Exercise 1 Calc. : ✓

(Give your answers to this question accurate to 4 decimal places where appropriate)
Many squirrels live in the forest around the ESK in Waldstadt.
When a squirrel leaves the forest to go to the trees inside the school grounds, the probability of it being seen by a student is 1/3.
One morning, 10 squirrels decide to go to the trees inside the school grounds.
Let X represent the number of squirrels which are seen by a student.

1. **Calculate** the probability that exactly 7 squirrels will manage to get to the trees in the school grounds without being seen by a student. — 4 marks
2. **Calculate** the probability that less than two squirrels will be seen by a student. — 4 marks
3. **Calculate** $E(X)$. **Interpret** this result. — 4 marks
4. **Calculate** the standard deviation of X. — 3 marks

Exercise 2 Calc. : ✓

A fair coin is tossed three times in a row and the results obtained are noted.
For example, "Heads, Heads, Tails" is an outcome that may be noted HHT.

1. **Determine** the probability of getting Heads at least twice. — 3 marks

For each toss, 20 points are awarded for Heads and 10 points for Tails.
Let X represent the sum of the points obtained after the three tosses.

2. **Calculate** $P(X = 40)$. — 3 marks
3. **Copy** and **complete** the probability distribution table for X shown below. — 4 marks

x	30			60
$P(X = x)$	$\frac{1}{8}$			$\frac{1}{8}$

4. **Calculate** the expected value of X and **interpret** this result. — 4 marks

Exercise 3 Calc. : ✓

In a village with 700 inhabitants, 14 of them decide to start a rumour at the same time.
After 15 hours the rumour has been heard by all of the inhabitants.
A linear function is proposed to model this problem.

1. **Explain**, why the function — 5 marks

$$f(t) = 45,73 \cdot t + 14$$

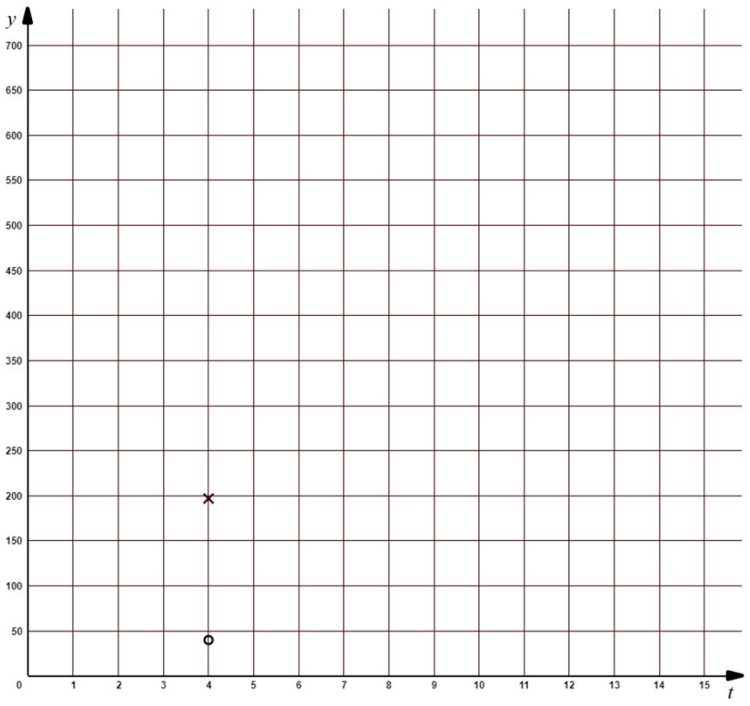
could be used to model this problem, what the variables f and t represent with units, and what the numbers represent.

2. **Determine** the domain of the function. — 2 marks

3. Use this function to **calculate** the time taken for half of the inhabitants to have heard the rumour. — 3 marks

4. **Copy** the graph below onto your 5 mm square answer paper using a scale of 1 cm for 1 unit on the horizontal axis and 1 cm for 50 units on the vertical axis. — 3 marks

Draw the line representing the function f on your copy of the graph. One of the points has already been marked for you with an X (the point marked O is used later in the question).



(This question continues on the next page)

Another function is now proposed to model this problem

$$g(t) = 14 \cdot 1,298^t.$$

5. **Givee** the name of the type of model represented by function g. — 1 mark

6. **Draw** the line representing the function g on the same graph as for f above. One of the points has already been marked for you with an O. — 3 marks

7. Using your graph or otherwise, **determine** also for this function the time taken for half of the inhabitants to have heard the rumour. — 3 marks

8. **Compare** the two functions f and g and **decide**, with a reason, which is the better model for this situation. — 4 marks

Exercise 4 Calc. : ✓

The depth of water at a landing jetty in a small harbour on the North Sea varies according to time due to the tide. There are two tides every day at this harbour.
The depth was measured at 3-hour intervals on 15th June and the following figures were recorded.

Time	00:00	03:00	06:00	09:00	12:00
Depth (m)	3.6	5.2	3.6	2.0	3.6

The depth of water can be modelled by a sine function.

1. **Show that** the function — 6 marks

$$h(t) = 1.6 \cdot \sin(0.5236 \cdot t) + 3.6$$

can be used to model the depth of water h (metres), at time t (hours), **explaining** how each of the three constants can be found from the data in the table.

A large ferry from a nearby island requires a minimum depth of 4 m to be able to dock at the jetty.

2. **Show that** the earliest time that the ferry can dock at the jetty on 15th June is 00:29 (rounded to the nearest minute). — 3 marks

3. **Find** the latest time before midday when the ferry can dock at the jetty. — 3 marks