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| **MATHEMATICS 3 PERIODS**  **PART B** |

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

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| **TIME ALLOWED FOR THE EXAM:**  2 hours (120 minutes)  **AUTHORISED MATERIAL:**  ● Examination with technological tool: Approved calculator  ● 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: 8**

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

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**NAME OF PUPIL:** …………………………………

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| PART B | | | | |
| QUESTION B1 | | | Page 1/3 | Marks |
| *In this question, parts 1, 2 and 3 are independent.* | | | |  |
| **Part 1.**  Sports watches are wristwatches that can be used during sporting activities. A lot of people use those watches.  The so-called *Sporty* sports watch is particularly popular. The probability that a random person with a sports watch has the watch *Sporty* is 60 %.  We are looking at a sample of 500 people with sports watches. The random variable gives the number of people in this sample that have the sports watch *Sporty*. | | Ein Bild, das Text, Uhr, Schrift, Zahl enthält.  Automatisch generierte Beschreibung | |  |
|  | | | |  |
| a) | **Explain** why can be modelled by a binomial law and **give** its parameters. | | | 2 marks |
|  |  | | |  |
| b) | **Calculate** the probability that at least 300 people in this sample have the sports watch *Sporty*. **Round** to 2 decimal places. | | | 2 marks |
|  |  | | |  |
| c) | **Determine** the expected number of people in this sample with the sports watch *Sporty*. | | | 2 marks |
|  |  | | |  |
| d) | **Calculate** the standard deviation of . **Round** to 3 decimal places. **Interpret** it in the given context. | | | 2 marks |

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| PART B | | | |
| QUESTION B1 | | Page 2/3 | Marks |
| **Part 2.**  The sports watch *Sporty* can give the effort during a run very accurately if the person gives his or her weight.  A woman with a weight of 60 kg is running uphill for 30 minutes. Therefore, her effort level is not steady. Her running power can be modelled by the following function:  , with  where is in minutes and in kJ/min (kilojoules per minute). | | |  |
|  | | |  |
| e) | **Calculate** at which power the woman is running when she starts running, and 15 minutes after she started. | | 3 marks |
|  |  | |  |
| f) | **Draw** the graph of the function in the given definition set. | | 3 marks |
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| g) | **Determine** at what time the woman’s running power is 106 kJ/min. | | 3 marks |

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| PART B | | | |
| QUESTION B1 | | Page 3/3 | Marks |
| **Part 3.**  A lot of people are using the internet to buy their sports watch *Sporty*, and ask for a delivery at a shop called “RunAway”.  We know that 80% of the time the *Sporty* arrives on time (in a few days), 15% of the time it arrives late (it takes some weeks to arrive) and the rest of the times it doesn’t arrive at all.  We also know that when the *Sporty* arrives on time, the probability that people like the shop “RunAway” is 0.9; when it arrives late, the probability that people like it is 0.3; and if it doesn’t arrive at all the probability that people like the shop is 0.1.  We randomly select a user who ordered a *Sporty* watch online and asked for delivery in this shop. | | |  |
|  |  | |  |
| h) | **Sketch** a tree diagram of the situation above. | | 3 marks |
|  |  | |  |
| i) | **Compute** the probability that this user likes the shop “RunAway”. | | 2 marks |
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| j) | If we know that this person liked the shop, **give** the probability that the *Sporty* that was ordered arrived on time. | | 3 marks |

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| PART B | | |
| QUESTION B2 | Page 1/3 | Marks |
| *In this question, parts 1 and 2 are independent.*  **Part 1.**  A musician plays a guitar and wishes to model its shape. The main wood box can be modeled by the following equation:  The following picture shows the curve of (in red, plain line), together with the symmetric of this curve, with respect to the -axis (in blue, dashed line). In this equation, is in decimetres, and is also in decimetres. The surface between those two curves forms the wood box of this guitar. | |  |
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| As can be seen on the graph, the function is in fact defined from to a value , which is the other solution of the equation . | |  |

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| PART B | | | |
| QUESTION B2 | | Page 2/3 | Marks |
| a) | **Determine** the value of , **rounding** to 3 decimal places. **Give** the length of the wood box, in centimetres. | | 2 marks |
|  |  | |  |
| b) | **Determine** the maximum value of , **rounding** to 3 decimal places. **Give** the width of the wood box, in centimetres. | | 2 marks |
|  |  | |  |
| c) | The function has three stationary points. In question b) we have found one of them. **Give** the coordinates of the two other stationary points, **rounded** to two decimal places. | | 4 marks |
|  |  | |  |
| Before a big concert, our musician wants to paint the back of the wood box in black. We hence want to know what is the area of this surface. | | |  |
| d) | **Determine** an approximate value of the following integral, **rounded** to 3 decimal places:  **Give** the area that has to be painted, in square decimetres. | | 3 marks |

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| PART B | | | |
| QUESTION B2 | | Page 3/3 | Marks |
| **Part 2.**  Our musician opens a webpage for his band, and is interested in the number of followers across time ( when the webpage is created). The table below shows the number of followers for the first 20 weeks:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | = Time (weeks) | 2 | 4 | 5 | 8 | 10 | 11 | 12 | 13 | 16 | 18 | | = Number of followers | 275 | 240 | 180 | 300 | 380 | 350 | 250 | 350 | 440 | 400 | | | |  |
|  |  | |  |
| e) | **Draw** a scatter diagram to represent the data from the table. | | 3 marks |
|  |  | |  |
| f) | **Compute** the linear correlation coefficient. **Determine** if a linear model would be appropriate for his data. **Discuss** how we could improve the linear model by combining it with another one. | | 3 marks |
|  |  | |  |
| g) | **Determine** an equation in the form of the linear regression of on using this data. Round and to one decimal place.  **Draw** the regression line on the same diagram as e). | | 3 marks |
|  |  | |  |
| In h) and i), use the linear model . | | |  |
| h) | **Compute** when the number of followers would be over 800. | | 3 marks |
|  |  | |  |
| i) | **Explain** why the model is not appropriate over many weeks. | | 2 marks |

**END OF THE EXAMINATION**