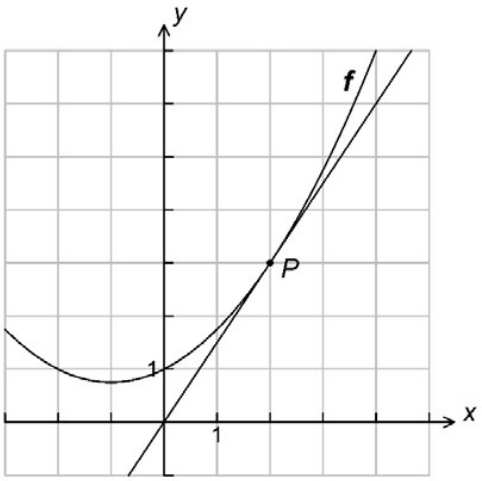
Exercise 1 Calc. : ✗

The diagram below shows the graph of a function f and the tangent at the point P where $x = 2$.



a) **Determine** $f(2)$ and $f'(2)$ graphically. — 2 marks

b) **Determine** an equation of the tangent to the graph of f at the point P. — 2 marks

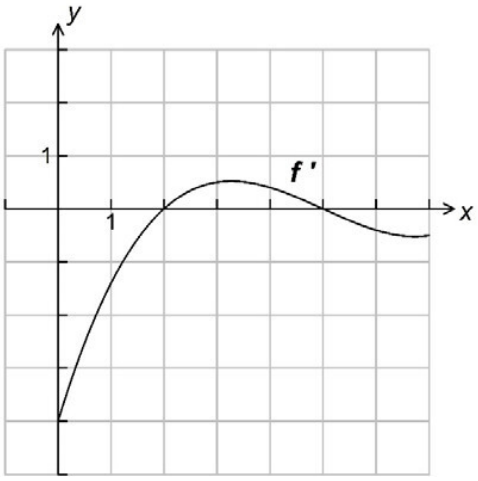
c) **Solve** the equation $f'(x) = 0$ graphically. — 1 mark

Exercise 2 Calc. : ✗

Consider the function f where $f(x) = \frac{1}{2}x^2 + 1$.
In a coordinate system **sketch** the graph of f, and **draw** 4 rectangles to approximate the region bounded by the graph of f and the x-axis for $0 \leq x \leq 4$.
Use these rectangles to **determine** an approximate value of the area of this region. — 5 marks

Exercise 3 Calc. : ✗

Consider a differentiable function f. The figure below shows the graph of its derivative f' for $0 \leq x \leq 7$.



Which one of the tables below describes the variation of the function f for $0 \leq x \leq 7$? **Explain** your answer. — 5 marks

A.

x	0		3.5		7
$f(x)$		↗		↘	

B.

x	0		2		5		7
$f(x)$		↘		↗		↘	

C.

x	0		2		5		7
$f(x)$		↗		↘		↗	

D.

x	0		2		7
$f(x)$		↗		↘	

Exercise 4 Calc. : ✗

On a farm the wheat production P in kg per hectare can be modelled by

$$P(t) = 6\,000 \cdot e^{-\ln(2) \cdot t},$$

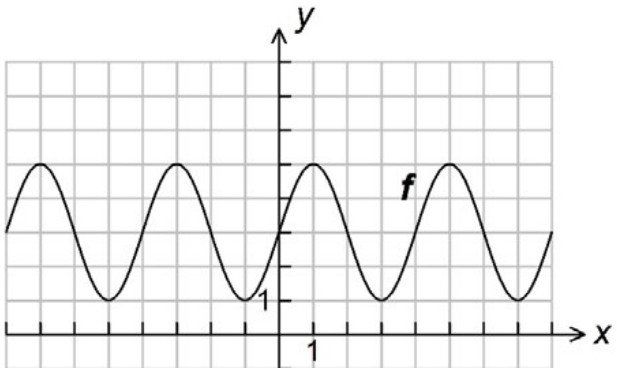
where t is the number of years after 2022.

a) **Calculate** the wheat production in 2023 according to this model. — 2 marks

b) **Determine** in what year the wheat production will be 1 500 kg per hectare according to this model. — 3 marks

Exercise 5 Calc. : ✗

The figure below shows the graph of the function f defined by $f(x) = a \cdot \sin(b \cdot x) + d$, where the parameters a, b and d are integers.



a) **Determine** the values of a and d. — 2 marks

b) **Determine** the period p of f and **calculate** the value of b. — 3 marks

Exercise 6 Calc. : ✗

A study at a certain university found that

- 70% of the students own a computer
- 40% of the students owning a computer also own a car.
- 55% of the students do not own a car.

A student from this university is selected at random.
Consider the following two events:
Event O: "the student owns a computer"
Event A: "the student owns a car".
Are the events O and A independent? **Justify** the answer. — 5 marks

Exercise 7 Calc. : ✗

800 cats were tested with a new test for a feline virus. The cats were also tested with an older version of the test, which is slower and more expensive, but totally accurate. The following results were obtained:

	Having the virus	Not having the virus	Total
New test positive	63		
New test negative		717	
Total			800

Complete the table and **copy** it to your answer sheet. — 5 marks
Using the table, **calculate** the following probabilities:

- The probability of getting a negative result with the old test and a positive result with the new test.
- The probability that the new test gives a correct result.
- The probability that a cat is tested negative with the new test, given that it has the virus.

Exercise 8 Calc. : ✗

Leila goes out into her family's garden to pick a few apples. Only one out of three apples is ok to eat. The rest of the apples are worm eaten.
Leila randomly picks 4 apples.

a) This may be seen as a Bernoulli process. **Explain** why. 1 mark

b) **Calculate** the probability that Leila picks exactly 2 apples that are ok to eat. 2 marks

c) **Calculate** the probability that at least 1 of the 4 apples is ok to eat. 2 marks

Exercise 9 Calc. : ✗

The 1984 California Avocado Society study of more than two hundred twenty-five million avocados determined that the weight of avocados is normally distributed with a mean of 215 grams and a standard deviation of 5 grams.
Only avocados weighing between 210 grams and 225 grams are considered fit for sale.

a) **Show** that 81.5% of avocados are fit for sale. 3 marks

b) **Determine** the probability that an avocado weighs more than 215 grams, given that it is fit for sale. 2 marks

Give the answer as a fraction of integers.

Exercise 10 Calc. : ✗

A manufacturer produces titanium bicycle frames. The bicycle frames are tested before use and on average 7% of them are found to be faulty.
A cheaper manufacturing process is introduced, and the manufacturer wishes to check whether the proportion of faulty frames has increased.
A random sample of 18 bicycle frames is selected and it is found that 4 of them are faulty.
The manufacturer will carry out a hypothesis test at a 5% significance level to see if the proportion of faulty bicycle frames has increased.

a) **State** a suitable null hypothesis H_0 and an alternative hypothesis H_a for the test. 2 marks

The random variable X describes the number of faulty bicycle frames in a sample of 18 bicycles.
The table below shows the value of $P(X \geq k)$ for $k = 1, 2, 3, 4, 5$ and 6 for a probability of 0.07 of having a faulty frame.

k	1	2	3	4	5	6
$P(X \geq k)$	0.729	0.362	0.127	0.0333	0.00665	0.00105

b) Will the null hypothesis be rejected? Can we assume that the percentage of faulty bicycle frames has increased? **Explain** your answer. 3 marks