Numerical Integration
Class 18: Monday March 10

NUMERICAL INTEGRATION REVISITED. At this point (after the lab) we know several ways of approximating a definite integral, say $\int_a^b f(x)\,dx$, using numerical approximations. These include: Riemann Sum Approximations (specifically we had the computer do left-endpoint, right-endpoint, and midpoint approximations), Trapezoidal Approximations, and Simpson's Approximations. Let's try each of these for the following example (with $N = 2$ subintervals):

$$\int_0^4 x^2\,dx =$$

Left endpoint.

Right endpoint.

Midpoint.

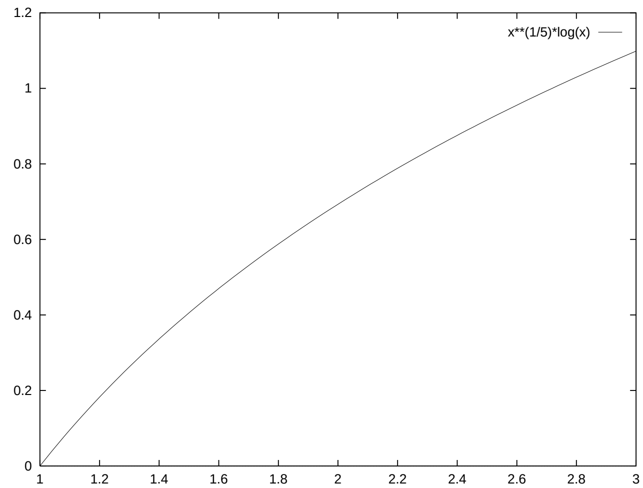
Trapezoidal. Simply the **average of the left and right endpoint approximations**.

Simpson's. Simply the **weighted average of the midpoint ($\frac{2}{3}$) and trapezoidal ($\frac{1}{3}$) approximations**.

Comparing the Methods

1. Using Left-Hand Riemann Sums (L), Right-Hand Riemann Sums (L), the Midpoint method (M) and the Trapezoidal Rule (T) (all with N=50) one obtains the approximations **L**, **R**, **M** and **T** to $I = \int_1^3 \sqrt[5]{x}\ln(x)\,dx$. From looking at the graph of $\sqrt[5]{x}\ln(x)$, the values themselves and your knowledge of each of the numerical methods, fill in the table with the letter (**L**, **R**, **M** or **T**) associated with the approximate value to the integral. and fill in the table with the name of the method associated with the approximate value.

Numerical Method	Approximate value
	1.493173
	1.520544
	1.520643
	1.547916



2. For each of the values you filled in the table in part **(1)**, write down your reasons. That is, *explain* how you know the relative sizes of **L**, **R**, **M** and **T**.

3. Use the data in the completed table to compute a numerical approximation **S** to the integral using Simpson's Rule.

4. Write a formula for **S** using some or all of the symbols **L**, **R**, **M** and **T**