Written Assignments for Math 161 HW

HW B (due Friday, 9th February)

1. Ten human-like sea creatures are captured from the ocean and placed in a large salt-water lake hidden in Utah. Guillermo, a scientist working on the secret project, conjectures that the time it takes for such a population to reproduce and reach C creatures is given by the function

$$T(C) = \int_{10}^{C} \frac{20}{x(400-x)}\, dx.$$

where T is measured in years after the the humanoids were placed in the lake.

(a) Evaluate the integral for T(C).

Hint: $\frac{400}{x(400-x)} = \frac{1}{x} + \frac{1}{400-x}$

(b) How long will it take the humanoids to reach a population of 50? State your answer in a complete sentence and include units in your answer.

(c) Determine if the integral

$$T(400) = \int_{10}^{400} \frac{20}{x(400-x)}\, dx$$

converges or diverges. What does your conclusion mean in terms of the creatures in the lake?

2. Albertine enjoys juggling, as does her friend, Marcel. The number of minutes Albertine can juggle five balls without dropping one is a random variable, with probability density function $a(t) = ce^{-0.8t}$. Similarly, Marcel's skill is represented by m(t) = $de^{-1.5t}$.

(a) Determine the constants c and d.

(b) What percentage of Marcel's juggling attempts are "embarrassing", meaning that they last for 10 seconds or less?

(c) How long, on average, can Albertine juggle?

(d) Who is the better juggler? Give a good reason for your choice.

3. The quantity

$$\int_1^{\infty} \frac{1}{\sqrt{(a^2+x)(b^2+x)(c^2+x)}}\,dx$$

Roughly models the resistance that ellipsoidal-shaped plankton when falling through water.

Note that a = 1, b = 2, and c = 3 are constants that determine the dimensions of the plankton.

Find a value for which

$$\int_1^{M} \frac{1}{\sqrt{(a^2+x)(b^2+x)(c^2+x)}}\,dx$$

Differs from the original model of resistance by at most 0.001.

Hint: Use the integral

$$\int_M^{\infty} \frac{1}{\sqrt{(a^2+x)(b^2+x)(c^2+x)}}\,dx$$

and the comparison test.