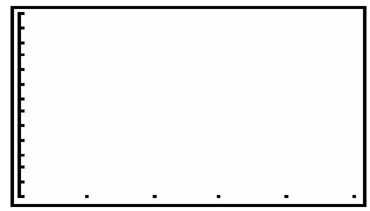
Assignment 13: Numerical Integration (4.7) **Name**____________________
Please provide a handwritten response.

1. Graph $y = \sqrt[3]{x^2 + 1}$ on the axes provided and estimate the area under the curve. (Be careful about where the origin is!) Record your answer in the space provided below.



$\mathbf{0 \le x \le 1, 1 \le y \le 1.26}$

2a. Run the program **RIEMANN** used in Assignment 12 with $a = 0, b = 1, n = 10$.

2b. The midpoint of each interval $[x_{i-1}, x_i]$ is given by $c_i = \frac{x_{i-1} + x_i}{2}$. Find the **Midpoint** approximation $\sum_{i=1}^{n} f(c_i)\Delta x$ from **RIEMANN**. Remember, it is result **M**. Is this result plausible? Enter it in the table below.

3. Calculate the **Trapezoidal Rule** approximation $\sum_{i=1}^{n} \frac{f(x_{i-1}) + f(x_i)}{2}\Delta x$ from the program **RIEMANN** by pressing **ENTER** and choosing the **Trapezoidal (T)** option. Enter the result in the table below.

4. Calculate the **Simpson's Rule** approximation $\sum_{i=1}^{n} \frac{f(x_{i-1}) + f(x_i)}{2}\Delta x$ from the program **RIEMANN** by pressing **ENTER** and choosing the **Simpson's Rule (S)** option. Enter the result in the table below.

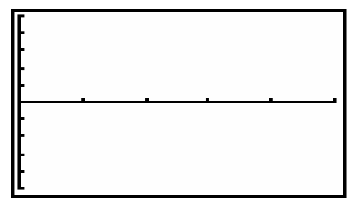
n	MIDPOINT	TRAPEZOID	SIMPSON'S
10			
20			
50			

5. Rerun the program with $n = 20$ answering questions **2b-4** in order. Record your results in the table. Which of the three approximations did not change when **n** was increased?

6. Repeat Question **5** with $n = 50$ and enter the results in the table. Are the three approximations drawing closer together as **n** increases?

7. You can use the calculator to accurately calculate $\int_0^1 \sqrt[3]{x^2+1}\,dx$ using **fnInt(** $y1, x, 0, 1$) or **fnInt(**$\left(x^2+1\right)$^$\left(1/3\right), x, 0, 1$ **)** and record the result below. Based on this, which of the three approximation methods applied above was the most accurate?

8a. You can almost always take the results of **fnInt** to be accurate. However, there are some unusual situations that cause trouble for **fnInt.** For example, let $f(x) = \sin\frac{1}{x}$. Sketch the graph (as best you can) over $[0,1]$ on the axes provided below.



$0 \le x \le 1, -1 \le y \le 1$

8b. Evaluate **fnInt(**$\sin\left(1/x\right), x, .001, 1$**)** to calculate $\int_{.001}^1 \sin\frac{1}{x}$ and describe what happens below. Do you think the numerical result is trustworthy?