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| **MATHEMATICS 3 PERIODS****PART A** |

**DATE:** January, Monday the 29th, 2024

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| **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:**

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| **EXAM PAPER** | **YES ⊠ NO** [ ]  |
| **ANSWER BOOKLET** | **YES** [ ]  **NO ⊠** |
| **FORMULA BOOKLET** | **YES ⊠ NO** [ ]  |
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**NUMBER OF PAGES OF THE EXAM PAPER: 6**

*REMINDER: NO ANSWERS TO BE WRITTEN ON THE EXAM PAPER*

**NAME OF TEACHERS:** S. ANGELOZI, Y. BARSAMIAN, K. HANSEN, A. HARSÁNYI, M. PÉREZ PÉREZ, C. PETRUZ, O. PICAUD, J. SZUTY, L. WURZER.

**NAME OF PUPIL:** …………………………………

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| PART A |
|  | Page 1/4 | Marks |
| 1) | The diagram below shows the graph of a function and that of its derivative function . |  |
|  |  |  |
|  | a) **Find** the value of and . | 2 marks |
|  | b) **Determine** an equation of the tangent to the graph of at the point where . | 3 marks |
|  |  |  |
| 2) | The diagram shows the graph of the derivative of a function . |  |
|  |  |  |
|  | a) **Give** the intervals on which the function is increasing. | 2 marks |
|  | b) **Determine** whether the function has a local maximum. **Justify** your answer. | 3 marks |

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| PART A |
|  | Page 2/4 | Marks |
| 3) | Consider the function defined by .Consider also the function defined by , where , , and are four real numbers. |  |
|  | a) **Find** the values of the three parameters , , and such that . | 3 marks |
|  | b) **Find** the value of the parameter such that . | 2 marks |
|  |  |  |
| 4) | Here is the curve of the function defined by: |  |
|  |  |  |
|  | a) **Find** an approximation of the area under the curve from to by using left sided rectangles of width 1. | 3 marks |
|  | b) Based on the graph, **discuss** if this approximation is an over-estimation of , or an under-estimation. **Justify** your answer. | 2 marks |

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| PART A |
|  | Page 3/4 | Marks |
| 5) | The graph below shows a periodic function , defined by:(where , , and are four real numbers). |  |
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|  | Based on the information in the graph,• **determine** the amplitude, the period and the vertical shift of , then **give** the values of , and .• **find** and . | 5 marks |
|  |  |  |
| 6) | Let us consider the function defined by:We recall that the function defined by is a primitive of . |  |
|  | **Calculate** the area under the curve of from to . | 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 |

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| 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 – the student has a dog,Event – the student has a cat. |  |
|  | a) **Determine** if the events and are independent. **Justify** the answer. | 2 marks |
|  | b) **Calculate** . | 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 indicates how often the player hits the bull's eye. |  |
|  | a) **Explain** why the random variable 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.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  = Year after planted | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|  = 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**