Exercise List for Lab 0

Wolfram Alpha in General

1. Find the value of the thousandth digit in the decimal expansion of the number π.
2. Provide the current distance from the Moon to the Earth.
3. Give the relative frequency of occurrence of letters in the alphabet in Polish text.
4. Compare Poland and Germany.
5. Compare Albert Einstein and Marie Curie.
6. Check the ratio of the population of France to Germany.
7. Check the distance between your city and Turin.
8. Check the effect of entering each of the phrases: Sierpiński Triangle, Stefan Banach

Math with Wolfram Alpha

1. Simplify the quotient $(x^3 - 1)/(x - 1)$.
2. Plot the function $\sin(x^2)/x$.
3. Draw the graph of the function $\sin(x^2)/x$ covering the interval from 10 to 20.
4. Check how to express $\sin(2\alpha)$ as a function of $\sin(\alpha)$ and $\cos(\alpha)$.
5. Calculate the sum of the reciprocals of successive natural numbers from 1 to 10000.
6. Calculate the sum of the reciprocals of the squares of all natural numbers.
7. Factorize the number 1234567890.
8. Expand the expression $(x + 1)(x - 2)$.
9. Find the factored form of the expression $2 - 5x - 3x^2$.

10. Determine in how many ways 6 different numbers can be chosen from 49.
11. How many permutations are there of a 15-element set?
12. Draw the set of solutions of the equation $x^2 + y^2 = 1$.
13. Draw the set of solutions of the equation $x^2 + y^3 = 1$.
14. Find all asymptotes of the function $f(x) = \frac{x^2-1}{x^2-4}$.
15. Find all asymptotes of the function $f(x) = \frac{x^2-1}{x-2}$.
16. Solve the equation $\sin(x) = \cos(x)$.
17. Solve the equation $\sin(x) = \cos(2x)$.
18. Solve the equation $\cos(x) = x/\pi$.
19. Draw 3D graph of the function $f(x, y) = \sin(\sqrt{x^2 + y^2})/\sqrt{x^2 + y^2}$.
20. Plot $\sin(1x)$, $\sin(2x)$, $\sin(3x)$, $\sin(4x)$ on the same plot.

Physics with Wolfram Alpha

1. What color corresponds to a 480 nm wave?
2. What gravitational acceleration do we have on planets in the Solar system?
3. 10 nearest stars.
4. Spring pendulum $l_0 = 0.12m$, $l_i = 0.24m$, $\theta_i = 80°$.
5. Joule's law $u = 3V$, $R = 1\Omega$ for 10s.
6. Add velocities, 200000 km/s, 200000 km/s.
7. Add velocities, $0.9c$, $0.9c$.
8. Atomic spectrum of nitrogen.
9. Calculate the diameter of a silicon atom in nanometers.
10. Single slit diffraction $d = 1/100$ inch, $\lambda = 500nm$.
11. RLC circuit 10Ω, $12H$, $400\mu F$.

12. Photon energy $435nm$.

13. Spring pendulum $l_0 = 0.12m$, $l_i = 0.24m$, $\theta_i = 80°$.

14. Orbital path of Hubble telescope.

15. Find distance between volcano Vesuvius and Warsaw and establish time when we will hear eruption in Warsaw.

Problems for GPT

Problem 1

Compute a derivative of the following function:

- $f(x) = x^2 + 3x - 5$
- $x(t) = t^2 + 3t - 5$

What is a difference between these two derivatives?

Problem 2

Compute an integral of the following function:

- $f(x) = x^2 + 3x - 5$
- $x(t) = t^2 + 3t - 5$

What is a difference between these two integrals?

Problem 3

Plot the following parametric function:

$$x(t) = 3t$$
$$y(t) = t^2 - 3t$$

What is the shape of the plot? What describes the parametric function? Can you tell what kind of physical process is described by the function?