

Exam on architect mathematics 7.6.2023

Instructions: Write your name and identity number clearly on the upper edge of each answer sheet. Start answering on the size sheet (folded A3) and if needed, continue on separate semi-sheets (A4). Mark it clearly if the answer continues to the next sheet. Justify your answers. Place the separate semi-sheets in between the size sheet when returning the exams answers. Tools: Writing instruments and a pocket calculator or a scientific calculator.

Question 1. The contract statistics a construction company reveals the following:

- 85 % of the contracts are finished by the deadline.
- 90 % of the contracts remain within the framework of the financing plan.
- 95 % of the contracts are accepted without additional requirements.

Based on this information, evaluate the following probabilities.

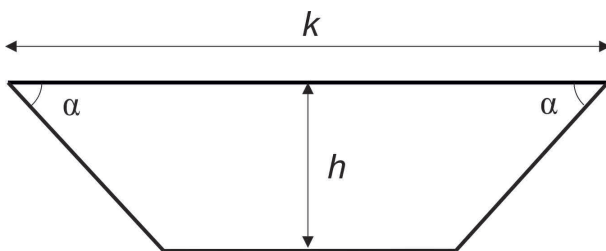
- a) What is the probability that none of the three conditions comes true? (2 p.)
- b) What is the probability that exactly two conditions come true? (4 p.)

Question 2. Matti has so far heated his house with fuel oil, which gives 10 kWh thermal energy per liter, of which 90 % results in heating the house and the rest goes out the chimney. The oil consumption is 3000 l per year and the oil price is 1.4 €/l.

Matti wants to get rid of fossil fuels and replaces the oil heating with an air-water heat pump, which costs 14 250 € to install.

Air-water heat pump consumes 1 kWh of electricity to produce 3 kWh of heat. The price of electricity is 15 c/kWh. How many years will it take for the installation costs of Matti's new heating system to be covered by lower energy bills? (6 p.)

Question 3. Researcher Hiedanniemi has a large water basin with a length of 100 meters. The cross section of the pool is as shown in the picture: the width is $k = 9$ meters and the angle between the water surface and the edge of the basin is $\alpha = 47$ degrees on the both sides. The height of the water level is $h = 2.5$ meters when the basin is full.



How much water does the basin contain when it is full? (6 p.)

Question 4. Determine the area of the region bounded by the line $y = x$ and the curve $y = x^2$. (6 p.)