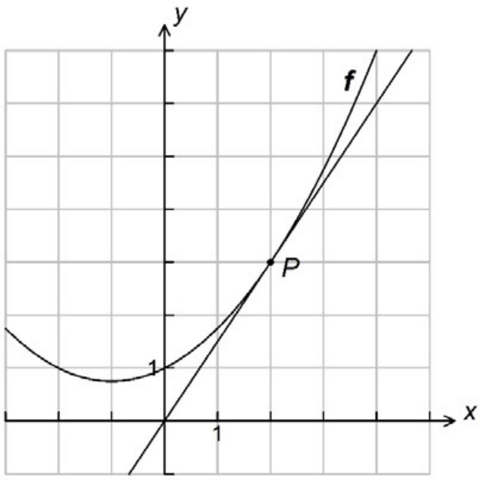
**Exercise 1** Calc. : ✗

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



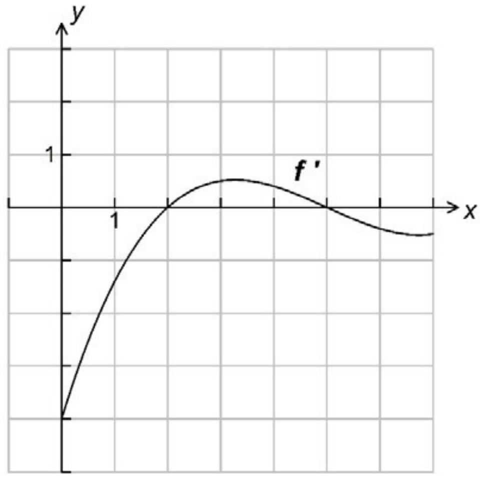

| | |
|---|---|
| a) **Determine** $f(2)$ and $f'(2)$ graphically. | 2 marks |
| b) **Determine** an equation of the tangent to the graph of $f$ at the point $P$. | 2 marks |
| c) **Solve** the equation $f'(x) = 0$ graphically. | 1 mark |

**Exercise 2** Calc. : ✗

| | |
|---|---|
| Consider the function $f$ where $f(x) = \frac{1}{2}x^2 + 1$.<br>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 $0 \le x \le 4$.<br>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 $0 \le x \le 7$.




Which one of the tables below describes the variation of the function $f$ for $0 \le x \le 7$? **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

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

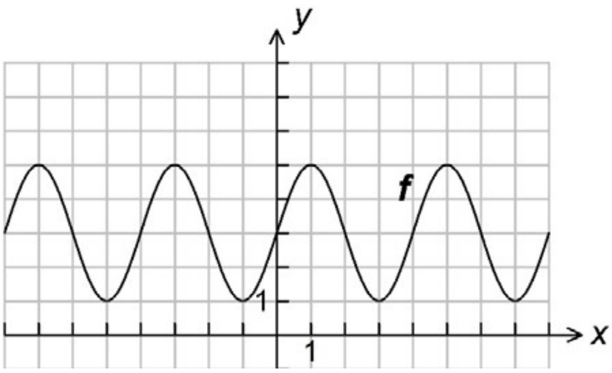
where $t$ is the number of years after 2022.

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