

Pre-Baccalaureate examinations – January 2023



Subject	Mathematics
Date	24/01/2023
Length of examination	2 Hours
Teacher	D Shaw
Pupils	11

Surname:

Name:

PART B : EXAM WITH TECHNOLOGICAL TOOL

Special remarks

- This exam is made up of 2 questions printed on 5 pages, including this one.
- Questions should be answered on a given answer booklet
- Use a different page for each question.
- Answers must be supported by explanations
- They must show the reasoning behind the results or solutions provided.
- If graphs are used to find a solution, they must be sketched as part of the answer.
- Unless otherwise indicated, full marks will not be awarded if a correct answer is not accompanied by supporting evidence or explanations of how the results or the solutions have been achieved.
- When the answer provided is not the correct one, some marks can be awarded if it is shown that an appropriate method and/or a correct approach has been used.
- Some of the questions can be answered only with the help of the calculator. The wording of these questions makes this clear. All other questions can be solved with or without the use of the calculator.

Good luck!

Part B**Question B1 ANALYSIS****25 Marks**

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



Frog and Toad, Arnold Lobel, 1970-1979

1. The value of a bicycle, in euros, depending on the time t in years, can be described by the function f given $f(t) = 750 + 2250 \cdot e^{-0,2t}$.

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 $f(t) = 1500$ 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 $5 \leq x \leq 50$ 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 5km/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*

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

PART B	
Question B2 ANALYSIS	25 Marks
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: $f(t) = 15 \ln(3t + 1)$, $0 \leq t \leq 52$, 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) i) Calculate the number of visitors the website got in the first week. ii) Calculate 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 $\int_0^{26} f(x)dx$ 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 marks
h) Write an integral that allows to calculate the total number of visits during the last 26 weeks.	2 marks

<p>In reality there were 7820 visitors in the last week of the first year.</p>	
<p>i) Which of the two models turns out to be better for predicting this number?</p>	2 marks
<p>One of the objects Jane sells on her website is a mic-stand base. Its profile can be modelled using the function $g(x) = \frac{4}{0.5x-1.4}$ on the interval $-5 \leq x \leq 2$. Each unit on x and y axis represents 1cm.</p>	
<p>j) Write the integral required to calculate the volume of revolution using the formula</p> $V = \int_a^b \pi(f(x))^2 dx$	2 marks
<p>k) Calculate the volume of metal used to make the mic-stand base, in cubic centimeters, to the nearest cm^3.</p>	2 marks