

Math 230a: Algebra
In-Class Exam 2
Monday, November 16 2015.

NAME:

- You have 50 minutes for this exam. Pace yourself, and do not spend too much time on any one problem.
- Show your work and justify all of your answers. The more you explain your thought process, the easier it will be to give partial credit for incomplete solutions.
- This is a closed-book exam. No notes or outside resources can be used. Do not use a calculator.
- If you need more room, use extra pages, and indicate clearly that you have done so.
- You may use results that we proved in lecture or on the homework without proving them here provided you clearly state the result you are using.

Problems	
1	
2	
3	
4	
5	
Total	

1. Is there an example of a group G whose subgroups are all normal but G is not abelian? If not, prove it. If so, describe one such group.

2. (a) For which positive integers n does S_n contain a subgroup isomorphic to $\mathbb{Z}/7\mathbb{Z}$?
(b) For which positive integers n does S_n contain a subgroup isomorphic to $\mathbb{Z}/14\mathbb{Z}$?

3. Show that a simple group with 168 elements has at least 14 elements of order 3.

4. Prove that if G is a finite group of order at least 3, then G has a nontrivial automorphism.

5. Show that if G is a finite group of odd order and $N \subset G$ is a normal subgroup of order 5 then N is in the center of G .