

**Functions and their Derivatives**

**Courses of Functions, Monotony, and Curvature**

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**Intention**

The Aim of this worksheet is o make pupils familiar with the connection between a function and its derivatives. No calculations are needed in order to solve the tasks. Practical experience shows that about 50min are needed to complete the worksheet.

**Background of Subject Matter**

Multiple tasks are aimed at an understanding of the relation between monotony and curvature.

**Methodical Advice**

The pupils should solve the tasks alone or together with a partner. The tasks’ level of difficulty is average.

**Performance Rating**

In an exam, it is easily possible to test if the students have understood the relations and are able to argue their claims through varying the tasks.

**Functions and their Derivatives**

May function f be continuous and differentiable.

**Task 1**

May function f be strictly monotonically decreasing in the interval I. What happens to functional value $f(x)$ in the in the interval if the x-value of the function is decreasing? Argue.

**Task 2**

In a right curve, may the function f have the slope 4 in$ x\_{0}$. Which slope will f have in $x\_{1}$ in this right curve, if $x\_{1}$ is located to the right of$ x\_{0}$? Argue.

**Task 3**

May $f''$ possess the value -5 in$ x\_{0}$. What does this tell you about $f'$ and $ f'(x\_{0})$ in a neighbourhood of$ x\_{0}$ ? What can be said about$ f(x\_{0})$? Argue.

**Task 4**

May $f'$ intersect the x-axis in $x\_{0}$ from above. Which special point is$ x\_{0}$? Argue.

**Task 5**

If necessary, correct the following argumentation:

In a right curve of a function f the slope of the tangent decreases if $x$ moves from left to right. As the derivate of a function describes the slope of the tangent in a particular point, $f'$ and $f''$ are strictly monotonically decreasing in the right curve. Argue if you have changed the argumentation.

**Task 6**

If possible, draw a sketch of a section of a function $f$ which has a left curve and is strictly monotonically decreasing. What can be said about $f''$ in this part of the curve? Argue.

**Task 7**

May function $f$ change from a right curve into a left curve in$ x\_{0}$. Additionally, may $f$ be strictly monotonically increasing close to$ x\_{0}$. Is this possible? Argue with the help of a sketch.

**Task 8**

May function $f$ change from a right curve into a left curve in$ x\_{0}$. Additionally, may $f$ be strictly monotonically decreasing close to$ x\_{0}$. Is this possible? Argue with the help of a sketch.

**Task 9**

May $f''$ be monotonically decreasing in an interval and possess an x-intercept in this interval. What can you conclude about $f$ in this interval? Argue.

**Task 10**

May $f'$ be strictly monotonically increasing in an interval I but may $f'$ possess only negative functional values in this interval. Sketch the course of $f$ in the interval and argue your solution.