Problem 1. Find the derivative of the following functions **by definition**.

$$f(x) = \frac{1}{2x+1}, \quad g(x) = \frac{1}{\sqrt{x}}$$

Problem 2. Find the derivative of the following function.

$$f(x) = \begin{cases} x^2 - 1 & \text{when } x \leq 2 \\ 4x - 3 & \text{when } x > 2 \end{cases}$$

Problem 3. Calculate derivatives.

1. $(x^3 - 2x^2 + 3\sqrt{x})' =$

2. $(x^3 \sin x)' =$

3. $\frac{\mathrm{d}}{\mathrm{d}x}(3\cos x \cdot \sqrt{x}) =$

4. $\frac{\mathrm{d}}{\mathrm{d}t}((2t + \frac{1}{t})(t^2 - 3)) =$

Problem 4. Find the tangent lines to the graph of $f(x) = x^4 - x^2$ at the points $(1, f(1))$ and $(2, f(2))$. Find the secant line through the points $(1, f(1))$ and $(2, f(2))$. What are the horizontal tangent line(s) to the graph?