Name:	
Class:	

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

AHS

January 2020

Mathematics

Supplementary Examination 2
Candidate's Version

Bundesministerium
Bildung, Wissenschaft
und Forschung

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	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 (or more) points for the guiding questions 4 points for the core competencies + 3 (or more) points for the guiding questions

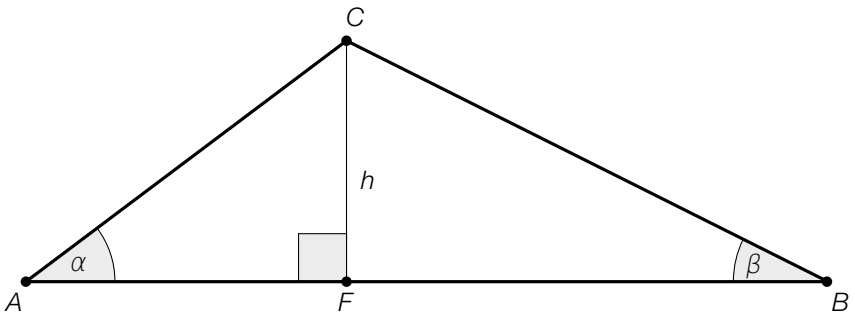
The examination board will decide on the final grade based on your performance in the supplementary examination as well as the result of the written examination.

Good Luck!

Task 1

Trigonometry

The triangle *ABC* is shown below. The foot *F* of the altitude *h* is closer to the vertex *A* and divides the line segment *AB* at a ratio of 2 : 5.



Task:

– Determine the size of the angle β when $h = 7$ cm and $\overline{AB} = 21$ cm.

Guiding question:

– Show by calculation that the triangle *ABC* is not a right-angled triangle.

The point *C* is moved so that the foot *F* of the altitude *h* lies to the left of the vertex *A*. The length of the altitude *h* and the length of the line segment *AB* remain the same.

– Write down whether this change causes the value of $\tan(\beta)$ to increase or decrease and justify your answer.

Task 2

Powder Dye

If 500 g of powder dye is put into a jug of water, then after one minute 70 g of this powder will have dissolved.

The amount of powder dye that has dissolved is modelled by the function p where $p(t) = 500 - 500 \cdot e^{k \cdot t}$ in terms of the time t (t in min, $p(t)$ in g).

Task:

– Determine the value of k.

Guiding question:

The function p fulfils the difference equation $p(t + 1) - p(t) = a \cdot (500 - p(t))$ with $a \in \mathbb{R}$.

– Determine the value of a and interpret your result in the context given.

Task 3

Maxima and Minima of a Fourth Degree Polynomial Function

The equation of a fourth degree polynomial function f is $f(x) = a \cdot x^4 + b \cdot x^3 + c \cdot x^2 + d \cdot x + e$ with $a, b, c, d, e \in \mathbb{R}$ and $a > 0$.

Task:

– Justify why f can have at most 3 maxima or minima.

Guiding question:

The following applies: $g(x) = p \cdot x^4 + q \cdot x^2 + r$ with $p, q, r \in \mathbb{R}$ and $p > 0$.

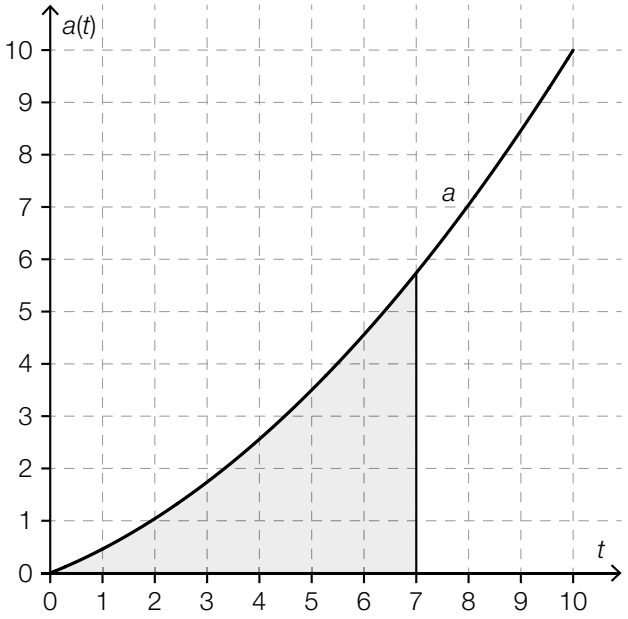
– Write down every number of local maxima or minima that g can have.
– Demonstrate by calculation how the sign of q influences the number of maxima or minima and for each case, sketch a typical graph of the function.

Task 4

Acceleration

An object with an initial speed of 5 m/s accelerates for 10 s.
The acceleration of the object is modelled by the function a in terms of time t.
The equation of the function a is: $a(t) = 0.06 \cdot t^2 + 0.4 \cdot t$ with t in s and $a(t)$ in m/s^2.

The diagram below shows the graph of the function a with a shaded area.



Task:

– Determine the size of the shaded area and explain what this value means in terms of the velocity of the object.

Guiding question:

– Determine the length of the distance covered during this 10 s long acceleration and explain your method.

Task 5

Fitness Training

The list of data shown below gives the number of hours per week that eight young people spend training at a gym.

3, 3, 5, 6, 7, 8, 9, x

The median and the mean of the training times have the same value.

Task:

– Assuming that x is the largest value of the list of data, write down the training time x.

Guiding question:

– Assuming that x is any integer value of the list of data, write down a second possible value for the training time x.

Three out of the eight young people are chosen at random.

– For each of the possible values of x, determine the probability that exactly two out of the three young people train at least five hours per week.