Exercise: Integrating Complex Functions

In this exercise, you will implement a Python function to integrate complex mathematical functions.

WE'LL COVER THE FOLLOWING

Task

Sometimes the integrals of complex functions are difficult to compute and the result is not as *clean*. For example:

$$\int tan^{-1}(x)\,dx = x\,tan^{-1}(x) - \frac{1}{2}ln(1+x^2) + C$$

Integrals of complex functions are simplified by approximating integrals of a simplified function using Taylor polynomials. The Taylor series of $tan^{-1}(x)$ is given as a simple addition of polynomials.

$$tan^{-1}(x) = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \frac{x^9}{9}...$$

Let's apply this in Python as well.

Problem statement

Define a **Python** function `ts_integral()` that computes the indefinite or definite integral of the Taylor series from the input mathematical function.

The function should have the following arguments in this order:

Obligatory Arguments - The function should always have these arguments at least.

1. The mathematical function input: `f`.

2. The variable to be integrated: `x`.

Optional Arguments - the function will input defaults even if the user does not provide these.

3. The order of the Taylor series expansion `n`, with the default value set to `5`.
4. The limits of integration; `lim1` and `lim2`.

```
def ts_integral(f, x, n, lim1, lim2)
```

Return Statement

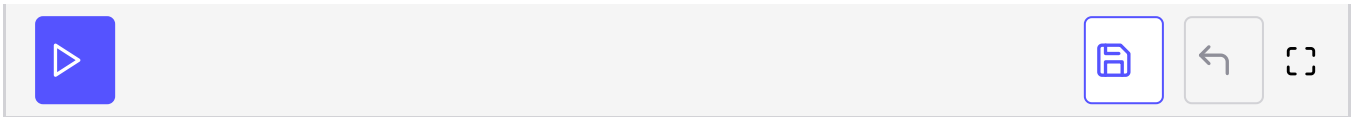
The function should return a tuple with two values:

1. The Taylor series of the input function.
2. The integral from the Taylor series of the input function. The value of the integral should be up to **3** significant figures.

```
from sympy import *

def f(x):   # just a mathematical function to assist you
  return atan(x)

def ts_integral():
    # write your code here
  pass
```



The solution to this exercise will be discussed in the next lesson.