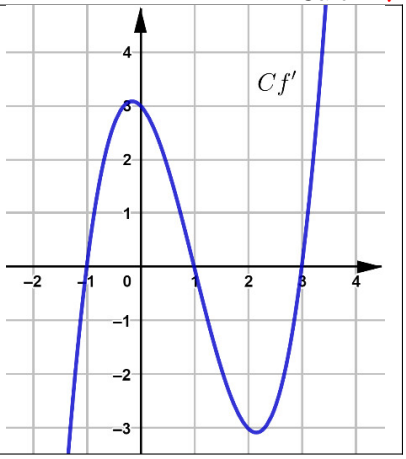
Exercise 1 Calc. : ✗

5 marks

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.



Exercise 2 Calc. : ✗

5 marks

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.

Exercise 3 Calc. : ✗

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.

5 marks Is picking a green lollipop in this context a Bernouilli process? **Justify** your answer.

Exercise 4 Calc. : ✗

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.

5 marks **Justify** the airline's decision to limit the number of seats reserved for persons with reduced mobility to two.

Exercise 5 Calc. : ✗

The value of a certain luxury wine is growing rapidly. The price for a single bottle can be modelled by the function:

$$f(t) = 1\,400 \cdot e^{\ln(1.10)\cdot t}$$

where $f(t)$ is the price for a bottle in Euros and t is years after 2020.

3 marks a) **Interpret** the two numbers 1 400 and 1.10.

2 marks b) **Calculate** the price of a bottle in 2021.

Exercise 6 Calc. : ✗

Let f be the function defined by: $f(x) = \ln(x)$.

1 mark a) **Give** the domain of f.

1 mark b) **Give** the limit of f when x approaches $+\infty$.

1.5 marks c) **Determine** any intervals over which f is increasing or decreasing.

1.5 marks d) **Give** the inverse function of $f(x)$.

Exercise 7 Calc. : ✗

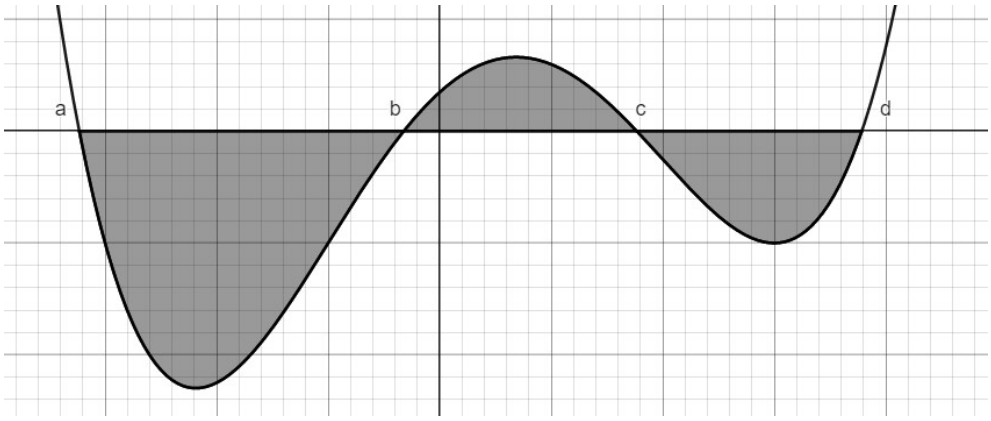
Let $f(x) > g(x)$ be two positive functions, with respective primitives $F(x)$ and $G(x)$. It is further known, that:

x	1	4
$F(x)$	-3	8
$G(x)$	2	6

5 marks **Determine** the area bounded by the graphs of $f(x)$ and $g(x)$ and the lines of equations $x = 1$ and $x = 4$.

Exercise 8 Calc. : ✗

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



Given the following results:

$$\int_b^c f(x)\,\mathrm{dx} = 2.3 \qquad \int_a^c f(x)\,\mathrm{dx} = -1.1 \qquad \int_b^d f(x)\,\mathrm{dx} = -0.4$$

5 marks ... **calculate** the value of the shaded area.

Exercise 9 Calc. : ✗

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

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

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

Exercise 10 Calc. : ✗

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

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

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

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

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

We can thus write : $\int_0^6 f(x)\,\mathrm{dx} = 0$

1 mark 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.