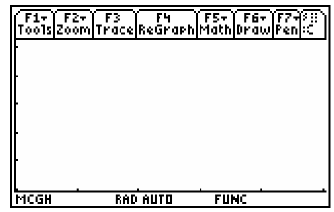
Assignment 13: Numerical Integration (4.7) **Name____________________**
Please provide a handwritten response.

1. Graph $y = \sqrt[3]{x^2+1}$ on the axes provided and estimate the area under $\int_0^1 \sqrt[3]{x^2+1}\,dx$. (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 **midsum**. 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** after the **midsum** is found. 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** after the **Trapezoidal Rule** is found. Enter the result in the table below.

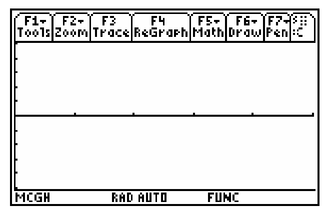
n	**MIDPOINT**	**TRAPEZOID**	**SIMPSON'S**
10			
20			
50			

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 $\boldsymbol{n = 50}$ and enter the results in the table. Are the three approximations drawing closer together as $\boldsymbol{n}$ increases?

7. You can use the calculator to accurately calculate $\int_0^1 \sqrt[3]{x^2+1}\,dx$ using $\int\left(y1(x),x,0,1\right)$ or $\int\left(\sqrt[3]{x^2+1},x,0,1\right)$ 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 $\int$ to be accurate. However, there are some unusual situations that cause trouble for $\int$. For example, let $f(x) = sin\dfrac{1}{x}$.
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 $\int\left(sin\dfrac{1}{x},x,.001,1\right)$ to calculate $\int_{.001}^1 sin\dfrac{1}{x}dx$ and describe what happens below. Do you think the numerical result is trustworthy?