Math 241 – Activity 3
Exploring the Definite Integral Using Riemann Sums

In this activity we are going to use Excel to do calculations that would be tedious and time consuming for us to do on our own. You will write a report with your findings and attach all work done in Excel.

1. Calculate the left Riemann Sum for the integral $\int_2^4 \frac{1}{x}\,dx$ using $n = 10$ subdivisions. The division points will be 2, 2.2, …, 3.8. Remember we find length of the subdivisions by finding: $\Delta x = \frac{b-a}{n}$. So, the left Riemann Sum will look like:

$$[f(2)+f(2.2)+...+f(3.8)]\cdot(0.2)$$

To use Excel to do this calculation you will enter all of the division points into column A. Enter "=1/A1" in cell B1, and have Excel fill out the rest of the function values in column B. Now enter "=SUM (B1:B10)*(0.2)" in cell C1. The value in C1 is the required Riemann Sum. Now calculate this integral by hand using the Fundamental Theorem of Calculus, how close did the Riemann Sum get to the actual value?

2. Calculate the left Riemann Sum for $\int_2^4 (x^3 - 2x^2 + 1)dx$ using:

   a) $n = 10$ subdivisions
   b) $n = 100$ subdivisions
   c) $n = 1000$ subdivisions

Now calculate this integral by hand using the Fundamental Theorem of Calculus, how close did the Riemann Sums get to the actual value?

3. In the first two problems, the integrals that you are approximating can be done by hand, and so it is in some sense unnecessary to find these approximations. However, there are functions for which it is not easy, or even impossible, to do this, while it still makes sense to talk about the values of the integrals of these functions. For example, the function $f(x) = \frac{1}{\sqrt{2\pi}}e^{-\frac{x^2}{2}}$ gives the standard normal distribution, the famous "bell curve". We use the integral $\frac{1}{\sqrt{2\pi}}\int_0^1 e^{-\frac{x^2}{2}}$ gives the percentage of the sample which falls between 0 and 1. (Note: The standard normal distribution of data has an average of 0. So we trying to find how much of the data will fall into the 0 to 1 range.) Calculate the left Riemann Sum for $\frac{1}{\sqrt{2\pi}}\int_0^1 e^{-\frac{x^2}{2}}$ using $n = 100$ subdivisions.