

MATH 152 – PYTHON LAB 6

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

1. The **Laplace Transform** of a continuous function $f(t)$ is given by

$$F(s) = \int_0^{\infty} f(t)e^{-st} dt.$$

(You'll use this plenty in differential equations!) Find the Laplace Transform for the following functions. In order to simplify, assume s and t are positive.

(a) $f(t) = 1$

(b) $f(t) = t$

(c) $f(t) = t^2$

(d) $f(t) = \sqrt{t}$

2. Given the sequence $a_n = \arctan\left(\frac{\ln(4^n)}{\ln(2n)}\right)$:

- (a) Find the first 10 terms of the sequence (as approximate decimals) and guess the value of the limit based on these values.
- (b) Plot the first 50 terms of the sequence and guess the value of the limit based on the graph.
- (c) Find the limit of the sequence directly using **sp.limit**.

3. Consider the following sequence:

$$a_{n+1} = \begin{cases} a_n/2 & \text{if } a_n \text{ is even} \\ 3a_n + 1 & \text{if } a_n \text{ is odd} \end{cases}$$

- (a) Find the first 40 terms of the sequence if $a_1 = 7$.
- (b) Find the first 40 terms of the sequence if $a_1 = 12$.
- (c) Based on your answers to parts (a) and (b), predict what happens to the sequence if $a_1 = \text{ANY positive integer}$.