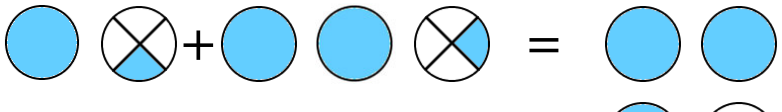
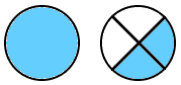
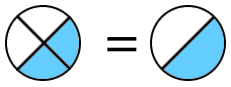
Adding and Subtracting Mixed Numbers

We're going to start out by looking at a few examples we are already familiar with: adding fractions with common denominators. Remember, adding means to **push together the sets and count.**

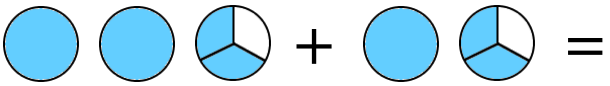
Example 1: $1\frac{1}{4}+2\frac{1}{4}$ 

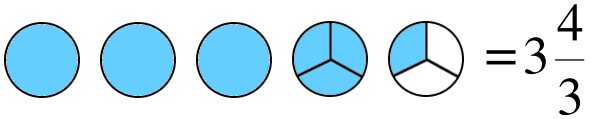
$= 3\frac{2}{4}$ 

Now, we can "trade in" the $\frac{2}{4}$ for an equivalent piece which represents the same amount: $\frac{1}{2}$. 

So, $1\frac{1}{4} + 2\frac{1}{4} = 3\frac{2}{4} = 3\frac{1}{2}$

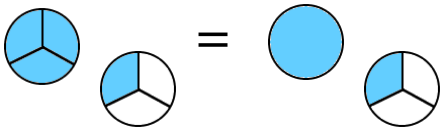
This type of adding does not require any type of regrouping, or "carrying". Let's look at one that does.

Example 2: $2\frac{2}{3}+1\frac{2}{3}$ 

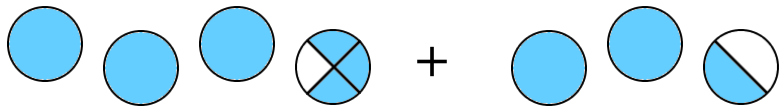


In this case, we can see that the $\frac{4}{3}$ come together to form an entire extra whole.

$\frac{4}{3} = 1\frac{1}{3}$. What we end up having is a total of 4 wholes and $\frac{1}{3}$ left over, or $3\frac{4}{3} = 4\frac{1}{3}$. *Notice how changing $\frac{4}{3} = 1\frac{1}{3}$ is just changing an improper fraction into a mixed number and adding it back to the other wholes!*

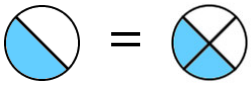


Next, we're going to be looking at getting a common denominator and regrouping.

Example 3: $3\frac{3}{4}+2\frac{1}{2}$ 

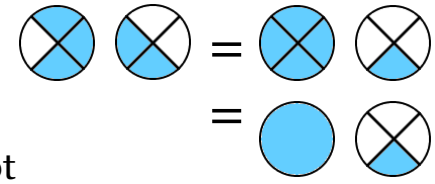
The problem here is that the sizes of the pieces of non-wholes are different, So we're going to have to break them up into a common size so that we can count how many we have in total. This is the *common denominator* we're all familiar with.

Notice that when we break these pieces up, the pieces become smaller, and therefore it takes more pieces to make a whole. At least one of the denominators becomes larger as a result.

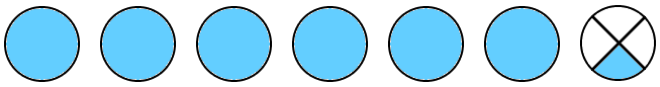
We know that $\frac{1}{2}=\frac{1}{2}\bullet\left[\frac{2}{2}\right]=\frac{2}{4}$ 

Therefore, we can substitute one in for the other. Our set looks like this:

For these last two, do you see how they can be combined further?



This is *just like* regrouping in base ten except instead of "carrying" when you get to 10, you're "carrying" when you get to 4, which is the common denominator of the fractions you're adding.

What does our final set look like? 

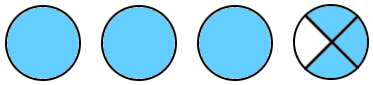
$6\frac{1}{4}$

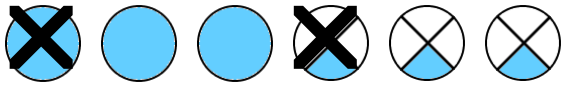
On your paper, draw sets to represent

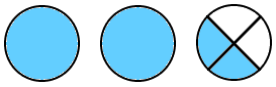
1) the original sets
2) the sets after getting a common denominator
3) the combined sets
4) the simplified sets for each of the problems below

1. $2\frac{1}{2}+3\frac{1}{3}$
2. $2\frac{3}{4}+1\frac{3}{4}$
3. $2\frac{3}{4}+3\frac{3}{8}$
4. $3\frac{1}{4}+1\frac{2}{3}$
5. $2\frac{1}{2}+2\frac{4}{5}$

Now we're going to take a look at subtraction. Subtraction differs from addition in that we start off with one set and remove part of it instead of starting off with two sets and combining them. At this point, we're all familiar with the "take away" model of subtraction. As before, we will start with a problem that requires no regrouping and no denominator change.

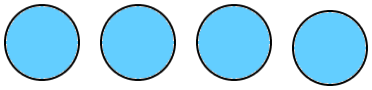
Example 4: $3\frac{3}{4}-1\frac{1}{4}$ 

Since we are getting rid of $1\frac{1}{4}$, we can just cross through what we are "taking away" to represent the subtraction. 
(To make things easier to see as far as crossing things out goes, I broke down my $\frac{3}{4}$ into 3 sets of $\frac{1}{4}$. You do not have to do this.)

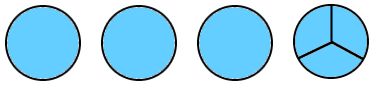
Putting our sets back together, we have the following:  $=2\frac{2}{4}$

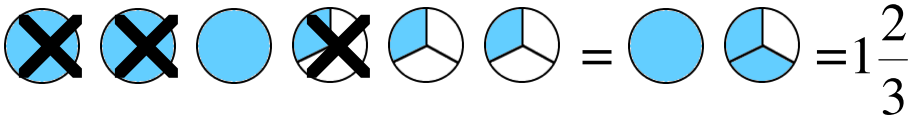
Simplifying our answer, we get  $=2\frac{1}{2}$

Now let's try one where the set we're starting with is a whole number.

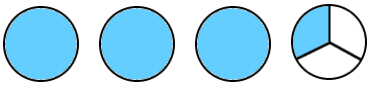
Example 5: $4-2\frac{1}{3}$ 

A *lot* of people make the mistake of taking away 2 and leaving $2\frac{1}{3}$ because they bring down the $\frac{1}{3}$ from the fraction column, but this is not how it works. We're going to have to break apart one of the wholes into thirds. It's similar to having 30 – 12 and having to "borrow" a ten from the 3 except we aren't going to be borrowing 10. We're going to borrowing 3, because that's what our denominator is.

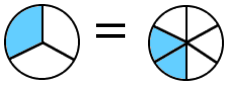
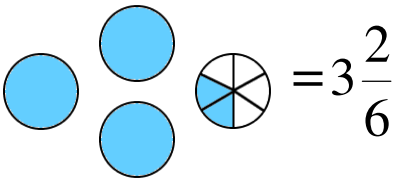
$4-2\frac{1}{3}=3\frac{3}{3}-2\frac{1}{3}$  Now we can remove $2\frac{1}{3}$. Again, I will split up the thirds to make it easier to cross things out.

 $=1\frac{2}{3}$

Finally, let's work on getting a common denominator and borrowing together.

Example 6: $3\frac{1}{3}-1\frac{1}{2}$ 

We can't take a half away because a) we don't have our fractions in terms of halves and b) we don't have enough on our fraction part to take a half away anyhow. We're going to have to regroup.

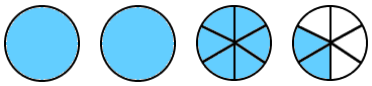
We know $\frac{1}{3}\bullet\left[\frac{2}{2}\right]=\frac{2}{6}$  so we have 

Since $\frac{1}{2}\bullet\left[\frac{3}{3}\right]=\frac{3}{6}$, then we're trying to take away $1\frac{3}{6}$ away from our set.

The problem is that we only have ***two-sixths***. We can't take 3 away from 2 without regrouping.

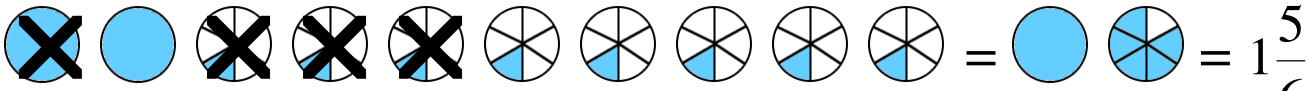
The biggest mistake people make here is that they try to "borrow" ten like when subtracting whole numbers. When you are working with fractions, you are not working with tens most of the time.

To be able to remove three pieces, we're going to have to break up one of our wholes. What kind of pieces are they going to be? Sixths.
Our set becomes the following:

 $=2\frac{2}{6}+\frac{6}{6}=2\frac{8}{6}$

Notice: We do not get $2\frac{12}{6}$ because we are not breaking pieces into tens.

The problem we are dealing with now is the following: $2\frac{8}{6}-1\frac{3}{6}$. Now we have enough sixths to take away three of them!

 $=1\frac{5}{6}$

Following the same instructions as given for the addition problems, solve the following subtraction problems.

1. $3\frac{4}{5}$ $-2\frac{3}{5}$
2. $2\frac{2}{3}$ $-\frac{1}{2}$
3. 5 $-3\frac{5}{6}$
4. $4\frac{1}{2}$ $-2\frac{2}{3}$
5. $6\frac{1}{2}$ $-3\frac{3}{4}$
6. 4 $-\frac{4}{5}$