Math 3311 Lab 1: Introduction to R

1. **Basic Arithmetic**.

   Use R to calculate $5x^3 - 6x^2 + 8x + 6$, where

   $$x = \frac{7 - 8(5)^4}{\ln(10) + \log_{10}(20) + \sqrt{7}}.$$

2. **Vectors**.

   (a) What is $5x - 6y$, if $x = (1, -7, 6, 4)$, and $y = (4, 0, 25, 6)$?

   (b) What is the 93rd entry of $5u+8v$, where $u = (7, 8, 9, \ldots, 199, 200)$, and $v = (56, 57, 58, \ldots, 248, 249)$?

   (c) Let $x = (1, 2, \ldots, 100)$. What number do you get if you square all the entries in x and add them up, i.e., what is $\sum_{i=1}^{100} i^2$?

   (d) Compute $\sum_{i=2}^{1000} \sqrt{i^3 - 6}$.

3. **Plots**.

   (a) Plot the function $y = x^3$ on the interval $-5 \leq x \leq 5$.

   (b) Plot the function $y = \sec(x)$ with the window $0 \leq x \leq 2\pi$, $-10 \leq y \leq 10$.

   Statistics.

4. Consider the normal distribution with parameters $\mu = 100$ and $\sigma = 15$.

   (a) What are the mean and standard deviation for this distribution? (Based on the theory of the normal distribution, not using R.)

   (b) Plot the probability density on the interval $55 \leq x \leq 145$. Recall that the probability density for $N(\mu, \sigma^2)$ is

   $$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}, \text{ for } -\infty < x < \infty.$$

   (c) Generate a sample of size 1000 from this distribution.

   (d) Compute the corresponding sample mean and sample standard deviation. How do these compare to your results from part (4a)?

   (e) Plot a relative frequency histogram for your sample, and superimpose the probability density from part (4b) on top of it.

5. Repeat problem (4) for a uniform distribution on $[100, 200]$ (using this interval when plotting the density).

6. Repeat problem (4) for an exponential distribution with parameter $\theta = 20$, using the interval $0 \leq x \leq 150$ when plotting the density.