# FPT University
# MAE101
# ASSIGNMENT NUMBER 1

September 18, 2022

1. *You need to give a solution (by presenting successive mathematical logics) in English for each of the following exercises. A clear and correct presentation of each exercise is counted up to* 50% *of the total mark.*
2. *Deadline: Return your paper before Friday* 30/09/2022.

**Exercice 1.** Let $f(x) = \sqrt{4 - x^2} - 1$, $g(x) = \log_2(x)$. Find the domain and the range of $f(x)$ and of $(g \circ f)(x)$.

**Exercice 2.** 1. Study the continuity of the following function at the given point

$$f(x) = \begin{cases} \frac{3x^2+2x-1}{x+1}, & \text{if } x \neq 1 \\ 3, & \text{if } x = 1 \end{cases}$$

2. Calculate the following limit (if exists)

$$\lim_{x \longrightarrow 0} x^3 \cos\left(\frac{x+2}{x^2+x}\right)$$

3. Find the horizontal and vertical asymptotes of the graph of the following function:

$$f(x) = \frac{\sqrt{x^2+1}}{3x-4}$$

**Exercice 3.** A 5 ft tall person walks away from a 10m lamppost at a constant rate of 3 ft/sec. What is the rate that the tip of the shadow moves away from the pole when the person is 10 ft away from the pole?

**Exercice 4.** Let $f(x) = \sqrt[3]{t+6}$.

1. Find the linear approximation of $f$ at $t = 2$ and use it to approximate $\sqrt[3]{8,02}$.

3. Show that the equation $f'(t) = \cos(t)$ has a solution in the interval $(0, \frac{\pi}{2})$.

**Exercice 5.**

1. Compute $\int_0^{\frac{\pi}{4}} (x^3 - 2\cos(x))dx$.
2. Approximate $\int_2^4 \frac{2}{\ln(x)}dx$ using the midpoint rule with for subdivisions to four decimal places.
3. Determine whether the following improper integral converges or diverges. Calculate the value of the integral if it converges.

$$\int_0^{+\infty} (x + e^{-2x}\cos(x))dx.$$