# Mathematics (Economics, Markets and Finance)

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Homework 1

**Exercise 1.** *Find the natural domain of the following functions.*

a) $f_1(x) = \sqrt{x^2 - 6x + 10}$.

b) $f_2(x) = \sqrt{4x^2 - 4x + 1}$.

c) $f_3(x) = \dfrac{1}{\sqrt{x-1}}$.

d) $f_4(x) = \dfrac{x+2}{x^2 - 3x + 2}$.

e) $f_5(x) = e^{1/(x-1)}$.

f) $f_6(x) = \ln\sqrt{x+3}$.

g) $f_7(x) = \ln\dfrac{1}{\sqrt{x-3}}$.

h) $f_8(x) = \sqrt[3]{\dfrac{x}{x^2 - 1}}$.

i) $f_9(x) = \sqrt{x} + \sqrt{x-1}$.

j) $f_{10}(x) = e^{\sqrt{x+2}}$.

k) $f_{11}(x) = \ln(e^x + 2)$.

l) $f_{12}(x) = \sqrt{x^2 + e^{x+3}}$.

m) $f_{13}(x) = \ln(x+1) + e^{1/x}$.

n) $f_{14}(x) = \ln(x+1) - 3\ln(x+2)$.

o) $f_{15}(x) = \sqrt{x-1} + \ln x - 1$.

p) $f_{16}(x) = \sqrt{\dfrac{x-1}{x-2}}$.

**Exercise 2.** *Given the function*

$$f(x) = \begin{cases} e^{-x}, & \text{if } x \leq 0; \\ x+1, & \text{if } x > 0; \end{cases},$$

*plot its graph and determine whether it is continuous or not.*

**Exercise 3.** *Given the function*

$$f(x) = \begin{cases} e^{-ax} + a, & \text{if } x \leq 0; \\ -x+2, & \text{if } x > 0; \end{cases},$$

*where $a \in \mathbb{R}$ is a parameter, find the value of $a$ that makes $f$ continuous. Plot the graph of $f$ with this value of $a$.*

**Exercise 4.** *Given the function*

$$f(x) = \begin{cases} 2x+a, & \text{if } x \leq 1; \\ x^2+3, & \text{if } x > 1; \end{cases},$$

*where $a \in \mathbb{R}$ is a parameter, find the value of $a$ that makes $f$ continuous. Plot the graph of $f$ with this value of $a$.*

**Exercise 5.** *Given the function*

$$f(x) = \begin{cases} e^{2x+a}, & \text{if } x \geq 0; \\ x+2, & \text{if } x < 0; \end{cases},$$

*where $a \in \mathbb{R}$ is a parameter, find the value of $a$ that makes $f$ continuous.*

**Exercise 6.** *Given the function*

$$f(x) = \begin{cases} ae^{3x}, & \text{if } x \geq -1; \\ x^8+bx+1, & \text{if } x < -1; \end{cases},$$

*where $a, b \in \mathbb{R}$ are parameters, find all the values of $a$ and $b$ that make $f$ continuous.*

**Exercise 7.** *Plot the graph of the function*

$$f(x) = \begin{cases} e^x, & \text{if } < 0; \\ 2, & \text{if } 0 < x \leq 1; \\ x^2+1, & \text{if } x > 1. \end{cases}$$

*Using the graph find whether $f$ is continuous.*