**Exercise 1** Calc. : ✓

**Use the calculator for questions b), c), d), e), f), h), i), j) and m)**

*Frog and Toad, Arnold Lobel, 1970–1979*

The value of a bicycle, in euros, depending on the time t in years, can be described by the function $f$ given $f(t) = 750 + 2\,250 \cdot e^{-0.2t}$.

| | |
|---|---|
| a) Calculate the value of the bike when new. | 1 mark |
| b) Calculate the value of the bike after one year, and after three years. | 2 marks |
| c) How much does the bicycle lose in value in the first year? Round to the nearest €1. | 1 mark |
| d) By what percentage has the value of the bicycle decreased after three years? Round to the nearest 1%. | 3 marks |
| e) Solve the equation $f(t) = 1\,500$ and interpret the result. | 3 marks |
| f) Determine value of the bicycle in the long-term based on this model. | 2 marks |
| g) Calculate the derivative $f'(t)$. | 2 marks |
| h) Calculate $f'(5)$ and interpret the result. | 2 marks |

*Tandem, Marke William, 1950*

A 48 $cm^3$ petrol engine is mounted on the bicycle.
The fuel consumption, measured in liters for 100 km, can be calculated as a function of the speed using the function $h(x) = 0.04x + \frac{25}{x}$, where $x$ is the speed in km/h.

i) Graph the function $h$ for $5 \le x \le 50$ using the following table of values. — 2 marks

| $x$ | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|
| $h(x)$ | | | | | | | | | | |

*Round the function values to one decimal place.*
*Graph paper is available.*

j) Calculate the petrol consumption at 25 km/h in liters for 100 km. — 1 mark

k) Read from your graph, for which speed, $x$, the fuel consumption is the least. — 2 marks

l) Calculate an antiderivative for the function $h$. — 2 marks

m) The bike is pushed and drives off at a speed of 5 km/h. It is then steadily accelerated to 50 km/h. — 2 marks

Calculate the integral $\int_5^{50} h(x)\,dx$ with the calculator. Round to the nearest whole number.

*Remark (this is not a question!): The value* $\frac{1}{45}\int_5^{50} h(x)\,dx$ *is the average fuel consumption per 100 km when accelerating from 5 km/h to 50 km/h.*

**Exercise 2** Calc. : ✓

**Use the calculator for questions a, b, c, d, e, g, i, and k.**

*Round your numerical answers to the nearest whole number.*

Jane is starting an online business, using a large social media base to promote her website. The weekly visits to her website over the first year can be modelled by the following function: $f(t) = 15 \cdot \ln(3t + 1)$, where $f(t)$ represents the number of hundreds of visitors her website got and $t$ represents the time measured in weeks with $0 \leq t \leq 52$.

a) Calculate the number of visitors the website got in the first week, and the number of visitors the website got in the last week of the year. — 2 marks

b) Calculate the total number of visits to the website in the first three weeks. — 2 marks

c) How long did it take for her to pass 20 000 visits in total from the moment she launched her website? — 4 marks

d) Calculate the integral $\int_0^{26} f(x)\,\mathrm{d}x$ with the calculator and interpret the result in the given situation. — 3 marks

e) Calculate $f'(26)$ to 2 decimal places and interpret the result. — 3 marks

Jane assumes that the rate of change will remain stable from week 26, and the number of visitors will now grow at the constant rate $m = 0.6$. It models the number of visitors (in hundreds) for $26 \leq t \leq 52$ with the function $g(t) = 0.6 \cdot t + 50$.

f) Explain how Jane came up with this equation to model future growth. — 2 marks

g) Calculate how many visitors Jane is expecting in the last week of the year using this new model. — 1 mark

h) Write an integral that allows to calculate the total number of visits during the last 26 weeks. — 2 marks

In reality there were 7820 visitors in the last week of the first year.

i) Which of the two models turns out to be better for predicting this number? — 2 marks

One of the objects Jane sells on her website is a mic-stand base. Its profile can be modelled using the function $h(x) = \dfrac{4}{0,5x - 1,4}$ on the interval $-5 \leq x \leq 2$. Each unit on $x$ and $y$ axis represents 1 cm.

j) Write the integral required to calculate the volume of revolution using the formula $V = \int_a^b \pi\,(f(x))^2\,\mathrm{d}x$. — 2 marks

k) Calculate the volume of metal used to make the mic-stand base, in cubic centimeters, to the nearest $\mathrm{cm}^3$. — 2 marks