

MAE 210C – FLUID MECHANICS III – SPRING 2017

HOMEWORK ASSIGNMENT # 2 (Due at 9:00AM on Monday May 8, 2017)

Problems 3.5 and 3.6 from Drazin (2002) Please show all the details of your derivation.

Problem 3: Analyze the annular cells found in Rayleigh-Benard convection in an annular vessel of height d and inner and outer radii d and βd , respectively. The lower wall is at temperature T_0 , the upper wall is at temperature T_1 , and the lateral walls are adiabatic. Slip flow is assumed on all walls. Represent the critical curves $R_c(\beta)$ corresponding to modes with different number of cells (i.e. $k = 1, k = 2, k = 3$, etc) and determine the value of β above which the bifurcated solution involves more than one cell. Compute also the critical value of R_c and the number of resulting cells near the bifurcation for vessels with $\beta = 5$ and with $\beta = 10$.

