Exercise 1 Calc. : ✗

To sterilise a petri dish before conducting an experiment, it is placed in an oven and the temperature is increased to destroy the bacteria. The population of bacteria, N, as a function of time, t, in hours is given by the function: $$N(t) = 1\ 000 \cdot e^{\ln(0.5)\cdot t}.$$ a) This formula could be written in an alternative form. Choose the equivalent formula from the following propositions (no justification required).	5 marks

$N_1(t) = 1\ 000 \cdot \ln(0,5)^t$	$N_2(t) = 0,5 \cdot 1\ 000^t$
$N_3(t) = 1\ 000 \cdot (0,5)^t$	$N_4(t) = 0,5 \cdot \ln(1\ 000)^t$

b) What is the initial population of bacteria before starting the sterilisation?

c) What is the quantity of bacteria after 2 hours?

Exercise 2 Calc. : ✗

5 marks

A landlord puts up one of his properties for rent. He offers his future tenants two possibilities:
Choix A: An initial rent of 1 000 € with a fixed annual increase of 25 €.
Choix B : An initial rent of 1 000 € with an annual increase of 2%.

a) Calculate the monthly rate of rent to be payed in the second year and in the third year if model A is chosen.

b) Calculate the monthly rate of rent to be payed in the second year and in the third year if model B is chosen.

c) Write a function, $f(x)$, to model the rate at which model A increases over time, where x is the number of years after the signature of the contract.

d) Write a function, $g(x)$, to model the rate at which model B increases over time, where x is the number of years after the signature of the contract.

e) Discuss the most interesting offer over a long term, justifying your choice.

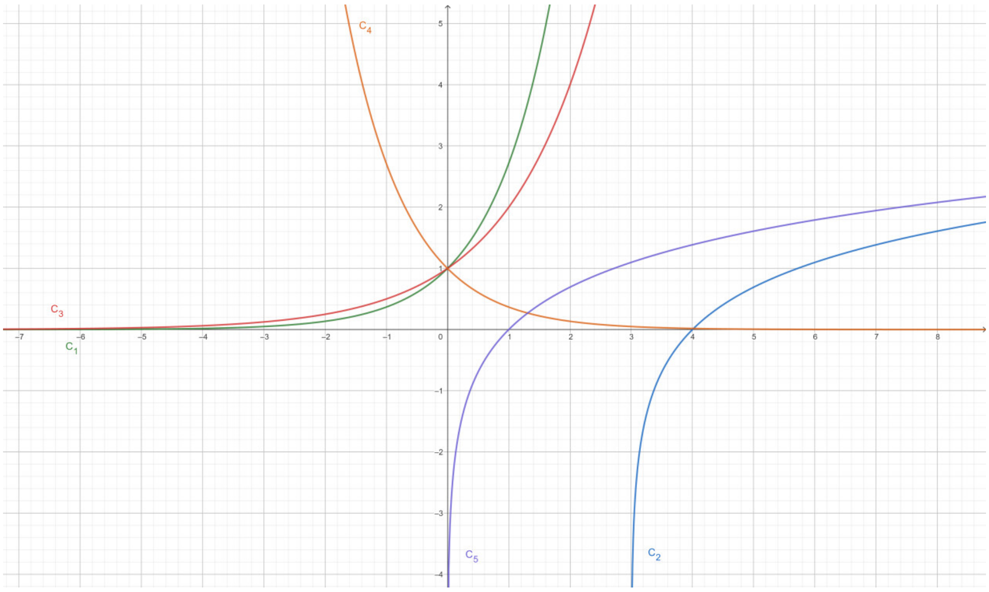
Exercise 3 Calc. : ✗

5 marks

Given the functions f, g, h, i and j defined by:

$$f(x) = 2^x \qquad g(x) = e^x \qquad h(x) = \ln(x) \qquad i(x) = \ln(x-3) \qquad j(x) = e^{-x}$$

And their graphic representations:

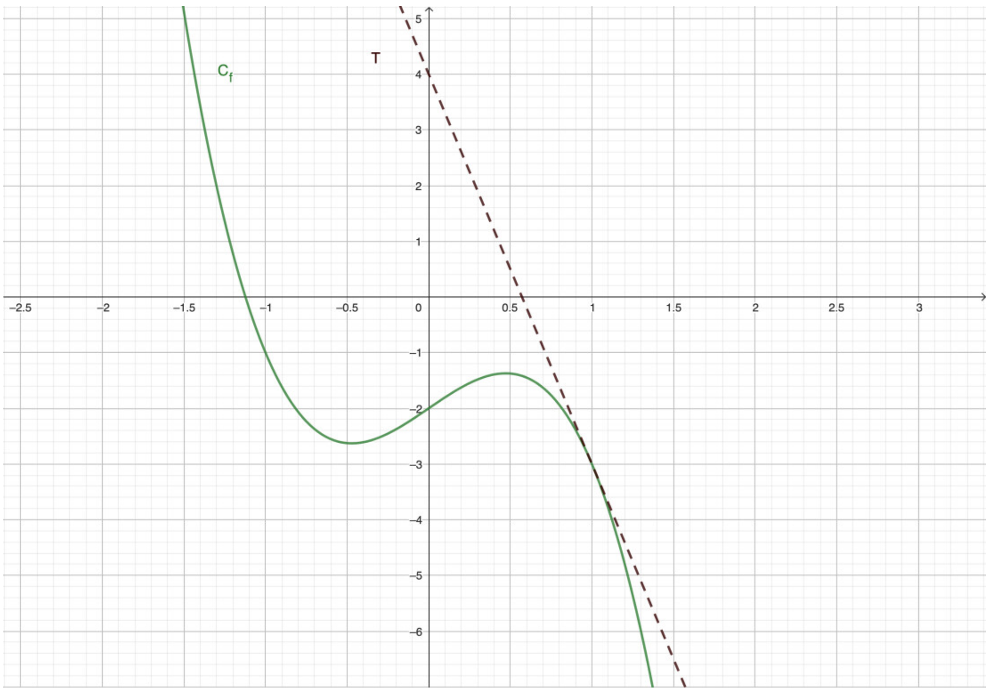


Match the function to its corresponding curve. No proof or justification required.

Exercise 4 Calc. : ✗

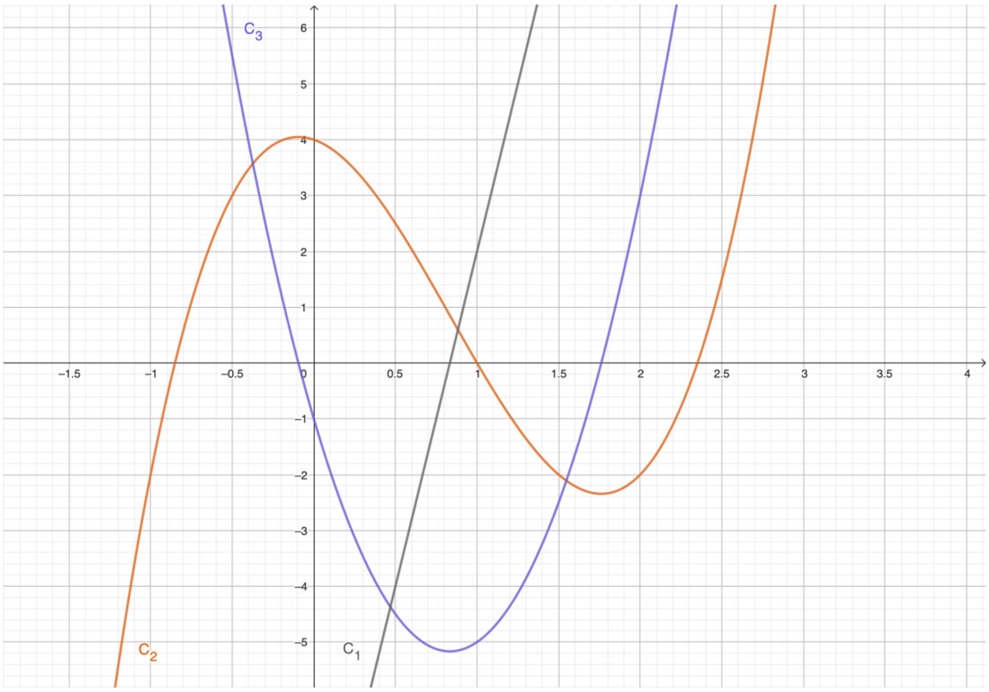
5 marks

Given below is the graph of a function f and the tangent to this function at the point $x = 1$. Determine the equation of the tangent, T.



Exercise 5 Calc. : ✗

On the graph below you are given the curves of a function f, the derivative of this function f', and one of its primitives F. — 5 marks



Identify which curve corresponds to which function and justify your response.

Exercise 6 Calc. : ✗

The velocity v in $\text{m} \cdot \text{s}^{-1}$ of an object after t seconds, between $t = 0$ and $t = 6$, is given by the function: $v(t) = 4t$ (en metres per second) — 5 marks

The acceleration of the object is given by the derivative of the velocity, $v'(t)$.
The displacement of the object is given by a primitive, $V(t)$, of the velocity.

a) What is the initial speed of the object? Which speed is the object travelling at after 3 seconds?

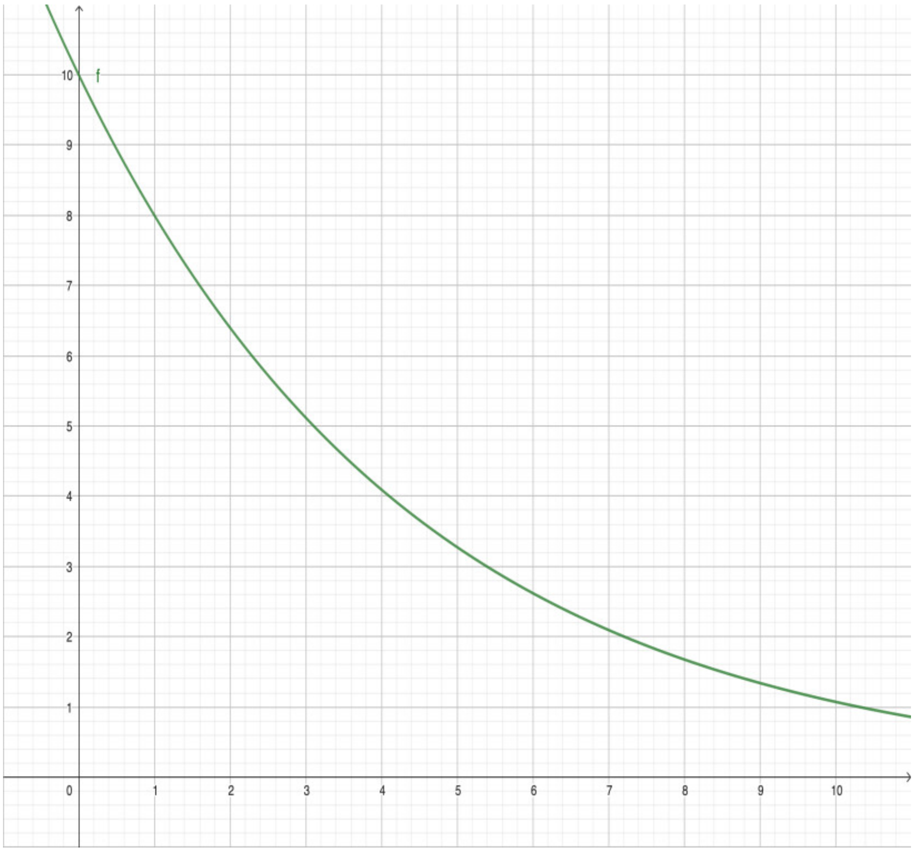
b) Give the expression of the acceleration as a function of time.

c) Knowing that the initial position of the object was 10 m ($V(0) = 10$), give the exact expression of the displacement as a function of time.

d) What distance has the object travelled after 6 seconds?

Exercise 7 Calc. : ✗

The above curve represents the flow rate, $f(t)$, in litres per minute for filling a container with a capacity of 25 L.	5 marks



a) Write in terms of $f(t)$ the integral you would use to get the area between the curve and the x-axis for $0 \leq t \leq 5$.

b) Using the rectangles method with a width of 1, give a left and a right hand estimate of the volume of water poured into the container in the first 5 minutes. Draw on the above diagram.

c) Interpret the meaning of finding the area between the graph and the horizontal axis on the interval $0 \leq t \leq 5$, in the given context.

d) Given that the capacity of the container is 25 L, will it be full after 5 minutes?

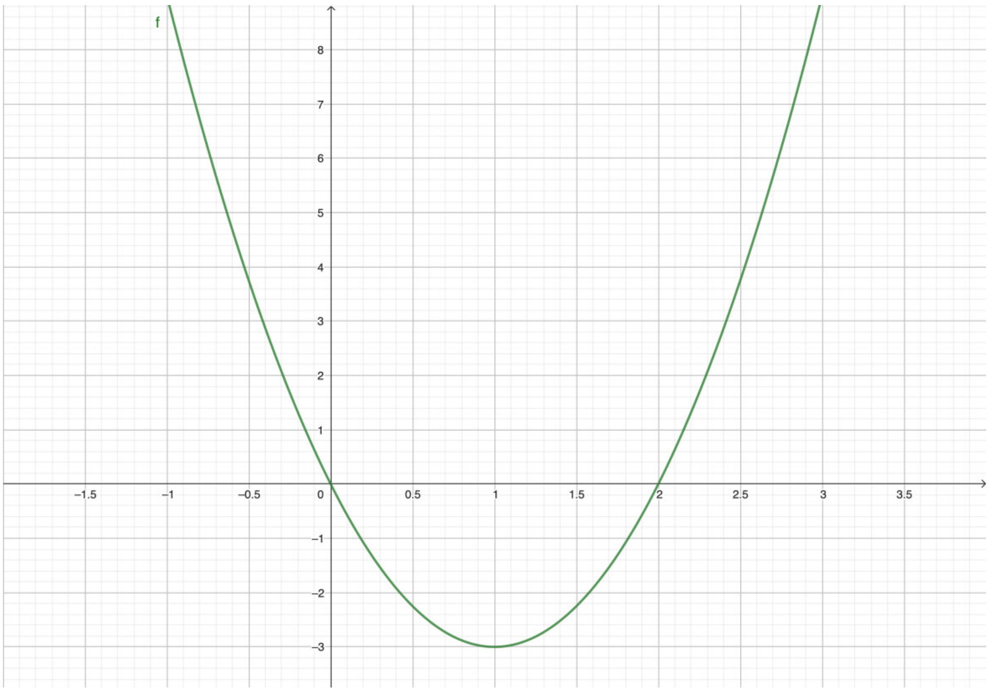
Exercise 8 Calc. : ✗

5 marks

Below is the graph of the function f defined by $f(x) = 3x^2 - 6x$.

a) Calculate an anti-derivative of f.

b) Calculate the area bounded by the function and the x-axis for $0 \leq x \leq 3$.



Exercise 9 Calc. : ✗

5 marks

a) Calculate the integral: $\displaystyle\int_0^1 4e^{5x}\, dx$.

b) Calculate the anti-derivative $F(x)$ of $f(x) = -3x^2 + x + 7$ for which $F(0) = 5$.

Exercise 10 Calc. : ✗

5 marks

Given the following integrals:

$$I = \int_{-2}^{2} f(x)\,\mathrm{d}x = 12 \qquad J = \int_{2}^{5} f(x)\,\mathrm{d}x = 3 \qquad K = \int_{5}^{-2} g(x)\,\mathrm{d}x = 14$$

a) Draw a sketch of the possible graphs of f and g showing the areas represented by the integrals.

b) Calculate the following integrals using the information from integrals I, J and K.

$$A = \int_{-2}^{5} f(x)\,\mathrm{d}x \qquad B = \int_{-2}^{5} (f(x) - g(x))\,\mathrm{d}x \qquad C = \int_{-2}^{5} 5f(x)\,\mathrm{d}x$$