

Math 301A Midterm review guide

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May 7, 2009



Hi everyone! Phillip J. Fry here, from Futurama. I'm here to clue all of you in as to what sorts of things Corey could ask about for your exam on May 13th. Enjoy, and ROCK ON!

1. Chapter 1: The Exploratory Approach. This chapter had 4 sections, which all had really interesting material. Section 1.1 dealt with exploring properties of addition such as the associative and commutative rules. In order to illustrate these rules we used box puzzles, and I would know the precise statement of these rules, and how we used box puzzles to demonstrate these rules. In Section 1.2, we looked at two types of manipulatives to help demonstrate these rules from addition: cuisenaire rods, and base-10 blocks. I would know what each of them are, how we used them, and what advantages each approach had. In particular, I would know how the base-10 blocks helped to demonstrate the notion of *carrying* in addition. In Section 1.3 we learned about multiplication, and using arrays to visualize what multiplication is. In addition, we discussed how box puzzles gave us a method to add up an arithmetic sequence of numbers—this is a tool which will be valuable for the exam. For the exam, I would be able to determine if a given sequence is arithmetic or not, and if it is, be able to apply what we did in class and on our homework to add up a given portion of it. In Section 1.4, we discussed the distributive rule and illustrated it using box

puzzles with boarders. It would be good to remember how those worked, and to be able to demonstrate the distributive property with the use of these box puzzles with boarders. In addition, demonstrating how to connect long multiplication to these box puzzles would be a good skill to have.

2. Chapter 2: Introduction to Negative Numbers. In this chapter, we began with Sections 2.1 and 2.2 with a description of subtraction, and that began with a definition of subtraction in terms of addition and negative numbers as $a - b = a + (-b)$. We also used algebra tiles to demonstrate different forms of subtraction, and Corey had lots of in-class questions that asked you to demonstrate these facts using the tiles—these would be good to know. In Section 2.3 we discussed multiplication of negative numbers in two ways: we used the distributive rule, and also a box puzzle approach—these approaches are good ones to know.
3. Chapter 3: Figurate Numbers. This chapter really just discussed patterns, and the difference between Sections 3.1 and 3.2 is simply that the origins of the patterns involved are different. In any event, a facility with finding patterns and being able to express them in terms of $a_n = \dots$ is what we practiced in class and for the homework, and I would expect to see something (or some things) similar on the exam.
4. Chapter 4: Multiples, Factors, and Primes. There are more than just two sections in this chapter, although for the exam, we will only be concerned with Sections 4.1 and 4.2 on multiples, factoring, and prime numbers. In particular, being able to completely factor a number (into a product of primes) will likely be on the exam. The use of a factor tree may be on there, too. But what will also be tested upon will be a knowledge of the divisibility rules we discussed in class. To summarize, our findings from class (and the textbook and homework) are below. You're expected to know these rules, **and** to be able to communicate a brief justification for why these rules hold true.

Divisibility test for:	Is divisible by that number if ...
2	the last digit is even
3	the sum of the digits is divisible by 3
4	the last two digits, as a two-digit number, is divisible by 4
5	the last digit is 0 or 5
8	the last three digits, as a three-digit number, is divisible by 8
9	the sum of the digits is divisible by 9
10	the last digit is 0
11	the alternating sum of the digits is divisible by 11

In addition, we discussed a result which helped to speed up the process of determining if a number is prime by only needed to check those primes which were no larger than the square root of the original number. More precisely put, the number n is prime if

it is not divisible by any prime number less than or equal to \sqrt{n} . These divisibility rules and this result will be of importance on the exam.

5. General information about the exam. The exam features a lot of the work we have done in class, along with a lot of the homework Corey has assigned. There isn't really any special emphasis on any one topic, rather, the topics are treated proportionally to how much attention they received during the course. For instance, we didn't speak as much about algebra tiles as we did about box puzzles, so, although both are fair game for the exam, one might expect there to be more about box puzzles. There will be no surprises of any kind on the exam, which means that there will not be any type of problems which you haven't seen before in some form. And conversely, the exam will ask you to demonstrate knowledge of the many topics we have discussed in class and for homework. And, to be even more specific, it would be fair to say that the exam doesn't just ask you about basic mathematical facts; this hasn't been what our course has been about, anyway. The exam will ask you to draw on your experiences (both in class and for homework) to describe basic mathematical facts, or perhaps even more complicated facts—but to do this using the tools we have developed. Some of these experiences, for example, may be our work with box puzzles, Cuisenare rods, and base-10 blocks, and their relation to the commutative and associative rules of addition (and in the case of box puzzles with boarders, multiplication and the distributive rule. Our in-class adventures about demonstrating the basic rules of associativity, commutativity, and distributivity using the tools of box puzzles, Cuisenare rods, and base-10 blocks will certainly be asked about on the exam). Some other experiences may involve sequences (both in closed form and recursively defined), and efficiency and skill in factoring numbers (both the process of coming up with a formula for a given sequence, adding up a certain portion of an arithmetic sequence, and a complete knowledge of how to factor efficiently will be asked about). All the same, as mentioned above, there won't be any surprises, and so you can expect all of the questions to be ones that you have seen before, so studying all of the material (both in class and homework) is more than sufficient for doing perfectly on the exam. All in all, this exam has been written to be a straightforward way to show Corey how well you know the material we have covered so far. Should you need any help, Corey reminds you that his office hours are from 12-4 on Mondays, and also encourages you to bring any questions you have to class on Monday, as time has been set aside to answer any questions you may have generated during your study over the remainder of the week and weekend. Good luck!!! And ROCK ON!