**Scientific computing with Python - 2018**
International Ph.D. in Science - Università Cattolica del Sacro Cuore, Brescia
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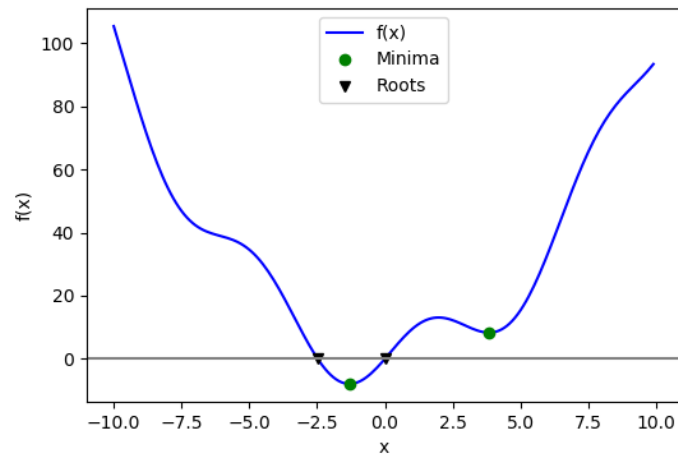
# Hands-on exercises, day 2

## 1. Minima and roots of a function

Given the function

$$f(x) = x^2 + 10\sin(x)$$



draw it in the interval [-10, 10], find its local minima and roots, as shown in the following figure.

## 2. Skyline problem (again...)

As stated in the previous problem...

"

A city's skyline is the outer contour of the silhouette formed by all the buildings in that city when viewed from a distance. In this problem, a building is represented by a tuple of three integer (**L**, *H*, **R**), where **L** and **R** are the $x$ coordinate of the building and $H$ represents the height of the building. The skyline of a set of $n$ buildings is a stepwise function represented here with a list of coordinates $x$ alternated with the heights.

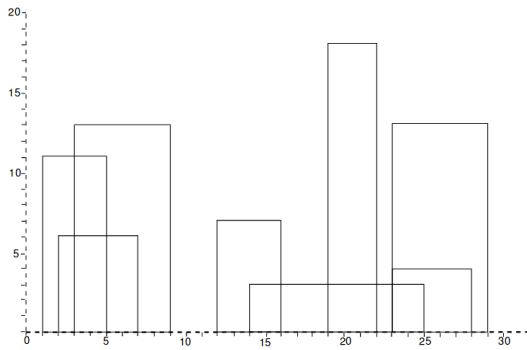For example, the skyline of the following eight buildings

[[**3**, 13, **9**], [**1**, 11, **5**], [**12**, 7, **16**], [**14**, 3, **25**], [**19**, 18, **22**], [**2** ,6, **7**], [**23**, 13, **29**], [**23**, 4, **28**]]

is

[**1**, 11, **3**, 13, **9**, 0, **12**, 7, **16**, 3, **19**, 18, **22**, 3, **23**, 13, **29**]

"

**Now, just represent the problem with a plot like the following.**

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Buildings
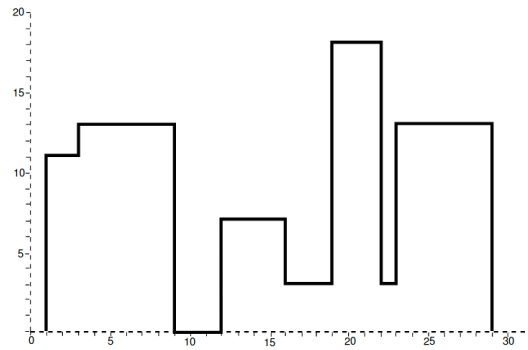


Skyline

# 3. Interpolation

Random generate 11 values as

$$m(t) = \sin(2\pi t) + N \quad \text{for} \quad t \in \{0, 0.1, 0.2, ..., 1\}$$

where $N$ is a random Gaussian noise with zero mean and 0.01 standard deviation.

Plot the linear and the cubic interpolation of these values, like in the following figure. What happens with a bigger the standard deviation?