Read each question carefully and be sure to SHOW ALL WORK. Correct answer without proper justification will not receive a "Complete" grade. Paç fat! Good luck!

Name: ____________________

LO 5. Integrals Challenge. I deeply understand the concepts behind Riemann sums, definite integrals, and their connection to antiderivatives and indefinite integrals through the Fundamental Theorem of Calculus.

Criteria for Success: I can solve conceptual questions related to Riemann sums, definite integrals, and the Fundamental Theorem of Calculus that lie on the top half of Bloom's Taxonomy (analyze, evaluate, and create).

Question: The goal of this question is to approximate arctan(2) using Riemann Sums.

(a) Use the Fundamental Theorem of Calculus to show that $\arctan(2) = \int_0^2 \frac{1}{x^2+1}\,dx$.

(b) Express the signed area between $y = \frac{1}{x^2+1}$ and the x-axis on the interval $[0, 2]$ using any Riemann Sum you wish with n rectangles of equal base lengths for some unspecified whole number n. Note that the summation notation is supposed to contain the variable n in it since we would like a general formula we can easily modify for different values of n. Sketch the function and the rectangles for $n = 4$. Use desmos `https://www.desmos.com/calculator/oceoomwdiy` to help with visualization and checking your answer (note that you need to update the function within desmos). **Hint:** Helpful questions to ask yourself at the end: Does my answer seem reasonable? Did I check my computations by typing it into the desmos link above?

Sketch of function with $n = 4$ rectangles:

Sigma notation for arbitrary n rectangles:

$$\sum_{k=}$$

(c) Plug in the above Riemann Sum with $n = 1000$ into Desmos, Wolfram Alpha, or your calculator to get an approximate value for arctan(2) up to 4 decimals. No need to show work here. Note that this is an approximation, so it will not match arctan(2) exactly, but it should be close to it.

$\arctan(2) \approx$