

Laboratory 1

0. Read carefully and try the Maple commands written in the first 3 pages of the tutorial.

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

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

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

3. Factorize: $x^8 - 1$

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) $f: R \rightarrow R$, $f(x) = e^x - \sin(x)$. 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 . Write the commands together with your comments in your notebook.

9. Assign to a variable g the expression $e^x - \sin(x)$. Evaluate this expression in $x=0$. Compute its first order derivative and then 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 $f(0)$. Write the commands together with your comments in your notebook.

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

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 $f(x) = \frac{1}{x}$ 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:

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

Write the commands together with your comments in your notebook.

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 at your choice. Write your comments in your notebook.

16. Write in your notebook the implicit equations of a circle, an ellipse and a parabola. Then plot at least a circle, an ellipse and a parabola.

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 $H(x, y) = x^2 + y^2$. For the variable (x,y) choose a rectangle centered at (0,0). What remarkable planar curves are the level curves of H? Write your comments in your notebook.

19. Plot in 3d the graph of the function $H(x, y) = x^2 + 4y^2$. For the variable (x,y) choose a rectangle centered at (0,0). What remarkable planar curves are the level curves of H? Write your comments in your notebook.

20. Plot in 3d the graph of the function $H(x, y) = 4x^2 + y^2$. For the variable (x,y) choose a rectangle centered at (0,0). What remarkable planar curves are the level curves of H? Write your comments in your notebook.