

**Exercise 01.**

Consider the function  $y(x) = \tan(x) + (1+x)e^x = \frac{\sin(x)}{\cos(x)} + e^x + xe^x$  and its approximation

$$y(x) \approx \frac{\sum_{k_1=0}^{K_1} \left[ (-1)^{k_1} \frac{x^{(2k_1+1)}}{(2k_1+1)!} \right]}{\sum_{k_2=0}^{K_2} \left[ (-1)^{k_2} \frac{x^{(2k_2+0)}}{(2k_2+0)!} \right]} + \sum_{n_1=0}^{N_1} \left\{ [(n_1)!]^{-1} x^{n_1} \right\} + \sum_{n_2=0}^{N_2} \left[ \frac{x^{n_2+1}}{(n_2)!} \right].$$

Write a program based on **FOR-loops** that implements the expression above:

- Use  $x = \pi/3$ ,  $K_1 = 4$ ,  $K_2 = 4$ ,  $N_1 = 8$  and  $N_2 = 8$ .

**Solution:**

```

1 from math import pi, factorial, sin, cos, tan, exp
2
3 x = pi/3
4
5 K1 = 4
6 num1=0.
7 for k1 in range(K1+1):
8     num1 += (-1)**k1 * (x**(2*k1 + 1))/(factorial(2*k1 + 1))
9
10 K2 = 4
11 den1=0.
12 for k2 in range(K2+1):
13     den1 += (-1)**k2 * (x**(2*k2 + 0))/(factorial(2*k2 + 0))
14
15 t1 = num1/den1
16
17 N1 = 8
18 s2 = 0.
19 for n1 in range(N1+1):
20     s2 += x**(n1+0)*(factorial(n1)**(-1))
21 t2 = s2
22
23 N2 = 8
24 s3 = 0.
25 for n2 in range(N2+1):
26     s3 += x**(n2+1)*(factorial(n2)**(-1))
27 t3 = s3
28
29 print(sin(x)/cos(x)+exp(x)+x*exp(x))
30 print(t1 + t2 + t3)

```