0.1 Introduksjon

Simply said, *algebra* is mathematics where letters represent numbers. This makes it easier working with *general* cases. For example, we have $3 \cdot 2 = 2 \cdot 3$ and $6 \cdot 7 = 7 \cdot 6$ but these are only two of the infinite many multiplication calculations there is! One of the aims of algebra is giving *one* example that explains *all* cases, and since our digits (0-9) are inevitably connected to specific numbers, we apply letters to reach this target.

The value of the numbers represented by letters will often vary, in that case we call the letter-numbers *variables*. If letter-numbers on the other han have a specific value, they are called *constants*.

In *Part I* of the book we studied calculations through examples with specific numbers, however, most of these rules are *general*; they are valid for all numbers. One page 1 - 4, many of these rules are reproduced in a general form. A good way of getting acquainted with algebra is comparing the rules here presented by the way they are expressed in[1] i *Part I*.

0.1 Addisjon er kommutativ (??)

$$a + b = b + a$$

Example

$$7 + 5 = 5 + 7$$

0.2 Multiplikasjon er kommutativ (??)

$$a \cdot b = b \cdot a$$

Example 1

$$9 \cdot 8 = 8 \cdot 9$$

Example 2

$$8 \cdot a = a \cdot 8$$

[1]The number of the rules as found in *Part I* is written in parentheses.

Multiplication by letters

When mutliplying by letters, it is common to omit the symbol of multiplication. If a specific number and a letter are multiplied together, the specific number is written first. For example,

$$a \cdot b = ab$$

and

$$a \cdot 8 = 8a$$

We also write

$$1 \cdot a = a$$

In addition, it is common to omit the symbol of multiplication when an expression with parenthesis is involved:

$$3 \cdot (a + b) = 3(a + b)$$

0.3 Brøk som omskriving av delestykke (??)

$$a : b = \frac{a}{b}$$

Example

$$a : 2 = \frac{a}{2}$$

0.4 Brøk gonga med brøk (??)

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$$

Example 1

$$\frac{2}{11} \cdot \frac{13}{21} = \frac{2 \cdot 13}{11 \cdot 21} = \frac{26}{231}$$

Example 2

$$\frac{3}{b} \cdot \frac{a}{7} = \frac{3a}{7b}$$

0.5 Deling med brøk (??)

$$\frac{a}{b} : \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$$

Example 1

$$\frac{1}{2} : \frac{5}{7} = \frac{1}{2} \cdot \frac{7}{5}$$

Example 2

$$\begin{aligned} \frac{a}{13} : \frac{b}{3} &= \frac{a}{13} \cdot \frac{3}{b} \\ &= \frac{3a}{13b} \end{aligned}$$

0.6 Distributiv lov (??)

$$(a+b)c = ac + bc$$

Example 1

$$(2+a)b = 2b + ab$$

Example 2

$$a(5b-3) = 5ab - 3a$$

0.7 Multiplikasjon med negative tal I (??)

$$a \cdot (-b) = -(a \cdot b)$$

Example 1

$$\begin{aligned} 3 \cdot (-4) &= -(3 \cdot 4) \\ &= -12 \end{aligned}$$

Example 2

$$\begin{aligned}(-a)\cdot 7 &= -(a\cdot 7)\\ &= -7a\end{aligned}$$

0.8 Multiplikasjon med negative tal II (??)

$$(-a)\cdot(-b) = a\cdot b$$

Example 1

$$\begin{aligned}(-2)\cdot(-8) &= 2\cdot 8\\ &= 16\end{aligned}$$

Example 2

$$(-a)\cdot(-15) = 15a$$

Extensions of the rules

One of the strengths of algebra is that we can express compact rules which are easily extended to apply for other cases. Let's as an example find another expression of

$$(a+b+c)d$$

Rule 0.6 does not directly imply how to calculate between the expression in the parenthesis and d, but there is no wrong-doing in defining $a+b$ as k:

$$a+b=k$$

Then

$$(a+b+c)d = (k+c)d$$

Now, by *Rule 0.6* we have

$$(k+c)d = kd+cd$$

Inserting the expression for k, we have

$$kd+cd = (a+b)d+cd$$

By applying *Rule 0.6* once more we can write

$$(a+b)d + cd = ad + bc + cd$$

Then

$$(a+b+c)d = ad + bc + cd$$

Notice! This example is not ment to show how to handle expressions not directly covered by Rule *0.1 - 0.8, but to emphasize why it's always sufficient to write rules with the least amount of terms, factors etc. Usually one applies extension of the rules without even thinking about it, and surely not in the meticulous manner here provided.*