Lesson 4

The Most Common Error

*This is the quick guide to the video. For more
complete details watch video 4.*

Goal:

- To locate and find how to avoid a common error

The Error

The error is handling a subtraction that goes **A**bove Zero as though it went **B**elow Zero by using the
"Add a Complement" strategy when it was not required.

Example

```
5 6
- 9
4 7
3 8
2 9        // 29 - 9 = 20 does not require "Add a Complement"
1 1 0      // Applying "Add a Complement" to it however gets this "error"
```

It is easy to make this mistake especially if one is subtracting in a series repeatedly as above. The
step "29 - 9" should have been carried out in the units entirely:

$$
\begin{array}{l}
\text{2 ten dollar bills and 9 one dollar coins} \\
\underline{\text{-   9 one dollar coins}} \\
\text{2 ten dollar bills and   0 one dollar coins}
\end{array}
$$

Mis-applying the "Add a Complement" strategy produces:

Step 1: Check the result goes below zero. This step was NOT done in this case!
Step 2: Drop the twenty down to the teens. The 2 becomes a 1.
Step 3: Add the complement of 9 (which is 1) to the units digit (which is 9). Here 9 and 1 make 10.

The result is 29 - 9 = 110 apparently.

Avoiding the Error
A two-digit addition will never occur if the calculation is one which goes "Below Zero" in the units digit in the first place. So in Step 3 the result 9 + 1 = 10 lets you know you have made an error.

The only way to avoid the error is to maintain Step 1, which is first of all checking that the subtraction goes "Below Zero" and therefore requires the "Add a Complement" strategy.

When first starting to use the strategy this tends to be a fairly common mistake, but it is one which disappears in time with practice.

Understanding the Error
This is not a true error in the sense that 2 + 2 = 5 is an error. There is a grain of truth to it. It is equivalent to the following error using the traditional method:

In error we say "9 from 9 won't go". Obviously it will go, leaving zero.
So we "borrow" from the tens. The 2 of 20 becomes the 1 of the teens.
The 9 becomes 19.
The units subtraction becomes 19 - 9 = 10
The same error as shown above.

The correct answer is 20.
The answer we have is 1 10   which means:
1 in the tens column   (worth 10)
10 in the units column   (worth 10)

Adding them together gives the 20.
It is like having 1 ten dollar bill and 10 one dollar bills instead of 2 ten dollar bills.