Laboratory 1

1. Evaluate the number using floating point arithmetic: $\frac{1}{2}$; $\sqrt{3}$; π ; $\sin(0.1)$

2. Assign the following expression to a variable and than expand it:

a) $(x^2+2\cdot x-1)^3\cdot(x^2-2)$ b) $(x+n)^5$. Unassign the used variables.

3. Factor: x^8-1

4. Add the following rational expressions by applying the simplify command: $\frac{2\cdot x^2}{x^3-1}+\frac{3\cdot x}{x^2-1}$

5. Simplify the expression: $\sin(x)^2+\cos(x)^2$

6. Evaluate using both subs and eval the expression $e^x+\ln(x)$ in x=1. Use first ?subs and ?eval

7. Solve: a) the equation $x^2-4\cdot x+3=0$ where x is the unknown;
b) the equation $x^2\cdot y+2\cdot y-x=0$ where x is a parameter and y is the unknown;
c) the equation $x^2\cdot y+2\cdot y-x=0$ where y is a parameter and x is the unknown;
d) the equation $x-\cos(x)=0$ where x is the unknown;
e) the equation $x^5-3\cdot x^3-1=0$ where x is the unknown;
f) the system of two equations $4x+3y=10,\ 3x-y=1$ where x and y are the unknowns.

8. Assign to a variable f the function (not the expression) $f: R\to R,\ f(x)=e^x-\sin(x)$. Evaluate $f(0), f(-1), f'(0), f'(1)$. Calculate the first and second order derivatives of f (using both D and diff) and a primitive of f. Evaluate $\int_{-1}^{1} f(x)\,dx$. Unassign f.

9. Assign to a variable g the expression $e^x-\sin(x)$. Evaluate this expression in $x=0$. Compute its first order derivative and than evaluate it in $x=0$. Find a primitive. Evaluate $\int_{-1}^{1} g\,dx$. Using unapply assign to a variable f the second order derivative of g. Evaluate $f(0)$.

10. Find $\lim_{x\to 0}\frac{\sin(x)}{x}$ and $\lim_{x\to \pi}\frac{\cos(x)+1}{x-\pi}$.

11. Plot the graph of $f(x)=\sin(x)$ in each of the intervals:
$[0, 2\cdot\pi]$, $[-4\pi, 4\cdot\pi]$, $[-100, 100]$, $(-\infty, \infty)$.

12. Plot the graph of $f(x)=e^{-x^2}$ in intervals at your choice.

13. Plot the planar curve of parametric equations $x=2-t^2,\ y=t-t^3,\ t\in[-2, 2]$.

14. Plot the planar curve of parametric equations $x=\cos(t),\ y=\sin(t)$ in each of the intervals:

$\left[0, \frac{\pi}{6}\right]$, $\left[0, \frac{\pi}{3}\right]$, $\left[0, \frac{\pi}{2}\right]$, $[0, \pi]$, $\left[0, \frac{3\cdot\pi}{2}\right]$, $[0, 2\cdot\pi]$, $[-10, 10]$.

15. Plot the planar curves of parametric equations a) $x = 2\cdot\cos\left(\frac{t}{3}\right)$, $y = 2\cdot\sin\left(\frac{t}{3}\right)$
b) $x = \cos(4\cdot t)$, $y = \sin(4\cdot t)$ in different intervals of your choice.

16. Write the implicit equations of a circle, an ellipse and a parabola, than plot them.

17. Plot the planar curves of implicit equations a) $x^2 - 2\cdot x\cdot y - y^2 = 1$ b) $y^3 + y^2 - 5\cdot y - x^2 = -4$.
You have to choose properly a rectangle where to see the curve.

18. Plot in 3d the graph of the function $H(x, y) = x^2 + y^2$.