MA0004 Mathematical Analysis 1

6th Seminar

Analysis of a function graph

A. Monotonicity and local extrema
B. Convexity/concavity and points of inflection

A. Monotonicity and local extrema

Inquiry-based task

1. Work sheet - monotonicity of a function

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2. Specify intervals of monotonicity and local extrema of the following functions:

a) $f(x) = x^3 - 12x, D(f) = \boldsymbol{R}$

b) $f(x) = x^2 \cdot e^{-x}, D(f) = \boldsymbol{R}$

c) $f(x) = \frac{x}{\ln x}, D(f) = \boldsymbol{R}^+ - \{1\}$

d) $f(x) = x - 2 \cdot \sin x, D(f) = (0, 2\pi)$

e) $f(x) = \frac{1}{x} \cdot \ln \frac{1}{x}, D(f) = (0, \infty)$

f) $f(x) = \frac{(x+3)^2}{e^x}, D(f) = \boldsymbol{R}$

B. Convexity/concavity and points of inflection

Inquiry-based task

1. Work sheet - convexity/concavity of a function

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2. Specify intervals of convexity/concavity and inflection points of the following functions:

1. $f(x) = x^3 - 12x,\ f'(x) = 3x^2 - 12, D(f) = D(f') = \boldsymbol{R}$

2. $f(x)=x^2\cdot e^{-x}, f'(x)=x\cdot e^{-x}\cdot(2-x), D(f)=D(f')=\boldsymbol{R}$

3. $f(x)=\dfrac{x}{\ln x}, f(x)=\dfrac{\ln x-1}{\ln^2 x} D(f)=D(f')=\boldsymbol{R}^+-\{1\}$

4. $f(x)=x\cdot e^{-\frac{x^2}{2}}, f'(x)=e^{-\frac{x^2}{2}}\cdot(1-x^2),\ D(f)=D(f')=\boldsymbol{R}$

5. $f(x)=x^4-2x^3-12x^2+7x-3, D(f)=\boldsymbol{R}$