

Ideas in Mathematics
Math 170, Spring 2016
Assignment 1, part 1

NOTE: As in class, we will use the additive form of Roman numerals, and so numbers are only added and not subtracted. For example, the number 4 should be written IIII instead of IV, and 9 should be written VIIII instead of IX.

1. a) Write the following numbers using Roman numerals.

- 27
- 21
- 93
- 136
- 867

b) Write the following numbers using decimal notation.

- VIII
- XX
- XVII
- XXXVIII
- MMXVI

2. a) Use a \odot for 10, a \triangle for 5, and a \bullet for 1 to denote the following numbers.

- 12
- 31
- 23
- 37
- 56

b) Rewrite the following numbers in decimal notation.

- $\odot \odot \triangle \bullet \bullet$
- $\triangle \odot \triangle \bullet \bullet$
- $\odot \bullet \triangle \triangle$
- $\odot \bullet \bullet \triangle$
- $\triangle \odot \odot \bullet \bullet$

3. Different numbers of symbols are typically needed in order to denote different numbers. For example, using Roman numerals (in additive form), writing the numbers from I to X requires 1, 2, 3, 4, 1, 2, 3, 4, 5, and 1 symbols, respectively. What is the first number that requires using 6 symbols? 7 symbols? 8 symbols?

Ideas in Mathematics
Math 170, Fall 2015
Assignment 1, part 2

The following questions require more thinking than those in part 1. Read each question carefully and think about it for a while. It is unlikely that you will think of a good answer immediately. You might spend some time thinking (perhaps while you're doing something else) before you get a good idea. Paper and pencil might help you try out certain ideas until you realize what will work and what won't.

Not every question (even in math) has a good answer. You might think and think and think and think and still not be able to figure something out. In cases where you cannot come up with a good answer, spend a few sentences explaining what you tried and why that didn't work out as you had hoped.

As indicated in the syllabus, working with other people is highly encouraged. That said, the final answers you write down should be your own. Handwritten answers, if legible, are acceptable.

4. We have discussed Roman numeral symbols used to represent numbers. Suppose that all powers of ten (i.e., 1, 10, 100, 1000, etc) had their own symbol, as did five times powers of ten (i.e., 5, 50, 500, 5000, etc.), up to some limit. How many symbols would we need if we were to have special symbols up to a million? a billion? a trillion? 5×10^{23} (close to Avogadro's number)?
5. A long time ago you learned how to multiply two numbers represented in decimal notation. Think about and describe how you would multiply two numbers written in Roman numerals. You might begin by making a multiplication table.
6. So far we have considered two methods of representing and communicating numbers: symbol-value number systems and positional number systems. Given that our (decimal) positional system seems so much more flexible of the two, why would anyone – such as everyone living in classical times – choose to use a symbol-value number system? Can you think of any reasons today to use a symbol-value system?