

## Tartalomjegyzék

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## Sage

### Derivatives

**2 points** Define  $f(x) = x^3 e^{-x^2}$  and plot  $f, f', \dots, f^{(5)}(x)$  on the interval  $[-2, 2]$ . Use list comprehension for calculating the derivatives and use `sum()` to add plots into a single picture.

### Collatz

**2 points** Define a function similar to Collatz:

- If  $n$  is odd, let  $g(n) = 3n + 1$
- otherwise divide  $n$  by the maximum power of 2 which divides  $n$

$$2^{a_1} \cdot 3^{a_2} \cdot 5^{a_3} \cdot \dots \mapsto 3^{a_2} \cdot 5^{a_3} \cdot \dots$$

For example  $53 \rightarrow 160 \rightarrow 5 \rightarrow 16 \rightarrow 1$

### Pythagoras

**2 points** Find all the Pythagorean triples up to 1000. You need  $1000 \geq i > j \geq k > 0$  where  $j^2 + k^2 = i^2$  and all integers. You cannot list the same triple twice.

### Pythagoras 2

**2 points** Find all the Pythagorean triples up to 100000. Mind that three **for** up to 100000 would take days, so you need to generate the triples with a formula, see

[https://en.wikipedia.org/wiki/Pythagorean\\_triple#Generating\\_a\\_triple](https://en.wikipedia.org/wiki/Pythagorean_triple#Generating_a_triple)

## Deadline

**2018.12.13 Thursday 23:59**

Download the solution notebook in a .sws format and attach that.