PART EXAMINATIONS (PRE-BACCALAUREATE)
2023-2024

MATHEMATICS 3 PERIODS
PART A

DATE: January, Monday the 29th, 2024

TIME ALLOWED FOR THE EXAM:

2 hours (120 minutes)

AUTHORISED MATERIAL:

- Examination without technological tool
- Pencil for the graphs
- Formula booklet

PARTICULAR REMARKS:

- Answers must be supported by explanations.
- 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 evident that an appropriate method and/or a correct approach has been used.

NUMBER OF EXAM DOCUMENTS: 2	
EXAM DOCUMENTS:	
EXAM PAPER	**YES ☒ NO ☐**
ANSWER BOOKLET	**YES ☐ NO ☒**
FORMULA BOOKLET	**YES ☒ NO ☐**

NUMBER OF PAGES OF THE EXAM PAPER: 6

REMINDER: NO ANSWERS TO BE WRITTEN ON THE EXAM PAPER

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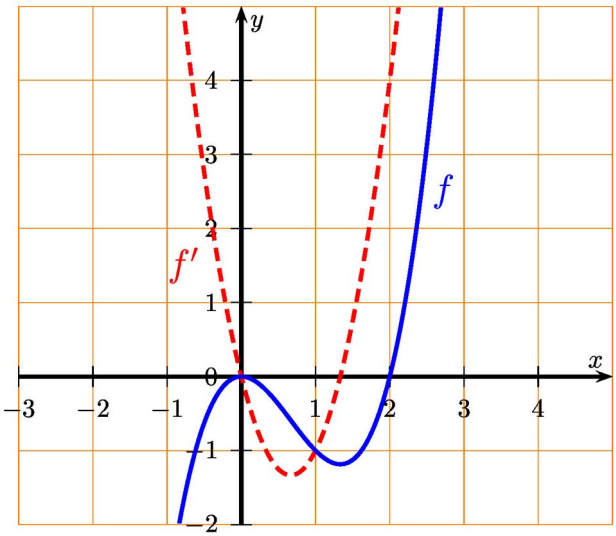
NAME OF PUPIL: ……

PART A

	Page 1/4	Marks

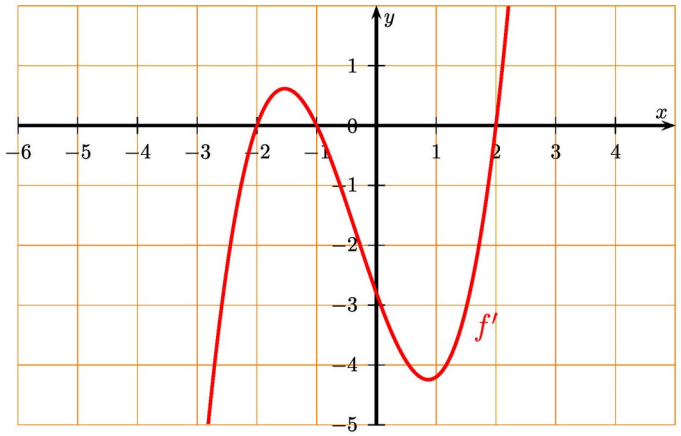
1) The diagram below shows the graph of a function f and that of its derivative function f'.



a) **Find** the value of $f(2)$ and $f'(2)$. — 2 marks

b) **Determine** an equation of the tangent to the graph of f at the point where $x=2$. — 3 marks

2) The diagram shows the graph of the derivative f' of a function f.



a) **Give** the intervals on which the function f is increasing. — 2 marks

b) **Determine** whether the function f has a local maximum. **Justify** your answer. — 3 marks

PART A

Marks

3) Consider the function f defined by $f(x)=3x^3-2x^2-1$.

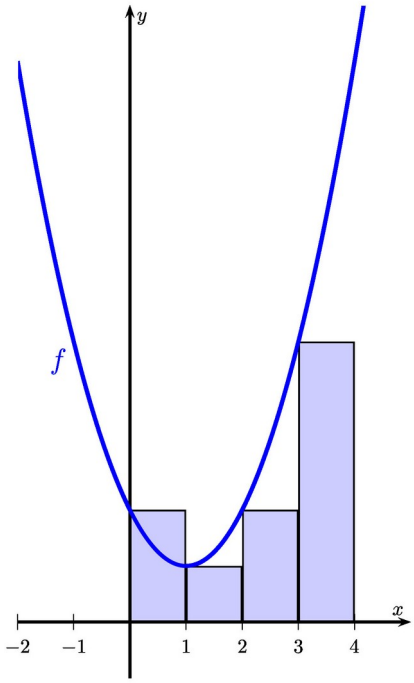
Consider also the function F defined by $F(x)=a\cdot x^4+b\cdot x^3+c\cdot x+d$, where a, b, c and d are four real numbers.

a) **Find** the values of the three parameters a, b, and c such that $F'=f$. — 3 marks

b) **Find** the value of the parameter d such that $F(1)=\frac{1}{12}$. — 2 marks

4) Here is the curve of the function f defined by:

$$f(x)=x^2-2x+2$$



a) **Find** an approximation of the area under the curve from $x=0$ to $x=4$ by using left sided rectangles of width 1. — 3 marks

b) Based on the graph, **discuss** if this approximation is an over-estimation of $\int_0^4 f(x)\,dx$, or an under-estimation. **Justify** your answer. — 2 marks

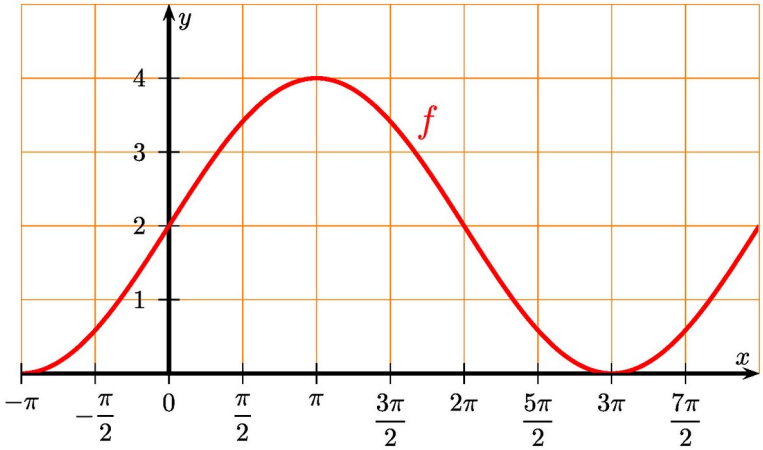
PART A

Marks

5) The graph below shows a periodic function f, defined by:

$$f(x)=a\cdot\sin(b(x-c))+d$$

(where a, b, c and d are four real numbers).



Based on the information in the graph, — 5 marks

- **determine** the amplitude, the period and the vertical shift of f, then **give** the values of a, b and d.
- **find** $f(\pi)$ and $f(9\pi)$.

6) Let us consider the function f defined by:

$$f(x)=\frac{1}{x}$$

We recall that the function F defined by $F(x)=\ln(x)$ is a primitive of f.

Calculate the area under the curve of f from $x=1$ to $x=e$. — 5 marks

7) Two brothers, Jarek and Kuba, wash the dishes after each dinner. Kuba is older and the probability that he washes the dishes after dinner is 4/7. When Kuba washes the dishes, the probability of breaking a plate is 2/100. When Jarek washes the dishes, this probability is 1/100.
We select a dinner at random.

a) **Draw** a tree diagram of the situation described. — 2 marks

b) A plate is broken during the washing of the dishes after the selected dinner. **Calculate** the probability that Kuba washed the dishes. — 3 marks

PART A

Page 4/4 | **Marks**

8) In a certain class, 60% of the students have a cat, 50% of the students have a dog. We also know that 30% of the students have both a dog and a cat. We select a student at random in this class and we consider the following two events:
Event A – the student has a dog,
Event B – the student has a cat.

a) **Determine** if the events A and B are independent. **Justify** the answer. — 2 marks

b) **Calculate** $P(A \cup B)$. — 3 marks

9) A player throws at a dartboard 4 times in a row. For each throw, the player hits the bull's eye in the center of the dartboard with a probability of 1/4. The random variable X indicates how often the player hits the bull's eye.

a) **Explain** why the random variable X follows a binomial distribution and **give** its parameters. — 2 marks

b) **Calculate** the probability that the player hits the bull's eye exactly three times. — 3 marks

10) The data presented in the table below describes the growth of a cactus. This type of plant can grow to be maximum 5 meters tall.

x = Year after planted	0	1	2	3	4	5	6
y = Height (m)	0	0.6	1.3	1.7	2.2	2.5	2.9

a) **Draw** a scatterplot for this data. **Use** an appropriate scale. — 2 marks

b) Knowing that the data describes the growth of a cactus that can maximum become 5 meters high. **Discuss** what kind of regression model would describe the data best. **Justify**. — 3 marks

END OF THE EXAMINATION