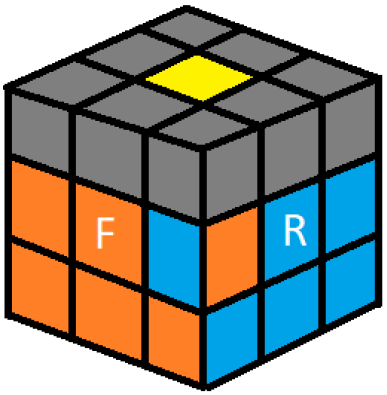


Your **edge piece** should now be **inserted** in the **correct place**.
Great! Now **repeat** it for the **remaining edges**.

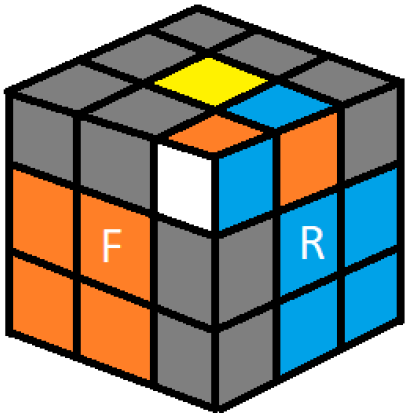
Special case: ALL TOP LAYER pieces have YELLOW and one EDGE in the SECOND LAYER is ORIENTED WRONG



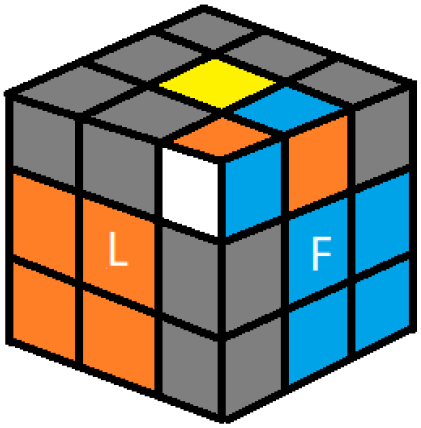
1. Hold the cube so that the **incorrect edge** is on the **front right**



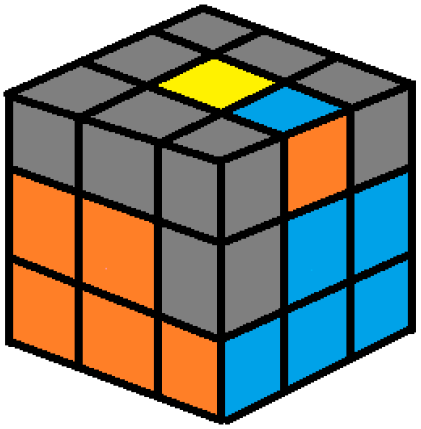
2. Do the **right sexy move** to pop out the edge into the top layer



3. **Change** the **hand** you hold the cube with (right -> left) and **face** the **centre colour** of the **top** of the **edge** piece



4. Do the **left sexy move** to return the white corner to its correct position
    a. It's the same thing you would do in step 2 to insert the white corner into the correct slot on the bottom layer



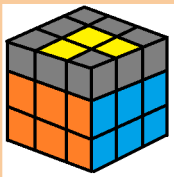
Proceed with solving the edge from **step 4** of the **main case**.

Top Layer

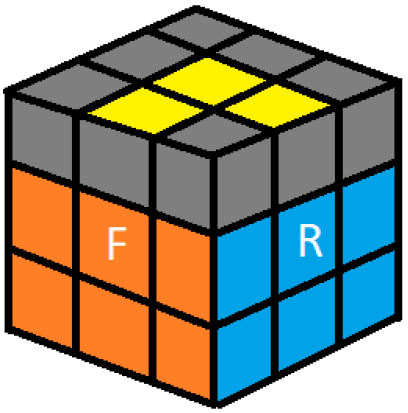
Step 4: Yellow Cross

Look at the **edge pieces** (or "petals") around the **yellow centre** and **compare** them to one of the 3 possible **cases** (**ignore** any **corner** pieces for now).
In this step you will need to learn a **new algorithm**. It's actually not very new, because it's just F or wide-F moves with a right sexy move sandwiched between them.

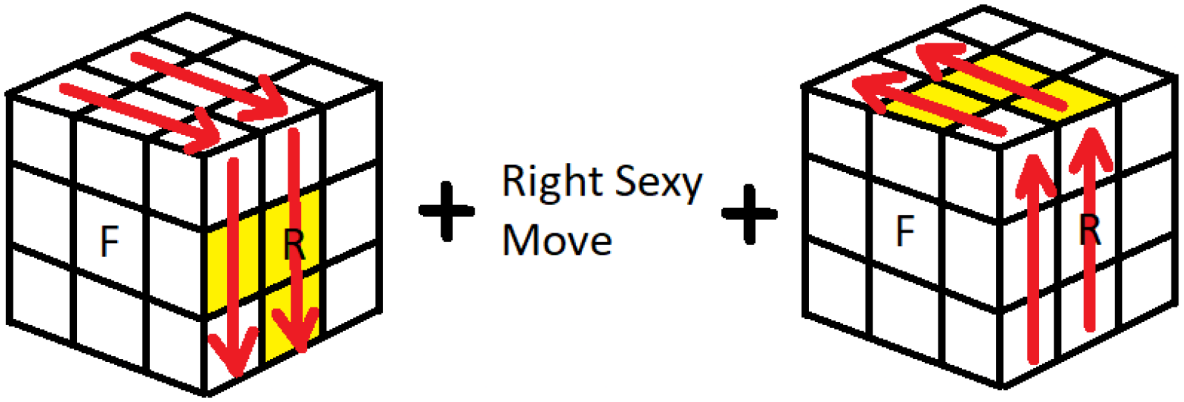
Case 1: L shape



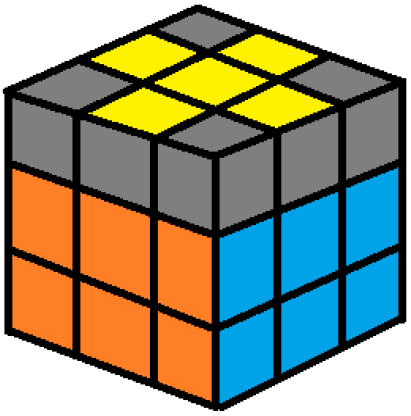
1. **Hold** the cube so that the **yellow pattern** is pointing to **6:15 o'clock**

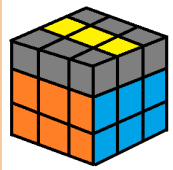


2. Do the **wide F** version of the **new algorithm**
    a. Tip: when turning the F faces, **hold** the **back face** of the cube to keep it upright while the 2 front layers are rotated

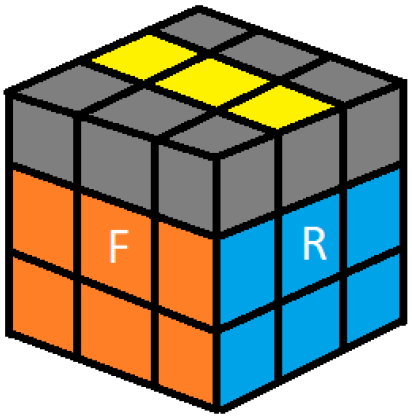


This will give you a **yellow cross**.

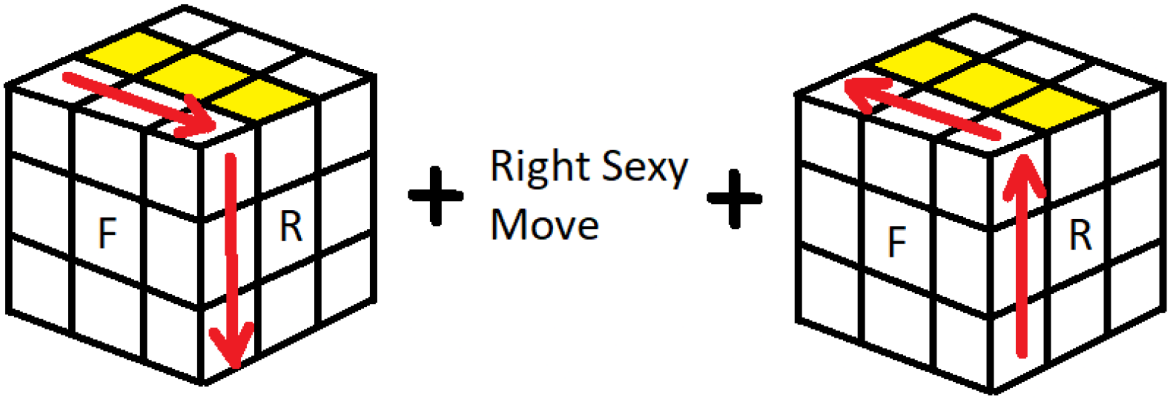


Case 2: Bar 

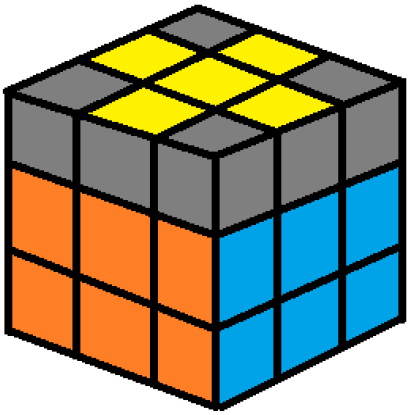
1. **Hold** the cube so that the **bar** is **horizontal**

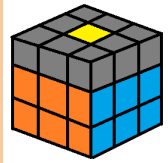


2. Do the **F** version of the **new algorithm**
    a. Tip: **hold** the **middle slice** of the cube to keep the cube upright while the front face is rotated

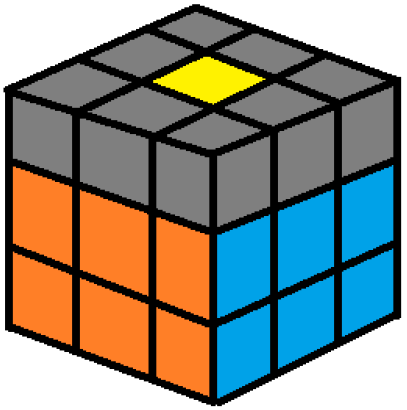


This will give you a **yellow cross**.



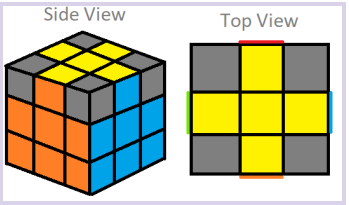
Case 3: Dot 

It doesn’t matter which way you **hold** the cube for this case, as long as the **yellow dot** is on the **top face**



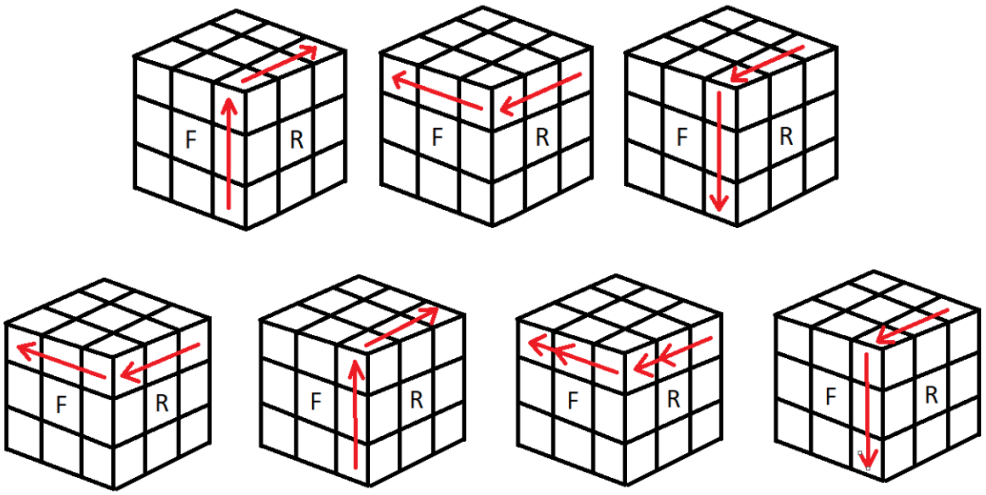
1. Do the **algorithm** of **Case 1** followed by the **algorithm** of **Case 2**

Step 5: Top Edges



Now we need to learn another algorithm. This algorithm is called the **Sune** (pronounced “soon”, as in “we’re almost there, just 2 more steps”). You know it’s an important algorithm when it has a name.
Tip: The **first 3 moves** are the same as the **Right Sexy Move**.

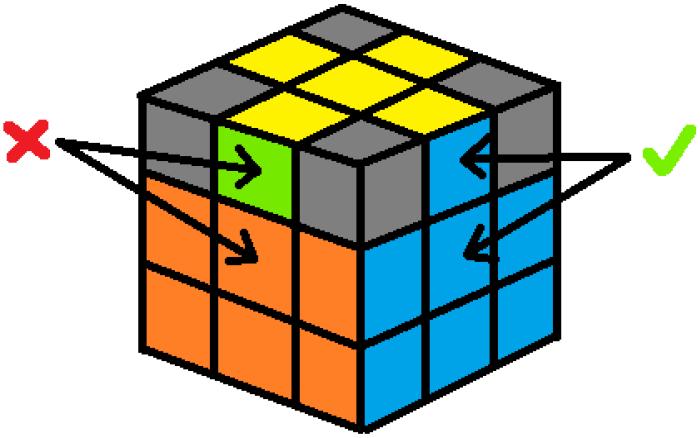
R U R’- U R U2 R’



The Sune **swaps 3 edges** around the **top layer anticlockwise**, **apart from** the (it also rotates and swaps all 4 corners in the top layer)

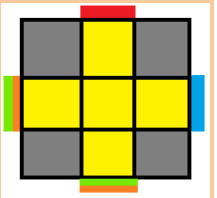
IN this step we’re going to **match** all the **yellow cross edge colours** to their **correct centres**.

1. **Rotate** the **top layer** and see if you can find any **edge sides** that **match** their **centre**

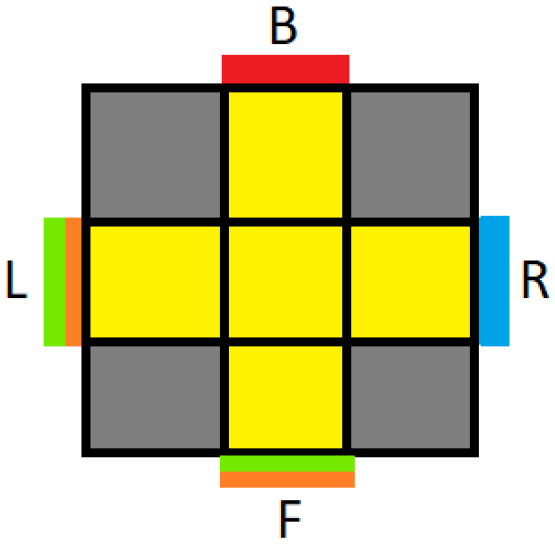


There are **2** possible **cases** (+ the case where all 4 edges are already aligned, so you skip the algorithm). If your cube **doesn’t match** them, you need to **keep rotating** the **top face**.

Case 1: Two edges match their centres

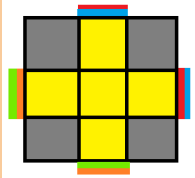


1. **Hold** the cube so that **one** of the **matching edges** is at the **back**, and the **other** one is in your **right hand**

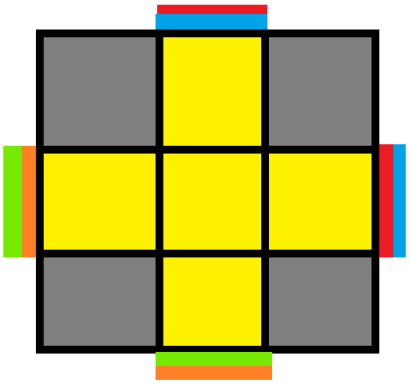


2. Do the **Sune**

Case 2: None of the edges match

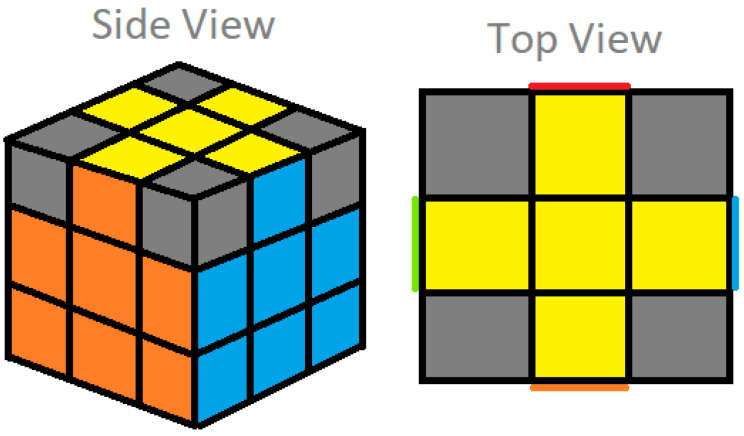


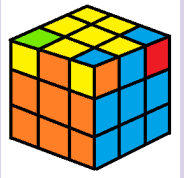
It **doesn't matter** which way you **hold** the cube (as long as the yellow face is on top)



1. **Do** the **Sune**
2. **Check** your **case after** the **algorithm**, **re-align**, and do the algorithm **again** until all **4 edges** are **aligned**
    a. Doing the algorithm on Case 2 will result in 2 edges aligning, becoming Case 1

After the algorithm, **all** 4 of your **edges** should **align** with **their centres**

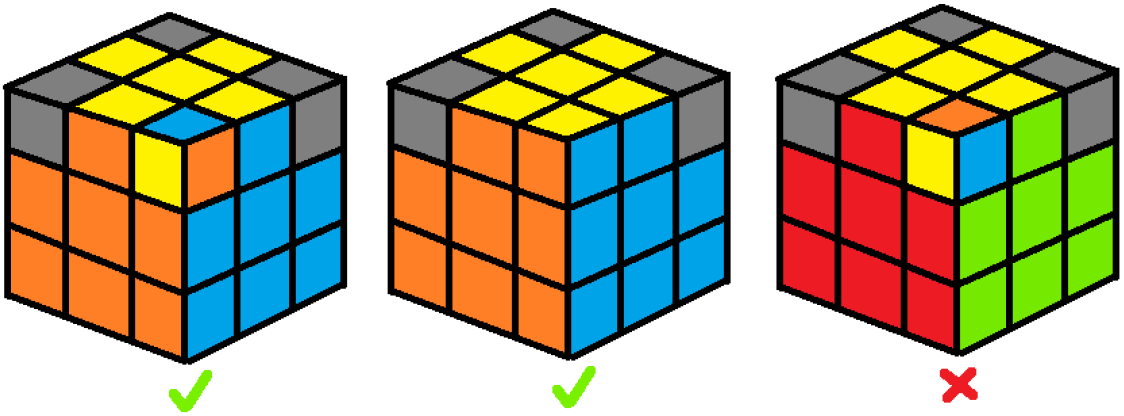




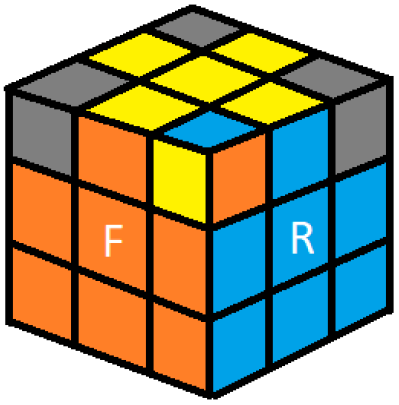
Step 6: Positioning Top Corners

Now we need to make sure all the **corners** are **between** the **correct coloured centres** (they don't yet need to be oriented correctly).
You **can't rotate** the **top layer** in this step, since the **edges** are **already in place**.

1. **Look** for a **corner** that is in the **correct position**. You may have one, none, or all (in which case you can skip Step 6)

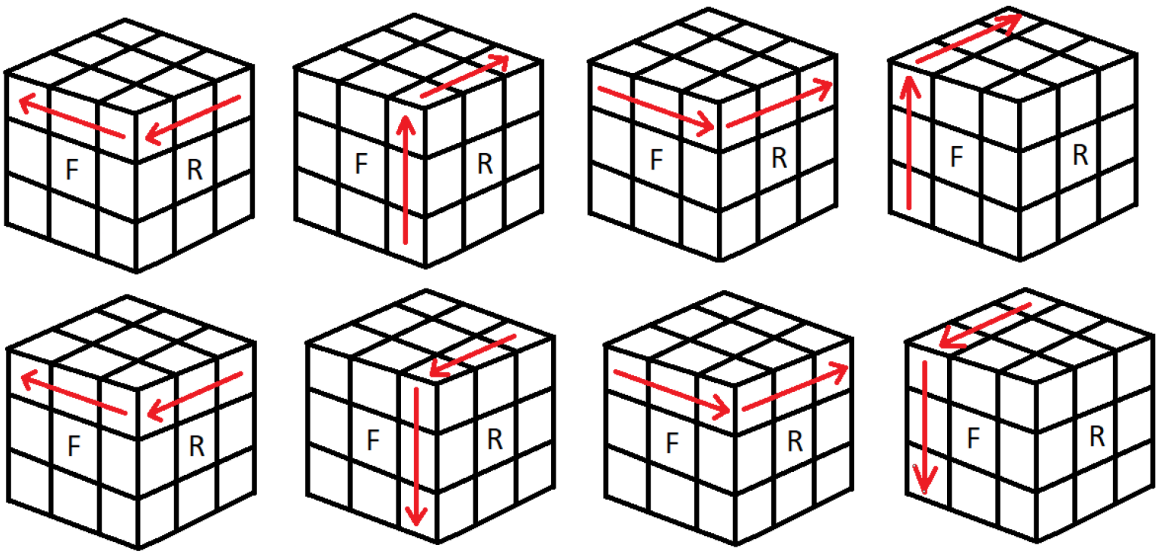


2. If you have **more than one** correct corner (but not all 4), **select one** and **hold** it at the **front right**. If you don't have any correct corners, it doesn't matter how you hold the cube.



It's time to learn the final algorithm. Maybe it has a formal name, but I don't know it. I call it the **Dancing Algorithm**, because… just look at it:

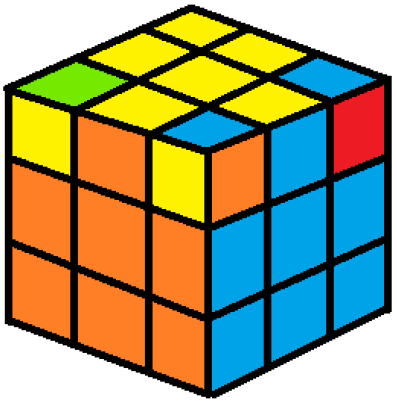
U R U' L' - U R' U' L

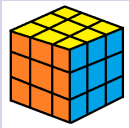


The dancing algorithm **moves** around **3 top corners anticlockwise**, making them **switch places** (the **only** corner that **stays in place** is the one on the **front right**)

3. **Do** the **dancing algorithm**
4. **Check** your **corners**. You may have more than one correct, all correct, or none again. **Repeat** the process and do the algorithm as many times as you need **until** all **4 corners** are **correct**

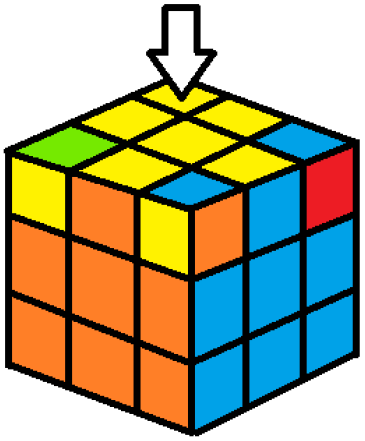
Your cube should now look something like this:



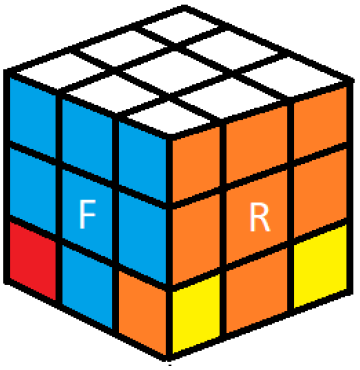
Step 7: Orientating Top Corners 

Finally, all we need to do now is make **all corners point** with the **yellow colour up**.
If you’ve been paying attention, I mentioned in Step 2 that you can **rotate** a **corner piece** using the **sexy move**. That’s exactly what we’ll be doing now.
Don’t get carried away with the joy of almost finishing though, because you need to be **very careful** here. One wrong move and you will mess up the cube. You have been warned. Pay attention.

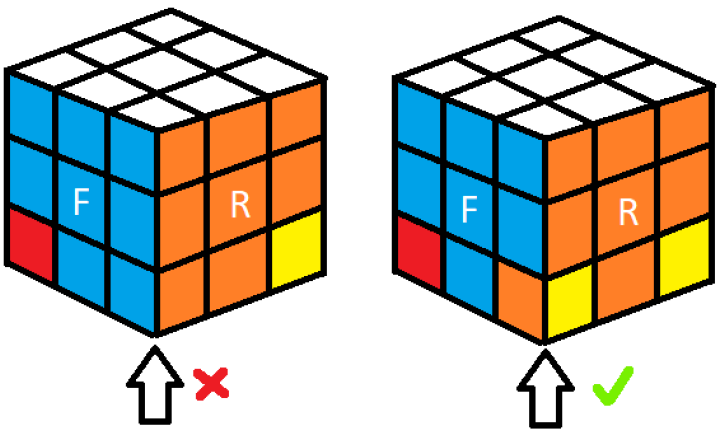
1. Find **any corners** that may **already** be **pointing** with the **yellow side up**. You will need to **exclude** them from the sexy move (i.e **rotate past them**). More on that in a bit, just be mindful of them for now.



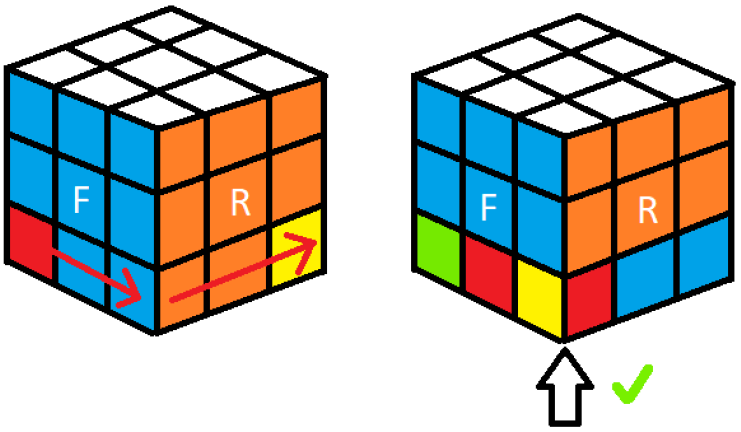
2. **Turn** the **cube upside down**. This action feels illegal, since you’re supposed to always solve the cube with the yellow face up. Better get this done quick, before the cops find you



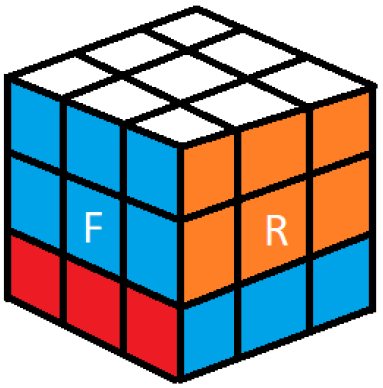
3. We will be working with the **front right pieces**. Check that the **front right corner** is **not** an **already solved** corner



4. If it isn't already solved, continue. If it is, **rotate** the **bottom layer** towards your **right hand** until the corner in the front right column is not solved. **Do not** rotate the **whole cube**



5. Do the **right sexy move**. You may need to do it **several times**, until the **piece** on the front right is pointing with its **yellow side down**. Because the order of the sexy move is 6, you should need **between 1 and 5** sexy moves for the piece to orient correctly. If it's still not correct after >6 times, you have probably messed up and need to backtrack.
    a. Tip: because you need to do the sexy move several times, **don't rush** it. It's easy to **lose count** or get a muscle cramp that will break the rhythm and leave you lost
6. Once the current piece is oriented correctly, go **back to step 4** and **repeat** for **all remaining corners**. Remember to **not rotate** the **whole cube**, just the **bottom layer**. Also **skip** any **corners** that are **already solved** by **rotating** the **bottom layer**.
    a. Tip: Your cube will look like a mess until all 4 corners are solved, that's normal. But keep in mind that the sexy move only affects the top face and the front right column. If other pieces are out of place (apart from the bottom corners which we are trying to solve), you have messed up and need to restart
7. When **all** the **corners** have been **solved**, your cube will look something like this:



8. You can now **turn** it **upside down** again and **align** the **top layer**. This is called AUF, or Aligning the Up Face. Why don't they call it the top face? I don't know, I wasn't the one who came up with this stuff

You’re done! You solved it! Time to celebrate and then never pick up the cube again.