Math 152 – Python Lab 5

Directions: Use Python to solve each problem, unless the question states otherwise. (Template link)

1. Given the integral
$$\int \frac{x^3 - 3}{x^4 + 3x^2 + 2} dx,$$
   (a) Write the form of the partial fraction decomposition (by hand). Use this form to write and solve equations in Python to obtain the coefficients.

   (b) Check your answer to part (a) by using the **sp.apart** command.

   (c) Use your answer to (a) or (b) to evaluate the integral. Check your answer by integrating directly.

2. (a) Calculate the value of a so that $\int_0^\infty \frac{x^2}{x^4 + a^2} dx = 0.1$. (Note: When defining x and a as symbolic variables, include **positive = True** to clear up some issues when solving.)

   (b) Find the value of a such that $\int_1^a x^6 e^{-x^7} dx = \int_a^\infty x^6 e^{-x^7} dx$.

   (c) Evaluate $\int_1^\infty x^6 e^{-x^7} dx$ using the value found in part (b).

3. Let $f(x) = \frac{4 \arctan(x)}{x^2}$ and $g(x) = \frac{2\pi}{x^2}$.

   (a) Show $\int_1^\infty g(x) dx$ converges.

   (b) Plot f and g on the same axes with domain [1,10] to show $f(x) \leq g(x)$ on the given interval.

   (c) Evaluate $\int_1^\infty f(x) dx$.

   (d) Using what you know from parts (a) and (b), how could you conclude that $\int_1^\infty f(x) dx$ converges WITHOUT using Python to evaluate the integral?