Name:	Date:
Class:	

Supplementary Examination for the
Standardised Competence-Oriented
Written School-Leaving Examination

AHS

May 2017

Mathematics

Supplementary Examination 6
Candidate's Version

BMB
Bundesministerium
für Bildung

Instructions for the supplementary examination

Dear candidate,

The following supplementary examination is comprised of five tasks that can be completed independently of one another.

Each task contains two parts: The statement of the task requires you to demonstrate core competencies, and the guiding question that follows it requires you to demonstrate your ability to communicate your ideas.

You will be given preparation time of at least 30 minutes, and the examination will last at the most 25 minutes.

Assessment

Each task can be awarded zero, one or two points. There is one point available for each demonstration of core competencies as well as for each guiding question. A maximum of 10 points can be achieved.

For the grading of the examination the following scale will be used:

Grade	Minimum number of points
Pass	4 points for the core competencies + 0 points for the guiding questions 3 points for the core competencies + 1 point for the guiding questions
Satisfactory	5 points for the core competencies + 0 points for the guiding questions 4 points for the core competencies + 1 point for the guiding questions 3 points for the core competencies + 2 points for the guiding questions
Good	5 points for the core competencies + 1 point for the guiding questions 4 points for the core competencies + 2 points for the guiding questions 3 points for the core competencies + 3 points for the guiding questions
Very good	5 points for the core competencies + 2 points for the guiding questions 4 points for the core competencies + 3 points for the guiding questions

The examination board will decide on the final grade based on your performance in the supplementary examination as well as the result of the written examination.

Good Luck!

Task 1

Equivalent Transformations

Below, you will see two equations that hold for $x \in \mathbb{R}$:

- $3 - \frac{2x}{5} = -1$
- $\frac{3x}{5} + 1 = x - 3$

Task:

Determine whether these two equations are equivalent.

If the equations are equivalent, show a series of possible equivalent transformations that transform the first equation into the second.
If the equations are not equivalent, justify why this is the case.

Guiding question:

With specific reference to the example given below, explain why the rearrangement shown does not give rise to an equivalent equation. The equation is defined over the set of all real numbers.

$(x - 2)^2 = 25 \mid \sqrt{}$
$x - 2 = 5$

Task 2

Cooling

At time $t_0 = 0$, a container with hot water is put outside where the ambient temperature is 0 °C. The temperature of the water, $T(t)$ (in °C), is dependent on the time t (in minutes) and can be described by the function T where $T(t) = 90 \cdot e^{-0.2 \cdot t}$.

Task:

Determine the half-life of this cooling process and explain the significance of this result within the context given.

Guiding question:

Show that the instantaneous rate of change of the temperature of the water, $T'(t)$, is directly proportional to the instantaneous temperature of the water at time t. Determine the constant of proportionality, k.

$k =$ _____

Explain the meaning of the absolute value T' in the context of the cooling process.

Task 3

Crude Oil Price

In December 2015, the price of crude oil tended to fall daily. The price of crude oil is given by the barrel in US dollars. One barrel contains 159 litres.

On the 1st December 2015 at 12:00 noon, the crude oil price was 41.70 US dollars per barrel. On the 11th December 2015 at 12:00 noon, the price was 37.94 US dollars per barrel.

Task:

Determine the absolute and relative (percentage) change of the crude oil price per barrel for the given time period.

Guiding question:

Determine the average rate of change of the crude oil price per litre for the given time period (in days) and interpret your result in the given context.

Determine the price of 1 litre of crude oil on the 16th December 2015 if the crude oil price from the 11th December 2015 had continued to develop with the same average rate of change per day.

Task 4

Integral

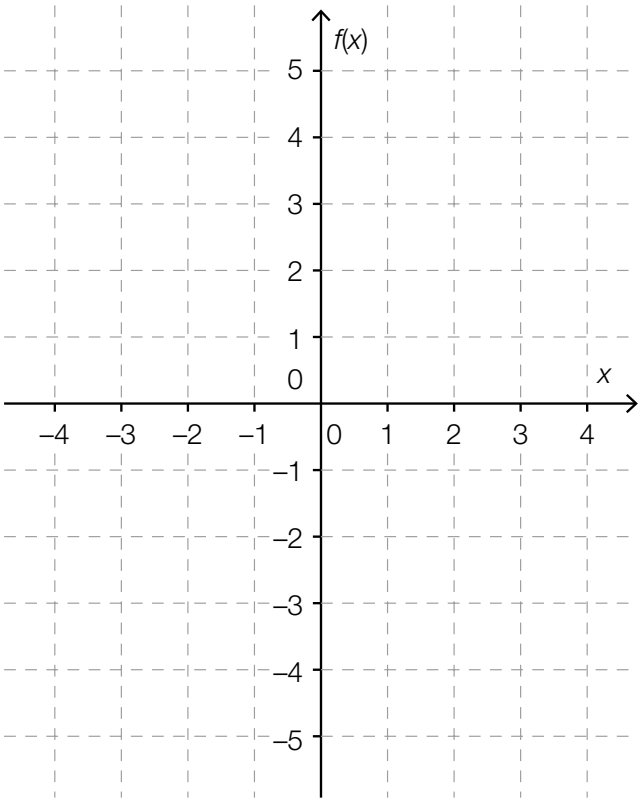
Let f be a linear function where $f(x) = -2 \cdot x + 2$.

Task:

Find the equation of the antiderivative of the function f, F, for which $F(2) = 1$ holds. Show your method.

Guiding question:

Find the value of the definite integral $\int_0^3 f(x)\,dx$. Show your method.
Draw the graph of the function f in the coordinate system given below and explain why, in this case, the value of the definite integral does not correspond with the area enclosed by the graph of the function and the x-axis in the range [0, 3].



Task 5

Cone

A cone that is thrown can either land on its curved surface or on its base.

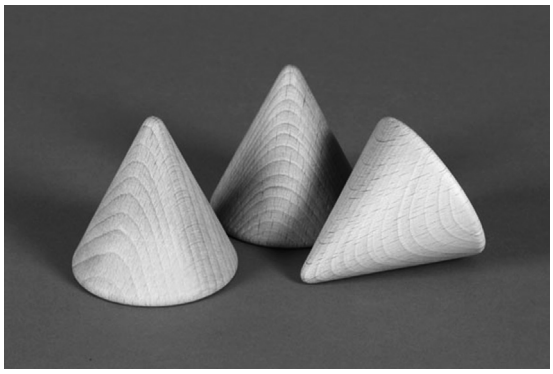


Image source: http://www.holzbausteine.at/images/Spitzkegel60.jpg [28.04.2016].

Task:

Throwing a cone of this kind can be seen as a random experiment. At first, the cone is thrown 50 times. In 12 of the throws, the cone lands on its base.

Felix carries out the following calculation:

$$\left(\frac{12}{50}\right)^2 = \frac{144}{2{,}500} = 0.0576 = 5.76\ \%$$

Interpret the result in the given context.

Guiding question:

Selin says that actually, the probability of the cone landing on its base is unknown.

Suggest an argument Selin can use to support her statement and how the experiment would need to be changed to calculate this probability as accurately as possible.