Mathematics 1, Homework 04
Leipzig University, Bernd Kirchheim, WiSe 2026/27
Due Date: Mo., 16.11.25 until 23:59 on-line

This homework will be estimated from 10 points (each problem is one point).

In problems 1 — 6 it is necessary to compute the limits. Explain your answers. You can use all limit in 1.5.(d) and in 9.&10. the addition theorema for sin and cos might be useful. No more advanced concepts are needed nor should be used in the explanations (but might help to check the result for yourself).

1. $\lim\limits_{x\to 5} \frac{x}{x^2+5} =$

2. $\lim\limits_{x\to 3} \frac{x^2-2x-3}{x-3} =$

3. $\lim\limits_{x\to 0} \frac{\sin 6x}{\operatorname{tg} 2x} =$

4. $\lim\limits_{x\to+\infty} \left(\sin\frac{1}{x} + \cos\frac{1}{x}\right)^x =$

5. $\lim\limits_{x\to-\infty} \frac{\ln(1+3^x)}{\ln(1+2^x)} =$

6. $\lim\limits_{x\to 0} \frac{2^{3\sin x}-1}{x} =$

7. $\lim\limits_{x\to 0} \frac{\sqrt{1+\operatorname{tg} x}-\sqrt{1+\sin x}}{x^3} =$

8. $\lim\limits_{h\to 0} \frac{a^{x+h}-a^x}{h} =$, where x is any real number and $a > 0$.

9. $\lim\limits_{h\to 0} \frac{\sin(x+h)-\sin(x)}{h} =$, where x is any real number.

10. $\lim\limits_{h\to 0} \frac{\cos(x+h)-\cos(x)}{h} =$, where x is any real number.