UNIVERSITY OF AGDER

SymPy

Lecture 7

Agenda

- Exercise recap
- SymPy
- Mandatory review

Exercise review - 2

- System of linear equations

$$
\begin{aligned}
3x + 2y - z &= 1 \\
2x - 2y + 4z &= -2 \\
-x + 0.5y - z &= 0
\end{aligned}
$$

Exercise review - 3

Download the file exercise_5_numbers.txt from Canvas.

- Use the file to generate a numpy array.
- Find the row with the highest sum (adding all the numbers). What is the value of this sum?
- Find the column with the highest sum. What is the value of this sum?
- What is the single highest value in the array?
- What is the sum of the two last rows?

Exercise review - 4

Download the file roman_emperors.csv from Canvas.

- Use the file to generate a numpy array.
- How many emperors were born in Rome?
- What was the most common way of rising to power? How many rose to power this way?
- Which emperors committed suicide?

SymPy

- SymPy is a library for symbolic mathematics in Python

- Derivatives
- Integrals
- Limits
- Differential equations
- ++++++++++

- Free and open source

SymPy

- Derivative
- Integration
- Limits

SymPy - Derivation

- Let’s say we want to derivate:

  `5x^5 - 3x^4 + 6x`

- Solution:

  `25x^4 - 12x^3 + 6`

SymPy - Integrals

- Let’s say we want to integrate:

$$\begin{aligned}\int_0^2 x^2 + 1\, dx &= \left(\frac{1}{3}x^3 + x\right)\Big|_0^2 \\ &= \frac{1}{3}(2)^3 + 2 - \left(\frac{1}{3}(0)^3 + 0\right) \\ &= \frac{14}{3}\end{aligned}$$

SymPy - Integrals

- Let’s say we want to integrate:

$$\int_0^\infty e^{-x}\,dx,$$

SymPy - Limits

- Limits
- f(x) = sin(x) / x
- X0 = 0

$$\lim_{x \to x_0} f(x)$$

SymPy - Limits

- Limits

$$\lim_{x \to 2} \frac{x^2 + 4x - 12}{x^2 - 2x}$$

SymPy - Limits

- Limits

$$\lim_{x \to 1} \frac{x^2 - 1}{x - 1}$$

SymPy - Limits

- Limits

$$\lim_{x \to 1} \frac{x^2 - 1}{x - 1} = \lim_{x \to 1} \frac{(x - 1)(x + 1)}{x - 1}$$