PHYS 310 — Homework #2

Reading:

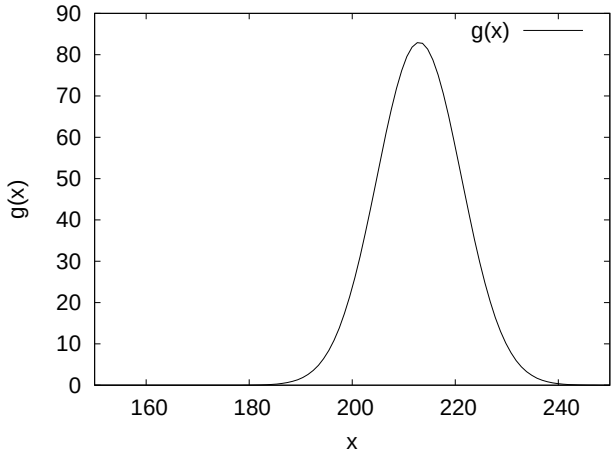
- Hughes and Hase, Chapter 3

Problems due Tuesday February 2:

1. Unnormalized Gaussians can be written in the form

$$g(x) = A \exp\left[-\frac{(x-\bar{x})^2}{2\sigma^2}\right].$$

   Estimate the parameters A, $\bar{x}$, and σ for the illustrated function.



2. Hughes and Hase, 3.2

3. Hughes and Hase, 3.5

4. Hughes and Hase, 3.7

5. Hughes and Hase, 3.8

6. Hughes and Hase, 3.9

7. Use a computer to simulate the PHYS 211 experiment in which students each open a bag of M&Ms and count the number of brown M&Ms. (You may want to use one additional Mathematica command beyond those we used in class on Tuesday: `Count[]`.) Make the following assumptions:

- There are 60 M&Ms in each bag.
- There are six different colors of M&Ms (brown, yellow, blue, orange, red, and green).
- The colors in a bag are determined probabilistically, with each color occurring with equal probability.

Part 1: From your simulation results, determine the average number of brown M&Ms in a bag (this should be the obvious result) and the standard deviation of the number of brown M&Ms in a bag.

Part 2: Assume that all lab sections have exactly 24 students, and each section calculates the average number of brown M&Ms in its 24 bags. Simulate data for the average number of brown M&Ms for 200 lab sections.

(a) Plot a histogram showing the distribution of the section averages.

(b) Calculate the mean and standard deviation of the distribution of section averages.

(c) Are your results consistent with the Central Limit Theorem? (Be quantitative where possible.)