

Show to the course assistant latest at 23.9.

1. Calculate derivatives of functions

a) $f(x) = \cos(\sin x)$

b) $g(x) = \arctan x$

c) $f(t) = \exp(t^t)$

d) $f(x) = x^2 \sqrt{x^3 - 1/x}$

2. Find the minima and maxima of functions $f(x) = (\sin x - \cos x)^3$ and $g(x) = \cos 2x + \cos x$.

3. Calculate the limits

a) $\lim_{x \rightarrow 0} \frac{\sin 3x}{\sin x}$

b) $\lim_{x \rightarrow 1/2} \frac{\cos \pi x}{2x - 1}$

c) $\lim_{x \rightarrow \infty} x^\alpha e^{-x}$, $\alpha > 0$

d) $\lim_{x \rightarrow 0^+} \frac{x^\alpha}{e^x - 1}$, $\alpha \geq 1$

4. Consider the function

$$f(x) = \begin{cases} \alpha(x+1)^2 & x < 0 \\ \beta \sin x + 1 & x \geq 0 \end{cases} .$$

What condition must the parameters α and β fulfill, if we want $f(x)$ to be
a) continuous, b) differentiable at point $x = 0$?

5. Find the zeros of $f'(x)$, when

a) $f(x) = 2x^2 - 24x + 6$

b) $f(x) = 2x^3 - 15x^2 + 36x + 17$.