LPR Cup

9.s01.e06

As for electricity, telephone and bath,
the restroom in 100 fathoms
V.B. Shklovsky

Shestyorochka 1.0[1]

Pavel sits in a concrete room of the dormitory №6. It's cold outside, so, to warm up, he decided to turn on his heater. After some time, the hostel was repaired and the walls of the building were changed from concrete to oak ones. Temperature inside increased on $\Delta T = 16\,^\circ C$ and became equal to $T = 20^\circ C$. Based on this data find:

1. An outside temperature T_1 *(2 points)*
2. A heater power N *(2 points)*

It's known that specific thermal conductivity for oak and concrete is $200\frac{\text{mW}}{\text{m}\cdot^\circ C}$ and $1000\frac{\text{mW}}{\text{m}\cdot^\circ C}$ accordingly. It's known, that a wall with an area of S, thickness d and temperature difference ΔT on the different sides of the wall, conducts power

$$P = \chi\frac{\Delta T\, S}{d}.$$

Shestyorochka 2.0

Pavel wants to optimize the temperature in the room. He has 5m^3 of concrete. The floor and the roof are insulated. It's known that near the west and north walls of his room an atomic reactor is located. Because of that, these two walls are warmer than the other ones. Cold walls have a temperature of T_1, the warm ones have a temperature of T_2.

1. What is a maximum inside temperature, and how to distribute all building material? *(3 points)*
2. Plot the dependency of maximum temperature on T_2 in a range from $-5\,^\circ C$ to $40\,^\circ C$. *(3 points)*

Consider a T_1 to be an outside temperature and N – a heater power from the 1st part of this problem.

Notification. It is understood that there are only those walls that will be created from the concrete. Old walls should not to be considered. By T_1 and T_2 we denote outdoor temperatures near the walls.

First hint — 01.06.2020 16:00 (Moscow time)
Second hint — 03.06.2020 16:00 (Moscow time)

Final of the sixth round — 05.06.2020 23:59 (Moscow time)

[1] name of the student dormitory №6