SOLUTION: VALUE ADDED TAX

In this section we were purposely trying to choose such numbers as to get the results in exact numbers and to avoid the work with inexact (rounded) numbers. We are dealing with inexact numbers in other sections. Therefore some of the food prices (e.g. tomatoes in the exercise 6) are not the whole numbers.

The set of the first four exercises is understood as an introduction to the theme. Others can be used in optional order and groupings.

Exercise 9 is a generalization of the Exercise 8.

1. **26.50 Sk**. VAT on the groceries was 6 %, we have to calculate 6% from 25 Sk. It is 1.50 Sk, the whole price (including VAT) is 26.50 Sk.

2. **2 438 Sk**. Whole price including VAT is 123%, it is 13 038 Sk. Then 1% is 106 Sk. VAT is 23%, which is 2 438 Sk.

3.

	1. product	2. product	3.product
net price	113 050.00 Sk	595 000 Sk	95 000 Sk
VAT	21 479.50 Sk	113 050 Sk	18 050 Sk
gross price	134 529.50 Sk	708 050 Sk	113 050 Sk

4.   **approximately 15.97 %**

   a)   The easiest way to solve the problem is to use concrete numbers. E.g.: If the net price is 100 Sk then VAT is 19 Sk and the whole (gross) price is 119 Sk. We have to find out what is the percentage of 19 from 119 :

$$\frac{19}{119} \cdot 100 = 15{,}966\ 386\ldots \cong \mathbf{15{,}97}\ (\%)\ .$$

   b) Gross price of the product is 119 % of the net price. Our task is to give the percentage of VAT in the gross price, it means what percentage is 19% from 119%:

$$\frac{19}{119} \cdot 100 = 15{,}966\ 386\ldots \cong \mathbf{15{,}97}\ (\%).$$

   b)   Let's mark the gross price by the letter *B*, the net price by the letter *N* and DPH by the letter *D*.

   Then

$$D = 0{,}19N,\ B = N + D\ .$$

   We are trying to express *D* through *B.* From the first relation

$$N = \frac{1}{0{,}19}D\ ,\quad \text{i.e.}\quad N = \frac{100}{19}D\ .$$

   After using it in the second relation

$$B = \frac{100}{19}D + D = \frac{119}{19}D\ ,$$

   and so $$D = \frac{19}{119}B = 0{,}159\ 663\ldots \cong 0{,}159\ 7B\ .$$

5.   **Milan paid 17 850 Sk, Kamil paid 16 250 Sk.**

   a) The difference between the price Milan really paid and the price he had thought he would pay is

$$1\ 250 + 1\ 600 = 2\ 850\ (\text{Sk}).$$

   This difference is VAT, which is 19% from the price without VAT. Therefore the price without VAT is

$$\frac{2\,850}{19}\cdot 100 = 15\,000 \ \text{(Sk)}.$$

Milan paid the gross price, which is

$$1.19 \cdot 15\,000 = 17\,850 \ \text{Sk,}$$

Kamil paid according to the exercise 1 600 Sk less, which is

$$17\,850 - 1\,600 = 16\,250 \ \text{Sk.}$$

b) Let's mark x the price paid by Kamil. It is a gross price. The price expected by Milan is $x - 1\,250$. As we already know it was a net price in reality. The gross price is 19% higher which is

$$1{,}19 \cdot (x - 1\,250).$$

According to the exercise this price was 1 600 Sk higher than the price paid by Kamil, so it was

$$x + 1\,600.$$

Therefore

$$1{,}19 \cdot (x - 1\,250) = x + 1\,600, \qquad \text{and so} \qquad x = 16\,250 \ \text{(Sk)}.$$

So, the price including VAT paid by Kamil was 16 250 Sk. Milan paid 1 600 Sk more than Kamil and it is 17 850 Sk.

6. **56,18 Sk**

    The price 63.07 Sk is the gross price, the net price is $\dfrac{63{,}07}{1{,}19} = 53$ (Sk). A new gross price according to the optimists would be $53 \cdot 1{,}06 = 56{,}18$ (Sk).

7. **6,50 Sk** on each kilogram of tomatoes.

    Gross price 63.07 Sk would not change according to the pessimists, so it would be also the gross price with 6 % VAT. Net price with 19% VAT is $\dfrac{63{,}07}{1{,}19} = 53$ (Sk), then it would be

    $\dfrac{63{,}07}{1{,}06} = 59{,}50$ (Sk). The difference (according to the pessimistic traders the earning) is

    $$59{,}50 - 53 = 6{,}50 \ \text{(Sk)}.$$

8. **9 %**

    The price without VAT is $981 - 81 = 900$ Sk. It is 100 % of the price, so 1% is 9 Sk. VAT, 81 Sk is then $\dfrac{81}{9} = 9$ (%).

9. $S = 100 \cdot \dfrac{D}{B - D}$

    a) We choose concrete numbers (e.g. numbers from the exercise 8 might be used). Let

    $$B = 200 \ \text{(Sk)}, \ D = 30 \ \text{(Sk)}.$$

    Then $\qquad\qquad\qquad\qquad N = 200 - 30 = 170 \ \text{(Sk)}.$

    We have to find out what percentage is D from N, so what percentage from $170 = 200 - 30$ is 30. We can do it by converting it to 1%:

    $$200 - 30 \ \text{is} \ 100 \ \%, \quad \text{then} \quad 1 \ \% \ \text{is} \ \frac{200 - 30}{100},$$

therefore 30 is $\dfrac{30}{\dfrac{200-30}{100}} = 100 \cdot \dfrac{30}{230}$ percent .

If we replace the numbers 200, 30 by the letters B, D in the formula $S = 100 \cdot \dfrac{30}{200-30}$,

we get the sought relation:

$$S = 100 \cdot \frac{D}{B-D} .$$

b) A transferred sum of VAT (marked as D) can be calculated as the percentage (S%, it is $\dfrac{S}{100}$) from the net price N, so

$$D = \frac{S}{100} \cdot N , \quad \text{and} \quad S = \frac{D}{N} \cdot 100 .$$

If we use the substitution $N = B - D$, we will get the sought formula $S = \dfrac{D}{B-D} \cdot 100$.