Name:	
Class:	

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

AHS

Main Examination Session 2021

Mathematics

Supplementary Examination 6
Candidate's Version

Bundesministerium
Bildung, Wissenschaft
und Forschung

Instructions for the supplementary examination

Dear candidate,

The following supplementary examination booklet contains five tasks that can be completed independently of one another. Each task comprises two sub-tasks: the “task” and the “guiding question”.

The preparation time is to be at least 30 minutes; the examination time is at most 25 minutes.

The use of the official formula booklet that has been approved by the relevant government authority for use in the standardised school-leaving examination in mathematics is allowed. Furthermore, the use of electronic devices (e.g. graphic display calculators or other appropriate technology) is allowed provided there is no possibility to communicate (e.g. via the internet, intranet, Bluetooth, mobile networks etc.) and there is no access to an individual’s data stored on the device.

Assessment

Each task can be awarded zero, one or two points. There is one point available for each task for the demonstration of a core competency and one point available for each guiding question. A maximum of ten points can be achieved.

Assessment scale for the supplementary examination

Grade	**Number of points achieved (core competencies + guiding questions)**
Very good	7 – 10
Good	6
Satisfactory	5
Pass	4

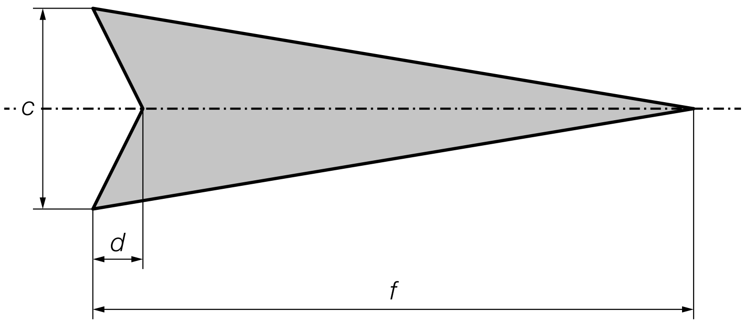
Good luck!

Task 1

Arrow

Task:

The diagram below shows a model of an arrow in 2-dimensional space. The dotted line is the axis of symmetry of this arrow.

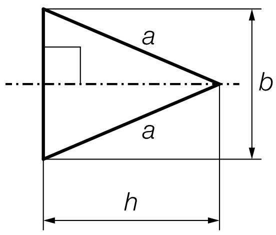


– Using c, d and f, write down a formula that can be used to calculate the area A of the area shaded in grey.

$A =$ ____

Guiding question:

The diagram below shows a model of the tip of an arrow. The dotted line is the axis of symmetry of the tip of the arrow.



The isosceles triangle shown in the diagram above has a base $b = 6$ cm, side length a cm and height $h = 7$ cm. The length of the base is to be kept the same, but the area of the triangle is to be increased by 20 %.

– Determine the side lengths of the triangle after the area has been increased.

Task 2

Mountain Railway

The station at the bottom of a mountain railway is at an altitude of 1 000 m. The horizontal distance between the station at the bottom of the mountain and the station at the top of the mountain is 2 500 m. In this task, the railway line is modelled as a straight line and has a constant gradient of 41 %.

Task:

– Determine the angle of elevation of the railway line.

– Determine the altitude of the station at the top of the mountain.

Guiding question:

The duration of the journey from the station at the bottom of the mountain to the station at the top of the mountain is 5 min.

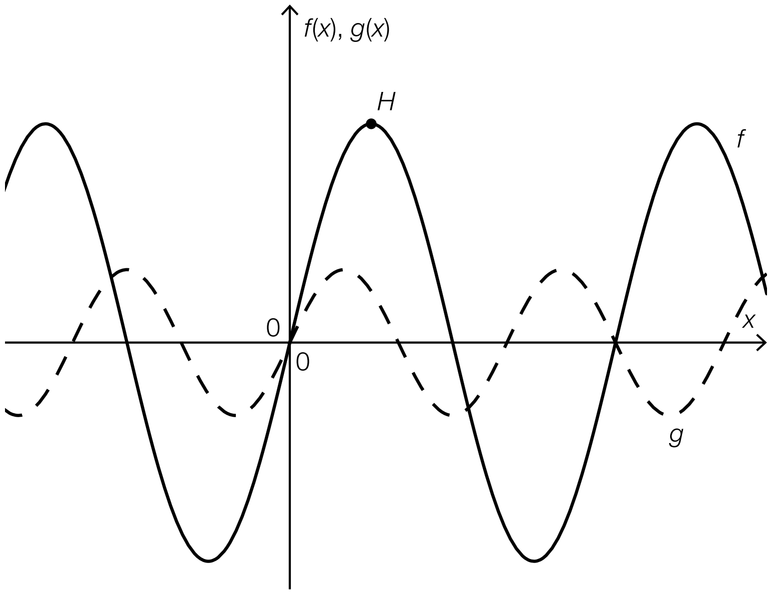
The function p with $p(h) = 1\,000 \cdot e^{-0.000126 \cdot h}$ can be used to approximate the air pressure at an altitude of h (h in m, $p(h)$ in mbar).

– Determine the average absolute change in air pressure per minute over the course of a journey with this mountain railway from the station at the bottom of the mountain to the station of the top of the mountain.

Task 3

Trigonometric Functions

The diagram below shows the graphs of the functions f and g with $f(x) = a \cdot \sin(b \cdot x)$ and $g(x) = c \cdot \sin(d \cdot x)$ with $a, b, c, d \in \mathbb{R}^+$.



Task:

– Complete each of the gaps below with the appropriate symbol "<", ">" or "=" and justify your answers.

a _____ c

b _____ d

Guiding question:

The maximum point of the graph of f labelled H in the diagram above has coordinates $H = \left(\frac{\pi}{4}, 3\right)$.

– Determine a and b.

Task 4

Drag Race

Jan and Tom are participating in a drag race. They set off at the same time when $t = 0$. The velocities of their vehicles in the first few seconds can be described by the two functions v_J and v_T.

t ... time in s
$v_J(t)$ ... velocity of Jan's vehicle at time t in m/s
$v_T(t)$ ... velocity of Tom's vehicle at time t in m/s

Task:

For the time-velocity function v_J, the following relationship holds:

$v_J(t) = 0.6 \cdot t^2 \cdot e^{-0.09 \cdot t}$

– Determine the acceleration of Jan's vehicle when $t = 10$.

Guiding question:

At time t_1, Tom's vehicle is ahead of Jan's vehicle. The distance between the vehicles at time t_1 is d metres.

– Using v_J and v_T, write down a formula that can be used to calculate d.

$d =$ __________________________________

Task 5

Balls

Task:

A box with 30 balls contains 14 red and 16 yellow balls.

Maria takes 2 balls out of the box at random and without replacement.

– Determine the probability that Maria removes 2 balls of the same colour from the box.

Guiding question:

Another box contains 3 white balls and 1 green ball.
Eva takes balls out of the box at random until she removes the green ball.

The random variable X gives the number of balls removed. If X takes the value 2, this means that the first ball is white and the second ball is green.

– Determine the expectation value of X.