

Decimals

How do we perform the multiplication. If we need to multiply the natural number by 10 (or 100, or 10000):

$$245 \cdot 10 = (100 \cdot 2 + 10 \cdot 4 + 5) \cdot 10 = 100 \cdot 10 \cdot 2 + 10 \cdot 10 \cdot 4 + 10 \cdot 5$$

$$= 1000 \cdot 2 + 100 \cdot 4 + 10 \cdot 5 + 1 \cdot 0 = 2450$$

$$245 \cdot 100 = (100 \cdot 2 + 10 \cdot 4 + 5) \cdot 100 = 100 \cdot 100 \cdot 2 + 10 \cdot 100 \cdot 4 + 100 \cdot 5$$

$$= 10000 \cdot 2 + 1000 \cdot 4 + 100 \cdot 5 + 10 \cdot 0 + 1 \cdot 0 = 24500$$

Using the distributive property, we have just shown that when we need to multiply any natural number by 10 we just need to write 0 at the end of a number, increasing all place values 10 times.

If we need to multiply the decimal by 10 (or 100)

$$245.23 \cdot 10 = (100 \cdot 2 + 10 \cdot 4 + 5 + 0.1 \cdot 2 + 0.01 \cdot 3) \cdot 10$$

$$= 100 \cdot 10 \cdot 2 + 10 \cdot 10 \cdot 4 + 10 \cdot 5 + 0.1 \cdot 10 \cdot 2 + 0.01 \cdot 10 \cdot 3 =$$

$$= 1000 \cdot 2 + 100 \cdot 4 + 10 \cdot 5 + 1 \cdot 2 + 0.1 \cdot 3 = 2452.3$$

Using the distributive property, we proved that the result will be the number with decimal point moved one step to the right. (2 steps for multiplication by 100, and so on), It's equivalent to increasing all place values 10 times.

$$230 : 10 = 230 \cdot \frac{1}{10} = (100 \cdot 2 + 10 \cdot 3 + 1 \cdot 0) \cdot \frac{1}{10} = \frac{100}{10} \cdot 2 + \frac{10}{10} \cdot 3 + \frac{0}{10} = 20 + 3 = 23$$

$$235 : 10 = 235 \cdot \frac{1}{10} = (100 \cdot 2 + 10 \cdot 3 + 1 \cdot 5) \cdot \frac{1}{10} = \frac{100}{10} \cdot 2 + \frac{10}{10} \cdot 3 + \frac{1}{10} \cdot 5$$

$$= 20 + 3 + \frac{5}{10} = 23.5$$

$$\begin{array}{r}
 43 \\
 64 \\
 64 \\
 \hline
 386 \\
 578 \\
 \hline
 3088 \\
 + 2702 \\
 \hline
 1930 \\
 \hline
 223108
 \end{array}$$

should be placed on the resulting line as many

To perform the long multiplication of the decimals, we do the multiplication procedure as we would do with natural numbers, regardless the position of decimal points, then the decimal point

$$\begin{array}{r}
 41 \\
 3 \overline{)123} \\
 \underline{-12} \\
 03 \\
 \underline{-03} \\
 0
 \end{array}$$

$$\begin{array}{r}
 41 \\
 3 \overline{)123} \\
 \underline{-12} \\
 03 \\
 \underline{-03} \\
 0
 \end{array}$$

$$\begin{array}{r}
 041 \\
 3 \overline{)123} \\
 \underline{-12} \\
 03 \\
 \underline{-03} \\
 0
 \end{array}$$

steps from the right side as the *sum of decimal digits of both numbers*. When we did the multiplication, we didn't take into the consideration the fact, that we are working with decimals, it is equivalent to the multiplication of each number by 10 or 100 or 1000 ... (depends of how many decimal digits it has). So, the result we got is greater by $10 \cdot 100 = 1000$ (in our example) time than the one we are looking for:

$$38.6 \cdot 5.78 = 38.6 \cdot 10 \cdot 5.78 \cdot 100 : (10 \cdot 100) = 386 \cdot 578 : 1000$$

Exercises:

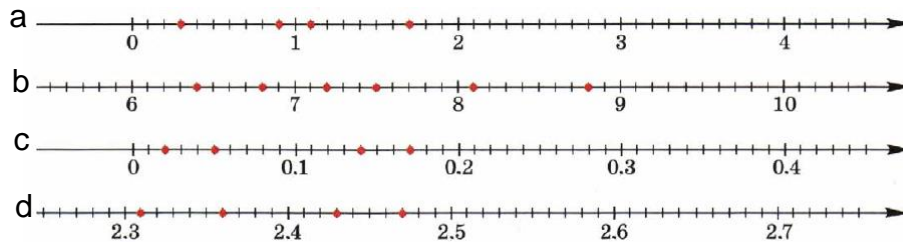
1. Write in decimal notation the following fractions:

Example:

$$1\frac{3}{25} = 1 + \frac{3}{25} = 1 + \frac{3 \cdot 4}{25 \cdot 4} = 1 + \frac{12}{100} = 1.12$$

$$1\frac{1}{10}; 2\frac{4}{10}; 4\frac{9}{10}; 24\frac{25}{100}; 98\frac{3}{100}; 1\frac{1}{100}; 4\frac{333}{1000}; 8\frac{45}{1000}; 75\frac{8}{10000}; 9\frac{565}{10000}$$

2. Which numbers are marked on the number lines below:



3. Evaluate:

- a. $1.2 + 2.3 + 3.4 + 4.5 + 5.6 + 6.7 + 7.8$;
 b. $2.3 + 3.4 + 4.5 - 5.6 + 6.7 + 7.8 + 8.5 + 9.2$;
 c. $1.7 + 3.3 + 7.72 + 3.28 + 1.11 + 8.89$;
 d. $18.8 + 19 + 12.2 + 11.4 + 0.6 + 11$;

4. On a graph paper draw a number line, use 10 squares as a unit. Mark points with coordinates 0.1, 0.5, 0.7, 1.2, 1.3, 1.9.

5. Write decimals as fractions and evaluate the following expressions:

a. $\frac{2}{3} + 0.5;$

b. $\frac{1}{3} \cdot 0.9;$

c. $\frac{3}{16} \cdot 0.16$

d. $0.6 - \frac{2}{5};$

e. $0.4 : \frac{2}{7};$

f. $\frac{9}{20} : 0.03$

6. Which part of 1 m is 1 cm?

Which part of 1 km is 1 m?

Which part of 1 cm is 1 mm?

Which part of 1 m is 1 dm?

Which part of 1 kg is 1 g?

Which part of 1 g is 1 mg?

7. 1 kilogram of candies costs 16 dollars. How much

a. 0.5 kg will cost?

b. 1.2 kg will cost?

c. 0.75 kg will cost?

d. 0.4 kg will cost?

e. 2.5 kg will cost?