

**Physics 7653: Statistical Physics**  
<http://www.physics.cornell.edu/sethna/teaching/653/>  
Material for Week 6  
Exercises due Tuesday Oct. 3  
Last correction at September 24, 2017, 1:40 pm  
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Pre-class Preparation

**Thursday**

Cardy, chapter 3 (The renormalization group idea), up to and including section 3.3.

**Multiplicative scaling variables for the 1D Ising model.** *In the 1D Ising model, would it have been sensible for you to linearize your RG flows at the low-temperature fixed point, as discussed in Section 3.3? What were the multiplicative scaling variables in that system, corresponding to Cardy's equation 3.20? (Submit electronically by 9:30 Wednesday evening.)*

**Tuesday**

Cardy, sections 3.5, 3.6, and 3.9.

**Scaling form for the free energy.** *Cardy's equation 3.29 gives the scaling form for the free energy. Write the critical exponent  $y_h/y_t$  in the invariant combination inside  $\Phi$  in terms of  $\beta$ ,  $\delta$ , and  $\nu$ . Write the critical exponent  $d/y_t$  governing the temperature dependence of the free energy in three different ways: in terms of  $d$  and  $\nu$ , in terms of  $\alpha$ , and finally in terms of  $\beta$  and  $\delta$ . (Submit electronically by 9:30 Monday evening.)*

**Exercises**

- Sethna EOPC, exercise 12.18 (Bifurcation theory).
- Cardy, exercise 3.4 (Amplitude ratios). (Misprint: you should be using arguments of Section 3.9.)
- Cardy, exercise 3.5 and 3.6 (Analytic corrections, linearization, and resonances). (Note that 3.6 seems to contradict 3.5: it appears Cardy means 'generically' when he says 'in general'.) How do these exercises relate to exercises 12.3 (Nonlinear flows, analytic corrections, and hyperscaling) and 12.4 (Beyond power laws: Nonlinear flows and logarithms in the 2D Ising model) you did in problem set 4?