Lesson 2

Extending Add a Complement to Other Digits

This is the quick guide to the video. For more complete details watch the video.

Goal:

To extend the Add a Complement method to other numbers such as subtracting 7 or 8. The notes in the first method covered this fairly well already so this will recap those notes on the main, with the emphasis on subtracting numbers other than 9.

Handling Class B Subtractions Using "Add a Comp"

The subtraction "won't go". That is, if it did go, it would go **B**elow Zero.

Examples

6 3	**4 7**
- 7	**- 8**
5 6	**3 9**

Money Model:

6 3
- 7
5 6

6 ten dollar bills	and	3 one dollar coins
less		7 one dollar coins
what?		

Step 1: Note you can't take 7 coins away from 3 coins.
You will need to break into a ten dollar bill

Step 2: Take away 1 ten dollar bill and give back 3 one dollar coins as change
That's the same as taking away 7

6 ten dollar bills	and	3 one dollar coins
less		7 one dollar coins
5 ten dollar bills	and	7 one dollar coins

Closer Focus on Method:

Step 1: Note you can't take 7 coins away from 3 coins.
You will need to break into a ten dollar bill

Step 2: Change 1 ten dollar bill for 10 one dollar coins
There are only 5 ten dollar bills left now.
We reduce the tens unit by 1:

6 ten dollar bills	and	3 one dollar coins
less		9 one dollar coins
5 ten dollar bills	and	what?

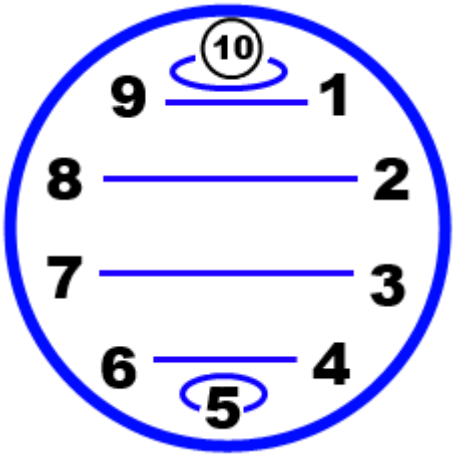
Step 3: Split the 10 one dollar coins into 7you want to take away
and 3 you will leave behind

Step 4: Take away the 7 and add the 3 to the existing 3 to get 4 one dollar coins.

Add a Complement Method

Complements

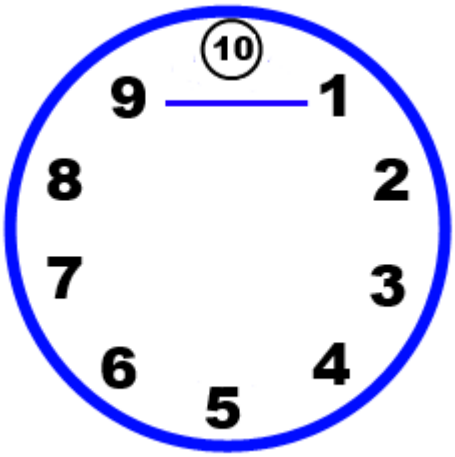
Step 3 is always to change a $10 bill into 10 one dollar bills, and then to split that into two components. One is the part you are taking away and the other is what you will end up adding on to the rest of the units. In Circlemaths we call these two numbers complements of one another.



These are the complements in a 10-circle
0 and 10
9 and 1
8 and 2
7 and 3
6 and 4
5 and 5

5 is its own complement.

The term "Friends of Ten" is commonly used in educational circles. In Circlemaths this concept is taken much further, we need "Friends of Nine" and "Friends of Eight" and so on indefinitely. For this reason and also because the term "complement" implies an amount required to complete up to a full circle, we prefer to call these linked numbers "complements" instead.



This is a 10-circle.
9 and 1 are complements of one another in 10-circle.
9 needs 1 to reach 10 (one complete circle)
1 needs 9 to reach 10 (one complete circle).

Hence the name of the method. The "Add a Complement" method.

From the simple idea of picking up a ten and putting back a one to subtract nine (for example), the general method for handling subtractions which go below zero can be produced:

Step 1: Spot it goes below zero for a start Step 2: Reduce the tens digit by 1 Step 3: Add the complement of the number you are taking away to the units column.

This is easy to accomplish and henceforth can be done with great rapidity.

Example 1:

6 4 Step 1: 4 - 8 goes Below Zero. This "won't go", is "hard" or class B
- 8 Step 2: Drop from sixty down to fifty
5 6 Step 3: The complement of 8 is 2. Add 2 to 4 to get 6.

Example 2:

8 7 Step 1: 8 - 7 goes Below Zero. This "won't go", is "hard" or class B
- 8 Step 2: Drop from eighty down to seventy.
7 9 Step 3: The complement of 8 is 2. Add 2 to 7 to get 9.

Example 3:

5 2	Step 1: 2 - 7 goes Below Zero. This "won't go", is "hard" or class B
- 7	Step 2: Drop from fifty down to forty.
4 5	Step 3: The complement of 7 is 3. Add 3 to 2 to get 5.

Repeat Subtraction of 8:

7 1	Step 1: 1 - 8 goes Below Zero. This "won't go", is "hard" or class B
- 8	Step 2: Drop from seventy down to sixty.
6 3	Step 3: The complement of 8 is 2. Add 2 to 1 to get 3.
5 5	Drop from sixty to fifty. Add 2 to 3 to get 5.
4 7	Drop from fifty to forty. Add 2 to 5 to get 7.
3 9	Drop from forty to thirty. Add 2 to 7 to get 9.
3 1	Take 8 off 39 to leave thirty-one exactly. (use 9 - 8 = 1)
2 3	Drop from thirty to twenty. Add 2 to 1 to get 3.
1 5	Drop from twenty to ten. Add 2 to 3 to get 5.
0 7	Drop from ten to zero tens. Add 2 to 5 to get 7.

- With practice that can be done as quick as you can write the answers up.
- We haven't mentioned step 1 each time, which is to check if it will go or not.
- At 39 - 8 the subtraction **will** go. It is class **A**. We simply subtract from the units column.

A Special Case: Subtracting 5's

Because the complement of 5 is 5 we have the makings of a special case for easy subtraction.

The rule is:
If you can subtract 5 from the units, do so.
If you can't, then:
Drop the tens digit by 1
Add 5 instead of subtracting it.

Examples 1 and 2

6 8	**4 6**	
- 5	**- 5**	
6 3	**4 1**	In both cases the 5 can be subtracted easily.

Example 3

6 3	5 can't be taken off 3, this is class B
- 5	Drop sixty down to fifty
5 8	Add 5 to the 3 instead.

Example 4

4 1	5 can't be taken off 1, this is class B
- 5	Drop forty down to thirty
3 6	Add 5 to the 1 instead.

This shortcut works because "adding the complement" of 5 just means adding 5. But it is very useful to be able to subtract 5 from any number with great rapidity.