BAC

SUBJECT	**MATHEMATICS 3p**

TEACHER	**Reynaud E.**

DATE	**30/1/2023**

DURATION (in hours + in minutes)	**2 hours (120 minutes)**

AUTHORISED MATERIAL

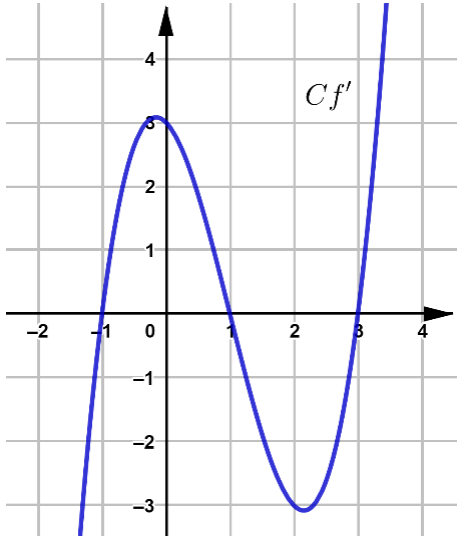**Formula booklet**

No calculator allowed

INSTRUCTIONS / SPECIAL REMARKS

Number all pages and the total number of pages submitted.
All answers must be supported by explanations.
If graphs are used to find a solution, they must be sketched as part of the answer.
Unless indicated otherwise, 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 obtained.

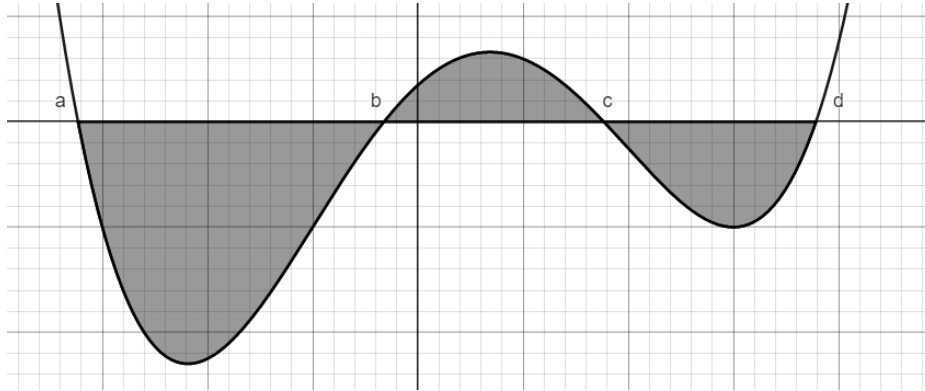|	PART A	
	Page 1/4	Marks
S1	The figure opposite shows the graph *Cf'* of the derivative $f'(x)$ of the function $f(x)$. Use this graph to **determine** the intervals over which the function $f(x)$ is decreasing.	5
S2	**Determine** the equation of the line tangent to the function $$f(x) = 3x^2 - 11x$$ at the point where the value of the instantaneous slope of the function is 1.	5
S3	A small bag of lollipops is left in a classroom. Half of the lollipops are green, the rest are red. 10 pupils enter the classroom, pick a lollipop from the bag at random, one after the other, and eat it. Is picking a green lollipop in this context a Bernouilli process? **Justify** your answer.	5
S4	European Union regulations prohibit airlines from refusing to transport people with reduced mobility solely because of their disability. In Luxembourg, it is estimated that around 1% of people with reduced mobility use airline travel. It is assumed that the population flying out of Luxembourg is large enough that the probability of selecting a person with reduced mobility is constant. On an airline flight from Luxembourg to London, only two out of 150 seats were reserved for persons with reduced mobility. **Justify** the airline's decision to limit the number of seats reserved for persons with reduced mobility to two.	5

The figure shows the graph *Cf'* with axis labels from −2 to 4 on the x-axis and −3 to 4 on the y-axis.

PART A		
	Page 2/4	Marks

S5	The value of a certain luxury wine is growing rapidly. The price for a single bottle can be modelled by the function: $$f(t) = 1400 \cdot e^{\ln(1.10) \cdot t}$$ where $f(t)$ is the price for a bottle in Euros and t is years after 2020. a) **Interpret** the two numbers 1400 and 1.10. b) **Calculate** the price of a bottle in 2021.	3 2
S6	Let f be the function defined by: $f(x) = \ln(x)$ a) **Give** the domain of f. b) **Give** the limit of f when x approaches $+\infty$. c) **Determine** any intervals over which f is increasing or decreasing. d) **Give** the inverse function of $f(x)$.	1 1 1.5 1.5
S7	Let $f(x) > g(x)$ be two positive functions, with respective primitives $F(x)$ and $G(x)$. It is further known, that <table><tr><td>x</td><td>1</td><td>4</td></tr><tr><td>$F(x)$</td><td>−3</td><td>8</td></tr><tr><td>$G(x)$</td><td>2</td><td>6</td></tr></table> **Determine** the area bounded by the graphs of $f(x)$ and $g(x)$ and the lines of equations $x = 1$ and $x = 4$.	5

PART A		
	Page 3/4	Marks

S8

The graph of the function $y = f(x)$ is presented here:

Given the following results:

$$\int_{b}^{c} f(x)dx = 2{,}3 \qquad \int_{a}^{c} f(x)dx = -1{,}1 \qquad \int_{b}^{d} f(x)dx = -0{,}4$$

…**calculate** the value of the shaded area.

5

S9

The table below gathers the values of two variables x and y:

x	0	2	4	6	8	10
y	6	7	10	14	15	20

a) **Draw** a scatter diagram using these values.

3.5

b) **Compute** and **add** the mean point to your graph.

1.5

PART A		
	Page 4/4	Marks

State if the following sentences are True (T) or False (F) and **justify** your statements:

S10

a) The point A (e;1) belongs to the function $y = \ln(x)$.

b) When a function is positive, its first derivative is necessarily increasing.

c) Let f be a function defined by $f(x) = e^x - 1$. Its first derivative is equal to zero for $x = 0$.

d) Let f be a function defined over $\mathbb{R}$ such that $\int_0^3 f(x) > 0$ and $\int_3^6 f(x) < 0$

We can thus write : $\int_0^6 f(x) = 0$

e) A set of bivariate data points $(x;y)$ has a linear correlation coefficient of -0.95. We can thus state that the correlation is weak.

Marks: 1, 1, 1, 1, 1

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