

Math 4103 (2017/18)
Assignment 5: Class Equation and Sylow Theorems

Answer all questions and show all working and check each of your results. Any rough work done before attempting your solutions should be attached to your answers as I need to know how you came up with them. You are allowed to talk with myself or other members of the class in general about the questions, but you must do them on your own. You have been assigned the key numbers and facts for your individualised assignment.

1. For your given alternating group identify all of the different cycle types that appear in it and use combinatorics to count how many of each type there will be. Which of these cycle types will not all belong to one conjugacy class (using the criterion established in Assignment 4 question 2)? [4]
2. Use the class equation to list the possible conjugacy class structures for a group with n elements. Use the Sylow theorems to show that there is only one group with n elements and identify its class equation from your list. [3]
3. What restrictions are there on the numbers of Sylow- p -subgroups of a group with k elements? [3]

Courtney: $A_9, n = 33, k = 225$

Illya: $A_8, n = 35, k = 196$

Sarah: $A_6, n = 51, k = 100$