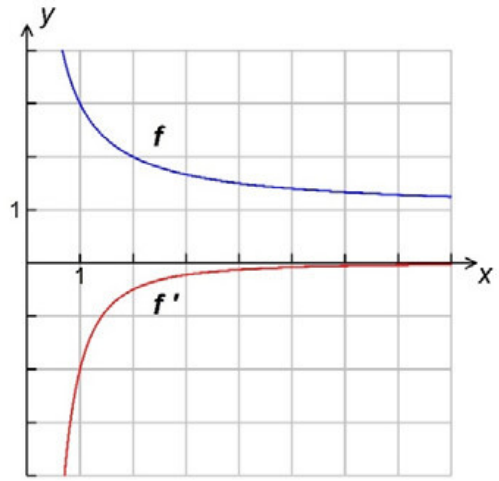
Exercise 1 Calc. : ✗

The diagram below shows the graph of a function f and its derivative f'.



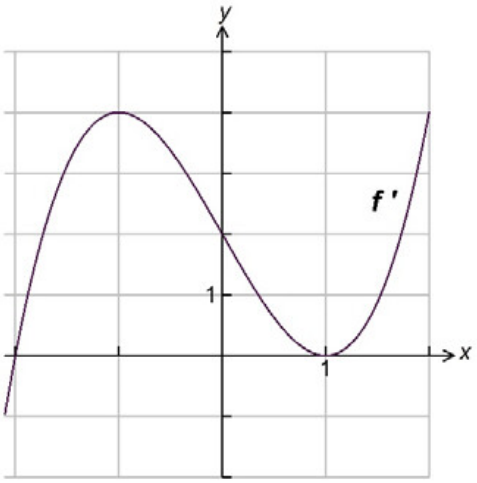
Determine and **interpret** graphically:

a) the average rate of change of the function f from $x_1 = 1$ to $x_2 = 2$. — 2 marks

b) the rate of change of the function f at $x_1 = 1$. — 3 marks

Exercise 2 Calc. : ✗

Consider a differentiable function f. The figure below shows the graph of its derivative f' for $-2.1 \leq x \leq 2$.



For each of the following statements **justify** whether it is true or false. — 5 marks

a) The function f is decreasing for $-1 \leq x \leq 1$.

b) The function f has a minimum at $x = -2$.

c) There is a horizontal tangent to the graph of f at the point where $x = 1$.

d) The slope of the tangent to the graph of f at the point where it intersects the y-axis is equal to 2.

e) The graph of f has three horizontal tangents for $-2.1 \leq x \leq 2$.

Exercise 3 Calc. : ✗

Consider the functions f and F defined by

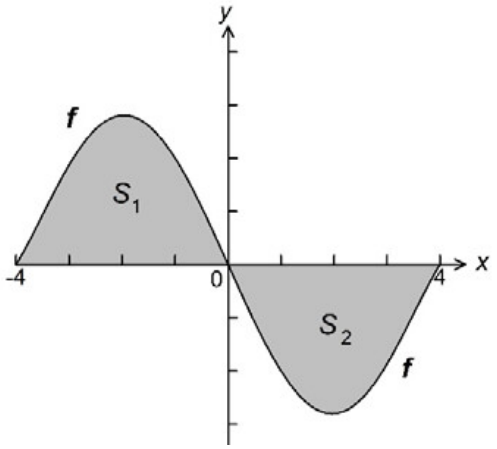
$$f(x) = 4x^3 + 3x^2 \qquad \text{and} \qquad F(x) = x^4 + x^3 + 5.$$

a) **Show** that F is a primitive function of f. — 2 marks

b) **Calculate** $\int_1^2 f(x)\,\mathrm{d}x$. — 3 marks

Exercise 4 Calc. : ✗

The figure below shows the graph of a function f and two regions S_1 et S_2 bounded by the graph of f and the x-axis.
The graph is symmetric with respect to the origin of the coordinate system.



You are given that $\int_{-4}^{0} f(x)\,\mathrm{d}x = 7$.

a) **Interpret** the integral $\int_{-4}^{0} f(x)\,\mathrm{d}x$ graphically. — 2 marks

b) **Determine** — 3 marks

1. $\int_0^4 f(x)\,\mathrm{d}x$.
2. $\int_{-4}^{4} f(x)\,\mathrm{d}x$.
3. the area of the region S_2.

Exercise 5 Calc. : ✗

A swimming pool is being emptied and the volume of water that remains can be modelled by the function V given by

$$V(t) = 5\,000 \cdot 0.60^t, \qquad t \geq 0,$$

where time t is measured in hours and $V(t)$, measured in litres, is the volume of water, remaining at a time t.
Emptying the pool starts at the time $t = 0$.

a) **Determine** the volume of water in the pool at the start and after 1 hour. — 2 marks

b) **Calculate** the percentage rate at which the volume of water decreases per hour. — 2 marks

c) **Explain** what the model tells us about the volume of water remaining after a very long time. — 1 mark

Exercise 6 Calc. : ✗

a) **Calculate** in how many ways the letters of the word PARIS can be ordered.	2 marks
b) **Calculate** how many "words" (not necessarily having a meaning) of 3 different letters you can write using letters of the word PARIS.	3 marks

Exercise 7 Calc. : ✗

A survey of 100 students enrolling at a university, shows that

- 45 speak English
- 40 speak French
- 35 speak German
- 20 speak both English and French
- 23 speak both English and German
- 19 speak both French and German
- 12 speak all three languages.

Using a Venn diagram or otherwise, **determine** the probability that a randomly selected student from these 100 students speaks only one of these three languages. — 5 marks

Exercise 8 Calc. : ✗

Applicants for jobs in a large company must sit an aptitude test. They are either

- accepted with a probability of $\frac{1}{5}$ or
- rejected with a probability of $\frac{1}{2}$ or
- retested with a probability of $\frac{3}{10}$.

When they are retested, there are just two outcomes, accepted with a probability of $\frac{2}{5}$ or rejected with a probability of $\frac{3}{5}$.

a) **Draw** a tree diagram to illustrate the outcomes.	2 marks
b) **Determine** the probability that a randomly selected applicant is accepted.	3 marks

Exercise 9 Calc. : ✗

A biased coin is thrown several times.
At each throw, the probability of getting a head is $\frac{1}{3}$.

a) Is this a Bernoulli process? **Justify** your answer.	2 marks
b) The coin is thrown 3 times. **Calculate** the probability of getting exactly 2 heads.	2 marks
c) The coin is thrown 60 times. **Calculate** the expected value for the number of heads.	1 mark

Exercise 10 Calc. : ✗

A machine produces steel balls. The diameter of the balls is normally distributed with mean $\mu = 18.0$ mm and standard deviation $\sigma = 0.5$ mm. A ball is selected at random.	
a) **Determine** the probability that its diameter is between 17.0 mm and 19.0 mm.	1 mark
b) **Determine** he probability that its diameter is between 17.0 mm and 18.5 mm.	2 marks
c) A batch of 400 steel balls is selected at random from this production and the diameter of each ball is measured. If the diameter of a ball is less than 17.0 mm, t will be rejected. **Estimate** how many balls will be rejected.	2 marks