Exercise 1 Calc. : ✓

Part 1

The table below shows the price of durum wheat in € per ton in the period 2016–2021.

Year		2016	2017	2018	2019	2020	2021
Years after 2016	x	0	1	2	3	4	5
Price of wheat (€ per ton)	y	110	140	145	170	266	341

a) **Draw** a scatter diagram to represent the data from the table. — 2 marks

b) **Determine** the average annual increase of the durum wheat price from 2016 to 2021. — 1 mark

c) **Determine** an equation in each of the forms $y = K \cdot A^x$ and $y = K \cdot e^{a \cdot x}$ of the exponential regression of y on x using the data from the table. — 4 marks

Give the constants A and a correct to 3 decimals.

In d) and e) use the exponential model $g(x) = 104 \cdot e^{0.22x}$ for the price in € per ton of durum wheat x years after 2016.

d) **Estimate** the price of durum wheat in € per ton in 2023. — 1 mark

e) **Compare** $g'(4)$ and $g'(5)$. **Explain** what these two values tell about the wheat price. — 3 marks

Part 2

Two agricultural farms A and B produce wheat. Wheat harvests are brought to a processing site which transforms the wheat into semolina or flour and packs it into bags.
40% of the wheat used at the processing site come from farm A, and the rest comes from farm B.
45% of the wheat from farm A is used to produce flour.
70% of the wheat from farm B is used to produce semolina.
At the processing site a bag is selected at random.

f) **Calculate** the probability that the bag contains flour, and that the wheat came from farm A. — 2 marks

g) Given the bag contains semolina, **calculate** the probability that the wheat came from farm B. — 3 marks

Part 3

The region in which farm B is located is affected by septoria, a disease that affects different types of plants, including wheat. Farm B treats all its plots of wheat.
Studies carried out in the region have made it possible to estimate that for wheat treated, 12% is affected by this disease.
We examine the wheat at 25 randomly selected check points on farm B.

h) **Determine** the probability that at most one of these check points show wheat affected by this disease.	3 marks
i) **Determine** the expected number of check points showing this disease.	2 marks

Part 4
The shaded region on the figure below shows a wheat plot on farm A.
The region is bounded by the graph of the function f defined by $f(x) = -x^2 + 2x + 5$ and the x-axis for $0 \le x \le 2$.
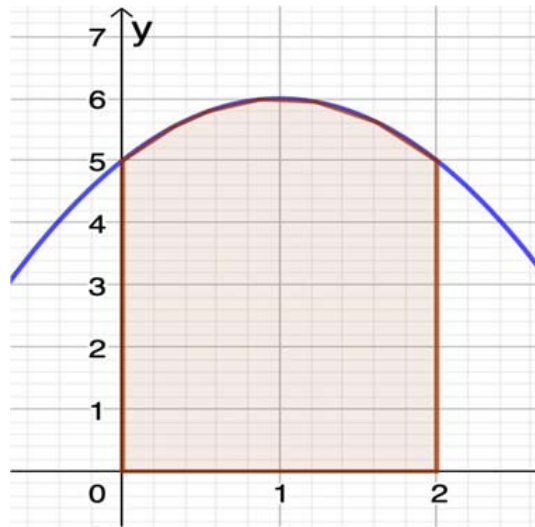
j) A function F is defined by

$$F(x) = -\frac{1}{3}x^3 + x^2 + 5x.$$

Show that F is a primitive of f.	2 marks
k) **Calculate** the area of the shaded region.	2 marks

Exercise 2   Calc. : ✓

Part 1	
The electric car VOLTWAGEN is tested on a short, straight test track. The car finishes the test track in 8 seconds and the speed v (in m/s) of the electric car can be modelled by $$v(t) = -2t^2 + 16t,$$ where t is the time in seconds, $0 \leq t \leq 8$.	
a) **Determine** $v'(t)$ and **interpret** what the derivative means in this context.	3 marks
b) **Calculate** $\displaystyle\int_0^8 v(t)\,dt$ and **interpret** what the result means in this context.	3 marks
c) **Calculate** the car's highest speed on the test track.	3 marks
Part 2	
In 2018 the number of Voltwagens sold was 3 325. The following years the number of cars sold increased by 8.2% per year.	
d) **Calculate** the number of cars sold in 2022.	2 marks
e) Consider the function f, where $f(x)$ is the number of cars sold x years after 2018. **Solve** the equation $f(x) = 5\ 000$, and **interpret** the result.	3 marks
f) **Determine** the doubling time, i.e. the time it takes for the number of cars sold to double.	3 marks

Part 3	
The manufacturer claims that 90% of the Voltwagens can go 700 km on one charge. A group of people using these cars suspects that the batteries are not that good. A research institute controls 80 randomly selected Voltwagens. The control shows that 66 of the 80 cars could go 700 km on one charge. To test the manufacturer's claim, the institute will conduct a hypothesis test at the 5% significance level.	
g) **State** the null hypothesis H_0 and the alternative hypothesis H_1.	2 marks
h) **Explain** whether the test is left or right sided.	2 marks
i) The random variable X describes the number of cars from a sample of 80 Voltwagens being able to drive 700 km on one charge of the battery. Assuming that H_0 is true, **calculate** the probability that X is less than or equal to 66. Hence **conclude** whether the hypothesis H_0 is rejected.	4 marks