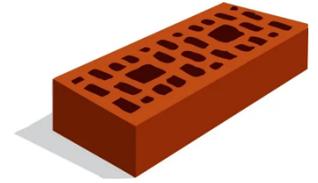# Math and Physics contest "Phystech School 2023"

Problem Set #1

recommended for grades 5 and 6

1. (1 point) A third of a brick weighs 2 kg. What is the weight of the whole brick?

2. (2 points) Sasha and Victor are equally tall. Victor's height constitutes 1/5 of a meter and 7/8 of Sasha's height. What is Sasha's height?

3. (3 points) The train traveled along the platform at a speed of 10 m/s. The length of the train is 3 times the length of the platform. The time between the moment the head of the train entered the platform and the moment the tail of the train left the platform was 1.5 minutes. Find the length of the train.
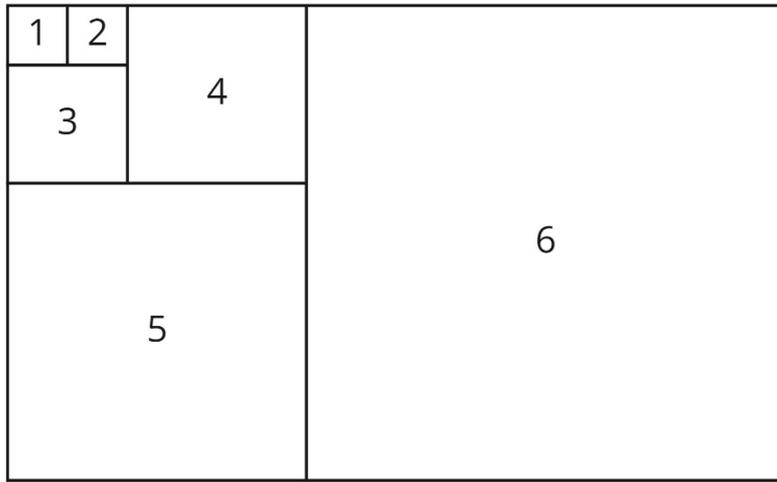
4. (4 points) Thor is the God of thunder and lightning. Before a duel against Thanos, he must get himself in the optimal shape. Thor knows that for healthy nutrition, in the daily diet fats should constitute 25%, proteins – 35%, and carbohydrates - the rest of the food. But it is difficult for him to visualize this relationship. Draw a pie chart to help Thor understand the ratio of proteins, fats, and carbohydrates in the daily diet. Label the angles of the sectors on the chart.

5. (5 points) Let's suppose that to protect information from theft, Apple Inc. encrypted data and divided it into 2 parts. Then, at each stage, all parts were divided into 2, and the resulting parts were divided into 2 more, and so it continued for a certain number of times. The resulting data parts were hidden on different computers in the US, Ireland, and Australia. Employees of the company did not record on which computers they hid the files. To decipher the information, the company's specialists retrieved 120 parts - 40 from each of the countries, while all the parts are required for decryption. Will the company be able to decipher the information using only these 120 parts?

6. (7 points) A Wonder-Family built a house. The rooms of their house have the shape of a square and are labeled in the figure by the numbers 1, 2, 3, 4, 5, 6. The perimeter of room #1 is 12 m, and its height is 5 m. Room #2 has the same perimeter and height. Each next larger room is 0.5 m lower than the previous one. Room #6 has a door measuring 1.5x2 m and 6 windows measuring 3x2.25 m each. What is the minimum number of rolls of wallpaper 0.5 m wide and 9 m long the Wonder-Family needs to buy to hang wallpaper on the walls of room #6?

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7. (7 points) At a robotics competition, team members have been creating robots for speed walking. Robots Steve and Dave have reached the final. Steve's stride length was 1/5 shorter than Dave's, but during the competition he managed to make 1/5 more steps than Dave. Who won the tournament?
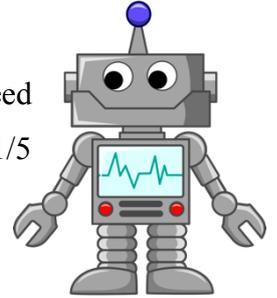
8. (11 points) If we add up the time that father spoke on the phone on some day, with the time mother spent talking on the phone on that day, and with the time of son's calls, we will get 50 minutes. Mom talked on the phone for 15 minutes, dad and mom talked to each other for 5 minutes, mom talked to son for 5 minutes, dad talked to son for 4 minutes, and not to son for 7 minutes. How many minutes on that day did the son talk on the phone not with his parents?

9. (11 points) Romeo is playing a game. There are 4 chests in front of him, each containing 6, 7, 11 and 19 coins, respectively. For 1 move, Romeo must put 1 coin into each of any two of these 4 chests. If after a certain number of moves all chests contain equal number of coins, Romeo wins those coins. Is it possible to win this game? If yes, what minimum number of moves is required to win?