Math 4a. Class work 15.

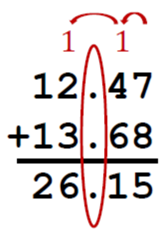
Algebra.

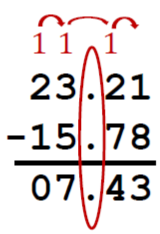
Today we are going to do some arthmetic operation with decimals.
First, let see how our normal addition and subtraction work when we do them with natural numbers and decimals.

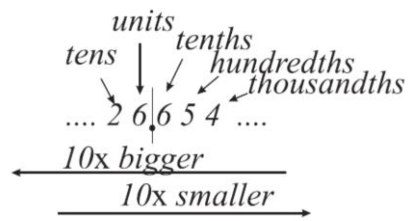
$$\begin{aligned}1247 + 1368 &= 1\cdot 1000 + 2\cdot 100 + 4\cdot 10 + 7 + 1\cdot 1000 + 3\cdot 100 + 6\cdot 10 + 8\\ &= 2\cdot 1000 + 5\cdot 100 + 10\cdot 10 + 15 = 2\cdot 1000 + 5\cdot 100 + 10\cdot 10 + 10 + 5\\ &= 2\cdot 1000 + 5\cdot 100 + 11\cdot 10 + 5 = 2\cdot 1000 + 5\cdot 100 + 100 + 10 + 5\\ &= 2\cdot 1000 + 6\cdot 100 + 1\cdot 10 + 5 = 2615\end{aligned}$$

In your notebooks do this addition in column.

This addition operation is very similar when used with decimal numbers; decimal notation is adopted to our place value number base 10 system (two consecutive place values are 10 times different).







To perform addition or subtraction with decimals using column method, both numbers should be written one under another in a way that decimal points are aligned, as shown on the pictures above.

Multiplication.

$$\begin{aligned}234\cdot 10 &= (200 + 30 + 4)\cdot 10 = 200\cdot 10 + 30\cdot 10 + 4\cdot 10 = 2000 + 300 + 40 + 0\\ &= 2340\end{aligned}$$

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 by 10 times. (Same goes for multiplication by 100 and so on….).

$$23.4\cdot 10 = (20 + 3 + 0.1\cdot 4)\cdot 10 = 20\cdot 10 + 3\cdot 10 + 0.1\cdot 4\cdot 10 = 200 + 30 + 4 = 234$$

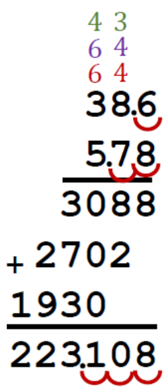
$$\begin{aligned}23.45\cdot 10 &= (20 + 3 + 0.1\cdot 4 + 0.01\cdot 5)\cdot 10 = 20\cdot 10 + 3\cdot 10 + 0.1\cdot 4\cdot 10 + 0.01\cdot 5\cdot 10\\ &= 200 + 30 + 4 + 0.1\cdot 5 = 234.5\end{aligned}$$

These are two example, how the numbers in decimal notation should multiply be 10. 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).

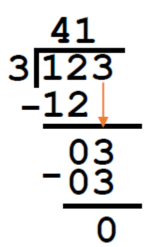
$$230: 10 = 230 \cdot \frac{1}{10} = (200 + 30 + 0) \cdot \frac{1}{10} = \frac{200}{10} + \frac{30}{10} + \frac{0}{10} = 20 + 3 = 23$$

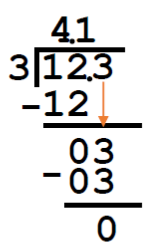
$$235: 10 = 235 \cdot \frac{1}{10} = (200 + 30 + 5) \cdot \frac{1}{10} = \frac{200}{10} + \frac{30}{10} + \frac{0}{10} = 20 + 3 + \frac{5}{10} = 23.5$$

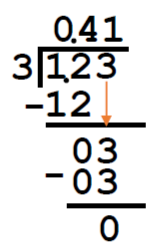
To perform the long multiplication of the decimals, we do the multiplication procedure as we would do with natural numbers, regardless the position of decimal points, then the decimal point should be placed on the resulting line as many steps from the right side as the sum of decimal digits of both numbers. 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 $10 \cdot 100 = 1000$ time then the one we are looking for.



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







1. Compute:

$1.2 + 2.3 + 3.4 + 4.5 + 5.6 + 6.7 + 7.8 =$

$2.3 + 3.4 + 4.5 - 5.6 + 6.7 + 7.8 + 8.5 + 9.2 =$

$1.7 + 3.3 + 7.72 + 3.28 + 1.11 + 8.89 =$

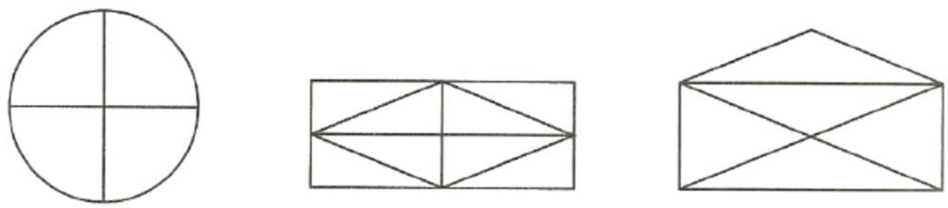
$18.8 + 19 + 12.2 + 11.4 + 0.6 + 11 =$

2. Compute:
   $6.57 + 23.345;$ $45.67 - 23.34567;$ $56 + 324.547;$

$3.23 \cdot 0.7;\qquad 5.23 \cdot 1.2;\qquad 67.8 \cdot 21;$

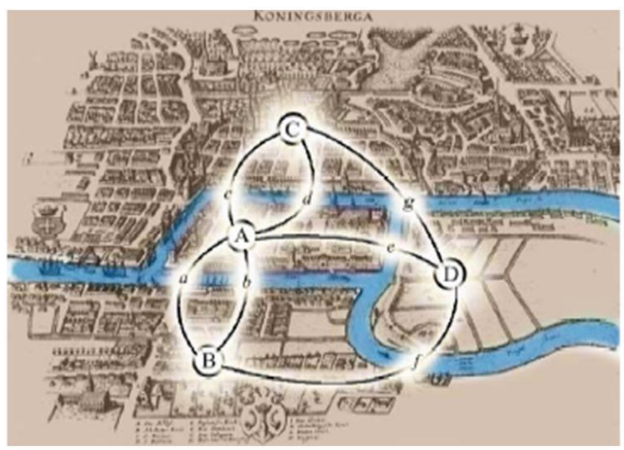
Geometry.

We did many problems about how to draw a picture without tracing twice any segment in a figure. Can you tell right away which figure can be traced this way and which cannot?



The old town of Königsberg has seven bridges:

Can you take a walk through the town, visiting each part of the town and crossing each bridge only once?



- A point is called a **ver**
- A line is called an **edge**
- The whole diagram is called a **graph**.