Lesson 8

Big Picture Overview

This is the quick guide to the video. For more complete details watch video 8.

Goals:

To give a big picture overview of arithmetic

To thereby show how long division fits in as repeated subtraction

The Big Picture Overview of Arithmetic

Circlemaths tends to view number as emerging from a starting point and evolving or growing

into the various different categories much as a seed grows to become a tree, in a naturally unfolding organic and holistic manner.

Multiplication	Division
Addition	Subtraction
Counting UP	Counting DOWN

Counting

Counting is the start of arithmetic. And it breaks into counting up and counting down.

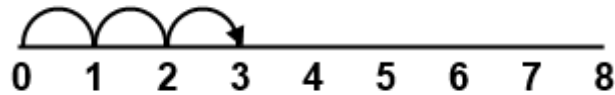Henceforth all of arithmetic must follow the up/down division.

Counting is *uniform*.

It increases (or decreases) by a count of 1 exactly each time.

0 1 2 3...

or

...3 2 1 0

Counting (up) goes by one's

Adding And Subtracting

Addition is **not uniform**.

We can add by large and varying amounts.

In the example above counting is in black, adding in red.

We can add 2 + 4 = 6.

Likewise we could add 111 + 222 = 333

without having to count one by one

to check that we got there.

Counting up turns into addition and

counting down turns into subtraction.

They do this by smoothly blending and turning into each other.

Consider this series and ask is it adding or counting?

0 + 1 = 1

$$1 + 1 = 2$$

$$2 + 1 = 3$$

etc.

In one way it is adding, because it is adding on 1 each time.

At the same time it is counting.

Because counting is adding on one's.

The two turn into one another at this point.

Subtracting is the exact opposite counterpart to addition

and grows out of counting down.

Notice

that subtraction undoes addition,

just as counting down undoes counting up:

$$5 + 3 = 8$$

$$8 - 3 = 5$$

Multiplication

In like manner multiplication grows out of addition.

Here are some addition sums:

$$3 + 1 + 5 = 9$$

$$2 + 2 + 2 = 6$$

$$4 + 5 + 1 = 10$$

The middle one is special.

It adds the 2 to itself repeatedly.
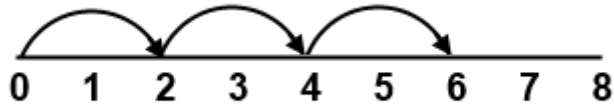
It is repeat addition.

We can shorthand it by saying:

three two's make 6

or

$$3 \times 2 = 6$$

We can draw that:

so you can see the three 2's.

Multiplication is just repeat addition.

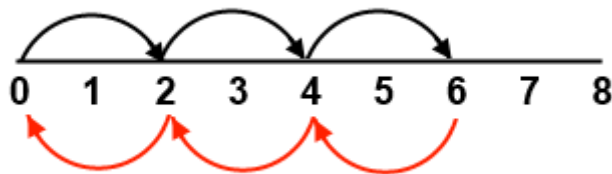# Division

Likewise division grows out of repeat subtraction.

If

3 x 2 = 6

then

6 / 2= 3

and we can draw that:

The black shows three 2's coming to 6

The red shows that there are three 2's which can be taken

off 6 before finally reaching zero.

6 / 2 = 3

Just as counting down undoes counting up

and subtracting undoes addition

so

division undoes a prior multiplication.

Conclusion

Division is no more no less than repeated subtraction.

The "Add a Complement" strategy works

because it applies first principles.