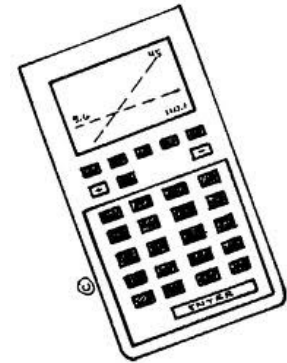


**MATHEMATICS 3 PERIODS  
PART B**

**DATE:** January, Monday the 29<sup>th</sup>, 2024

**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:**


EXAM PAPER	YES <input checked="" type="checkbox"/>	NO <input type="checkbox"/>
ANSWER BOOKLET	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
FORMULA BOOKLET	YES <input checked="" type="checkbox"/>	NO <input type="checkbox"/>

**NUMBER OF PAGES OF THE EXAM PAPER: 8**

*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:** .....

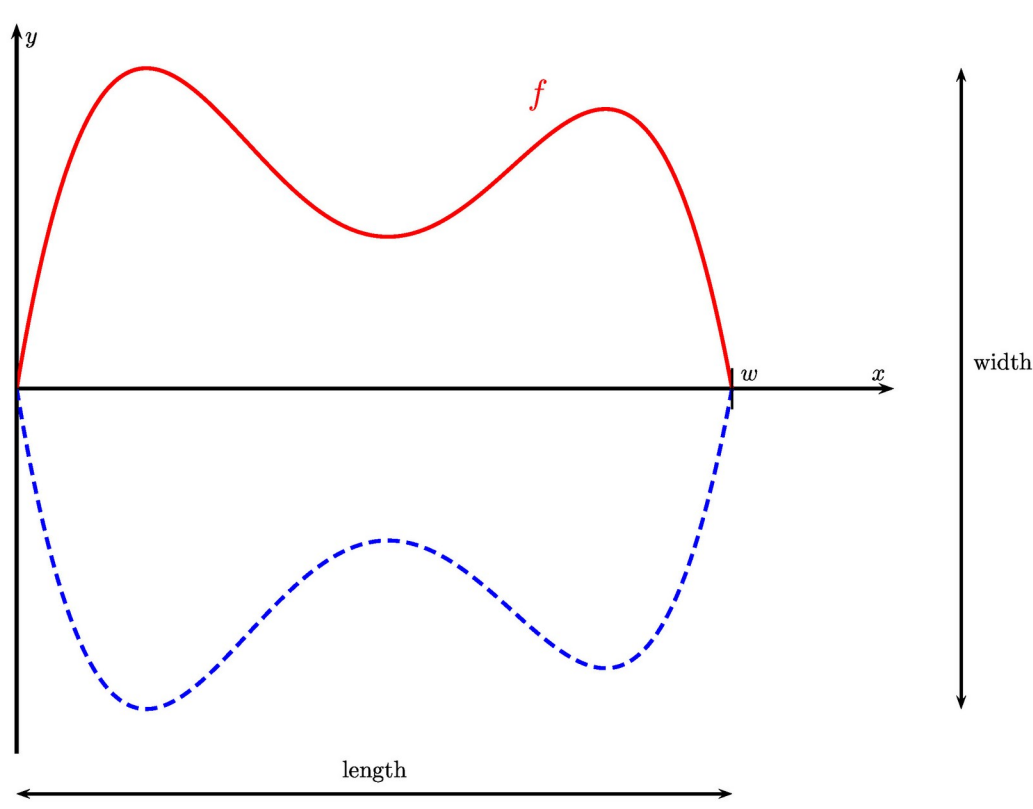
PART B		
QUESTION B1	Page 1/3	Marks
<p><i>In this question, parts 1, 2 and 3 are independent.</i></p> <p><b>Part 1.</b></p> <p>Sports watches are wristwatches that can be used during sporting activities. A lot of people use those watches.</p> <p>The so-called <i>Sporty</i> sports watch is particularly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

**PRE-BACCALAUREATE 2024: MATHEMATICS 3 PERIODS**

<b>PART B</b>		
<b>QUESTION B1</b>	<b>Page 2/3</b>	<b>Marks</b>
<p><b>Part 2.</b></p> <p>The sports watch <i>Sporty</i> can give the effort during a run very accurately if the person gives his or her weight.</p> <p>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:</p> $P(t) = -0.05t^2 + 3t + 66, \quad \text{with } 0 \leq t \leq 30$ <p>where <math>t</math> is in minutes and <math>P(t)</math> in kJ/min (kilojoules per minute).</p>		
e) <b>Calculate</b> at which power the woman is running when she starts running, and 15 minutes after she started.		3 marks
f) <b>Draw</b> the graph of the function $P$ in the given definition set.		3 marks
g) <b>Determine</b> at what time the woman's running power is 106 kJ/min.		3 marks

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<b>PART B</b>		
<b>QUESTION B1</b>	<b>Page 3/3</b>	<b>Marks</b>
<p><b>Part 3.</b></p> <p>A lot of people are using the internet to buy their sports watch <i>Sporty</i>, and ask for a delivery at a shop called “RunAway”.</p> <p>We know that 80% of the time the <i>Sporty</i> 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.</p> <p>We also know that when the <i>Sporty</i> 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.</p> <p>We randomly select a user who ordered a <i>Sporty</i> watch online and asked for delivery in this shop.</p>		
h)	<b>Sketch</b> a tree diagram of the situation above.	3 marks
i)	<b>Compute</b> the probability that this user likes the shop “RunAway”.	2 marks
j)	If we know that this person liked the shop, <b>give</b> the probability that the <i>Sporty</i> that was ordered arrived on time.	3 marks

PART B		
QUESTION B2	Page 1/3	Marks
<p><i>In this question, parts 1 and 2 are independent.</i></p> <p><b>Part 1.</b></p> <p>A musician plays a guitar and wishes to model its shape. The main wood box can be modeled by the following equation:</p> $f(x) = -0.13x^4 + 1.4x^3 - 4.9x^2 + 6x$ <p>The following picture shows the curve of <math>f</math> (in red, plain line), together with the symmetric of this curve, with respect to the <math>x</math>-axis (in blue, dashed line). In this equation, <math>x</math> is in decimetres, and <math>f(x)</math> is also in decimetres. The surface between those two curves forms the wood box of this guitar.</p>  <p>As can be seen on the graph, the function <math>f</math> is in fact defined from 0 to a value <math>w</math>, which is the other solution of the equation <math>f(x) = 0</math>.</p>		

**PRE-BACCALAUREATE 2024: MATHEMATICS 3 PERIODS**

<b>PART B</b>		
<b>QUESTION B2</b>	<b>Page 2/3</b>	<b>Marks</b>
<p>a) <b>Determine</b> the value of <math>w</math>, <b>rounding</b> to 3 decimal places. <b>Give</b> the length of the wood box, in centimetres.</p>		2 marks
<p>b) <b>Determine</b> the maximum value of <math>f</math>, <b>rounding</b> to 3 decimal places. <b>Give</b> the width of the wood box, in centimetres.</p>		2 marks
<p>c) The function <math>f</math> has three stationary points. In question b) we have found one of them. <b>Give</b> the coordinates of the two other stationary points, <b>rounded</b> to two decimal places.</p>		4 marks
<p>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.</p>		
<p>d) <b>Determine</b> an approximate value of the following integral, <b>rounded</b> to 3 decimal places:</p> $\int_0^{5.3} f(x) dx$ <p><b>Give</b> the area that has to be painted, in square decimetres.</p>		3 marks

PART B																																
QUESTION B2									Page 3/3	Marks																						
<p><b>Part 2.</b></p> <p>Our musician opens a webpage for his band, and is interested in the number of followers across time (<math>x = 0</math> when the webpage is created). The table below shows the number of followers for the first 20 weeks:</p> <table border="1"> <tr> <td><math>x =</math> Time (weeks)</td> <td>2</td> <td>4</td> <td>5</td> <td>8</td> <td>10</td> <td>11</td> <td>12</td> <td>13</td> <td>16</td> <td>18</td> </tr> <tr> <td><math>y =</math> Number of followers</td> <td>275</td> <td>240</td> <td>180</td> <td>300</td> <td>380</td> <td>350</td> <td>250</td> <td>350</td> <td>440</td> <td>400</td> </tr> </table>											$x =$ Time (weeks)	2	4	5	8	10	11	12	13	16	18	$y =$ Number of followers	275	240	180	300	380	350	250	350	440	400
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$y =$ Number of followers	275	240	180	300	380	350	250	350	440	400																						
e) <b>Draw</b> a scatter diagram to represent the data from the table.									3 marks																							
f) <b>Compute</b> the linear correlation coefficient. <b>Determine</b> if a linear model would be appropriate for his data. <b>Discuss</b> how we could improve the linear model by combining it with another one.									3 marks																							
g) <b>Determine</b> an equation in the form $y = a \cdot x + b$ of the linear regression of $y$ on $x$ using this data. Round $a$ and $b$ to one decimal place. <b>Draw</b> the regression line on the same diagram as e).									3 marks																							
In h) and i), use the linear model $f(x) = 20 \cdot x + 190$ .																																
h) <b>Compute</b> when the number of followers would be over 800.									3 marks																							
i) <b>Explain</b> why the model is not appropriate over many weeks.									2 marks																							

**PRE-BACCALAUREATE 2024: MATHEMATICS 3 PERIODS**

**END OF THE EXAMINATION**