Matrícula (First-name Last-name) **CK0030: Homework 03**

Exercise 1. Write Python functions that receive x as input argument and computes and returns the following function values:

1. $$f(x) = \frac{\sin\left[e^{x^2} - \cos(x) + 2\sin(x^2)\sqrt{1 + 2\sin^2(x)}\right]}{2\sin^2(x)};$$

2. $$g(x) = \frac{\sqrt{e^{x^2} - \cos{(x)} + 2\sin{(x^3)}\sqrt{1 + 2\sin{(x^3)}}}}{2\sin^3 x};$$

3. $$h(x) = \frac{x^{\arctan{(x)}} - x^{(\pi/2)}}{(1 + x)^{1+\pi/2}\sqrt{\log{(x)}}}.$$

Test your functions when $x \in \mathcal{X}$, for some $\mathcal{X}$ of your choice such that $|\mathcal{X}| > 1$.

Exercise 2. Given the functions in Exercise 1, $f(x)$, $g(x)$ and $h(x)$, write Python functions that receive x and N, (x, N), as input arguments and computes and returns the corresponding function values, when the following approximations are used:

- $$e^x \approx \sum_{n=0}^{N} \frac{x^n}{n!};$$

- $$\sin{(x)} \approx \sum_{n=0}^{N} \left[\frac{(-1)^n x^{(2n+1)}}{(2n+1)!}\right];$$

- $$\cos{(x)} \approx \prod_{n=1}^{N} \left[1 - \frac{x^2}{\pi^2(n - 1/2)^2}\right];$$

- $$\arctan{(x)} \approx \sum_{n=0}^{N} \left[\frac{(-1)^n}{2n+1} x^{(2n+1)}\right].$$

Test your functions when $x \in \mathcal{X}$, for the same $\mathcal{X}$ of your choice such that $|\mathcal{X}| > 1$ in Exercise 1, and for $N \in \{2, 4, 8, 16\}$.

Compare the function values with what obtained in Exercise 1.