Slide rule Activity

Part 1: how to use it

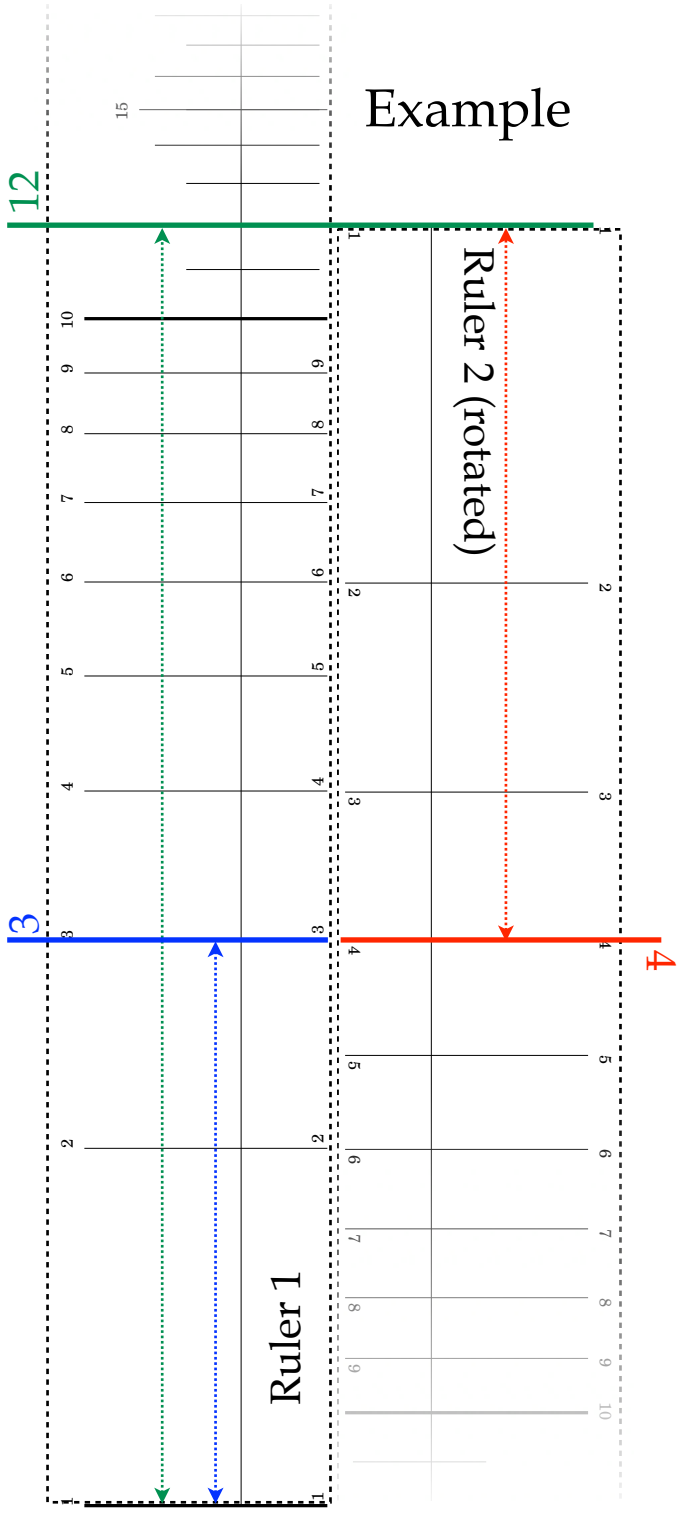
First, cut out both rulers, carefully following the dotted lines.

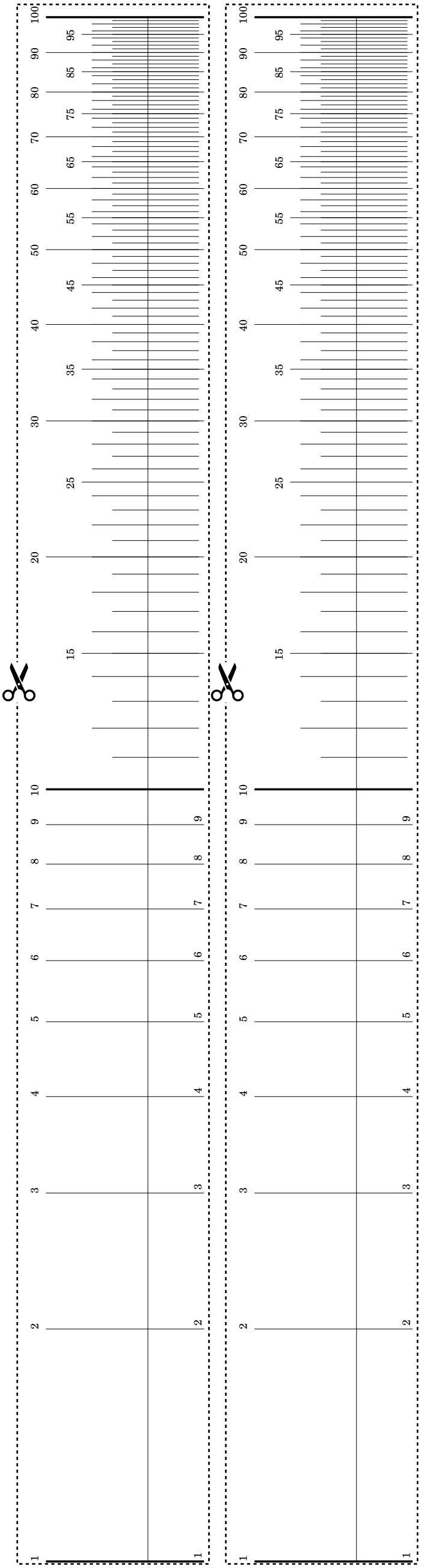
Now, think of two numbers you want to multiply.
It will be easier if the numbers are not too big to start with, so let's suppose you picked 3 and 4

We're going to add the "3" line from one ruler to the "4" line from the other ruler. There are various ways you can do this; a nice way is to flip one ruler around.

Read off the number that you've reached; this should be "12".

In general, by <u>adding</u> these special distances, we are <u>multiplying</u> the numbers!





Part 2: why does it work?

powers and exponents

Exponents are a way to write multiplication by the same thing. For example, we can write $10 \times 10 \times 10$ as 10^3. The "3" above the 10 means that we multiply 10 by itself 3 times.

This works for other numbers, too, like $7 \times 7 \times 7 \times 7 = 7^4$.

Now, observe the following $\underbrace{10 \times 10 \times 10}_{10^3} \times \underbrace{10 \times 10}_{10^2} = 10^5$.

That is, $10^3 \times 10^2 = 10^5$.

This works in general: $10^a \times 10^b = 10^{a+b}$

If you know about decimals and fractions, then you may be interested to know that it turns out that we can even make sense of non-integer exponents, like $7^{2.5}$.

Do you have a guess what something like $9^{\frac{1}{2}}$ could mean?

What about 9^{-1}?

logarithms ("logs")

Logarithms "undo" exponents. If we have a number y and $y = 10^a$, then we define $\log(y) = a$.

* for experts, we are using log base 10 in this worksheet

For example: $\log(10^5) = 5$, $\log(10^3) = 3$ and $\log(10^2) = 2$.

Now note that $a + b = \log(10^{a+b})$
but also $a + b = \log(10^a) + \log(10^b)$.

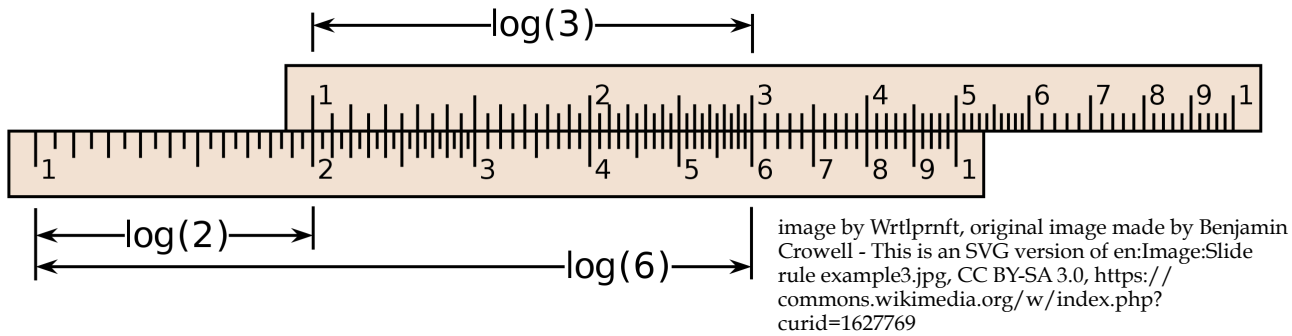
Hence $\log(10^a \times 10^b) = \log(10^{a+b}) = \log(10^a) + \log(10^b)$.

In fact, for any positive numbers x and y,

$$\log(x \times y) = \log(x) + \log(y)$$

meaning that logarithms convert **multiplication** into **addition**.

The markings of the slide rule are the **logarithms** of the numbers.



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Do you think you could use slide rules to perform **division**?

Part 3: history

Slide rules were invented around 1620, shortly after the concept of logarithms was developed. They were common until the early 1970s.

Slide rules were used extensively in engineering, including in aircraft and spacecraft design.

Astronaut Buzz Aldrin took his slide rule with him to the moon!