

Math 545 Midterm Exam Review Sheet of Goodness!

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February 4, 2008



Hi there everyone! Time for your midterm review sheet, as your midterm is THIS WEEK! My goodness, where has the time gone? Before long you'll get your final exam review sheet! But not before the midterm I guess. I hope everyone is enjoying the class and is looking forward to the midterm. Or at least, maybe, one out of two ain't bad.

1. Chapter 1: An introduction to Groups. This chapter really only contained information to help point our thoughts towards group theory. In particular, we learned a lot about the dihedral groups D_n , and how they are examples of *nonabelian* groups. In fact, we have had LOTS of examples, see the review for the next chapter as well. From this chapter, though, one really wants to remember the definitions of the dihedral groups, and to keep in mind the lessons of the homework assignment. In particular, when you write down your group calculations, be sure to define everything. And in the case of dihedral groups (and as we will see, permutation groups as well) one reads off the operation in the right to left order.
2. Chapter 2: Groups. Here is where we learned the definition of a group, along with about a billion examples. We learned about the groups \mathbb{Z} , \mathbb{R} , \mathbb{C} , the n^{th} roots of unity,

the dihedral groups D_n , the matrix groups $M_n(\mathbb{R})$, $Gl(n, \mathbb{R})$, $Sl(n, \mathbb{R})$, $O(n)$, etc. We spent a bit of time on these examples for two reasons. First, we looked at them to give you all a good base of examples to draw from. Second, and more importantly, we looked at these groups so that you could see how one proves that something is actually a group! It would be good to know what of these groups are abelian and which are not, and more generally in an arbitrary group, it would also be good to know why the identity element and inverses are unique in an arbitrary group.

3. Chapter 3: Finite groups, subgroups. Here we learn the definition of a subgroup, and study tests to determine if a subset H of a group G is actually a *subgroup*. We had a one-step and two-step subgroup test, and used these tests to show that the sets $\langle a \rangle$, $Z(G)$, and $C(a)$ were subgroups of G . Knowing these subgroups, also, was good because it really helped distinguish different groups. For example, from one perspective, D_3 is different than \mathbb{Z}_6 since their centers are different. It would be a good idea, also, to be able to compute each of these special subgroups, and know certain relationships between them (for instance, is $Z(G) \leq C(a)$ for any a ?)
4. Chapter 4: Cyclic groups. There is quite a bit in this section besides just the definition of what a cyclic group is. There are several results concerning the order of cyclic groups, and the possible generators. Of course, the fundamental theorem of cyclic groups will come in handy.
5. General suggestions. When one gets to Abstract Algebra, one wants to know more than just definitions and exercises. Generally, I would like to know if you all have understood the material, more so than just being able to regurgitate random facts. So this means, for example, that being able to compute the center of a group is a good skill to know, as it asks you not only the definition of $Z(G)$ but how to use it in practice. I should warn you that for some groups it is difficult to compute their center, $Sl(2, \mathbb{R})$ for instance. Keep in mind that Corey knows the relative difficulty in the questions he'll ask on the exam, and won't have to do anything too computational and time-consuming—this defeats the purpose of an exam in many ways. But he does want to see that you've understood this material and to that end may ask you questions about groups you may have never seen before, or simply harp on the groups you HAVE seen. The idea is not to throw curveballs, but to see if you can USE the material you've learned. That being said, there are several parts of the exam that will look suspiciously like homework questions, either that you've turned in, or those that you didn't. Generally, the test will likely have about 5 questions, and you'll have SOME amount of choice to answer the questions that you choose. My only other suggestion is that you

ROCK ON!