5th Annual Lexington Math Tournament Theme Round

April 12, 2014

Name _____ Team _____

Minions

1. _____
2. _____
3. _____
4. _____
5. _____

Voting and Political Systems

1. _____
2. _____
3. _____
4. _____
5. _____

Making the LMT

1. _____
2. _____
3. _____
4. _____
5. _____

This page is intentionally left blank

1 Minions

"You have been beaten by a Gru"

1. All minions either have 1 or 2 eyes, and have one of 4 possible hairstyles. They are all thin and short, fat and short, or thin and tall. Gru doesn't want to have any 2 minions that look exactly alike, so what is the maximum possible amoount of minions can he get?
2. Dave is shaped like two hemispeheres placed on either side of a vertical cylinder. If Dave is 4 feet across in width (excluding arms) , and has total volume 20π feet^3, then how tall is he? (excluding legs and hair)
3. There are 400 minions. 120 like Agnes, 160 like Margo, and 180 like Edith. 37 of the minions like both Agnes and Margo, and 74 minions like only Margo and Edith. If the number of minions that like all three girls to the number of minions that like Agnes and Edith to the number of minions that like none of the girls is 1:2:3, how many minions like all 3 girls?
4. There is a circular chair, that has the same radius as a minion, so to seat him perfectly on the chair. Gru wants to save space, so he starts shooting them with the shrinking ray from the first movie. If the minions are 1/5 the size that they used to be (in diameter), how many minions can fit per chair?
5. Minion A fires a laser from a corner of a room to the opposite corner. The room has length 32 and width 24. Minion B walks from the middle of the width side on one end of the room to as far as he can to the other side of the room along the length of the room. He stops right before he gets hit by the laser. What is the area of the total amount of area that the minion can walk over if he only walks left and right along the length of the room? The minion's head from above angle has radius 5.

2 Voting and political systems

"All those in favor of real numbers say '$\sqrt{-1}$' "

1. In the Math Club, 30% of the people vote for algebra, 2/17 voted for geometry and 1/16 voted for combinatorics, and the rest voted for trigonometry. What is the smallest amount of people who could have voted in this election.?
2. Currently, there are 9 political parties in Numerica, and 100 members of the senate. The political parties are going to change the number of senate members. "Demicrats" want the number to be a multiple of 2, "Triplicrats" want it to be divisible by 3, and so on, up to "Decacrats", who want it to be divisible by 10. They will hold a vote, and the proposed number of senate members will pass if at least 5 of the 9 parties approve of the number. If the political parties don't want to hire any new senate members, (so they must have less than or equal to 100 members), how many possible numbers of senate members will pass the vote?
3. There are three candidates at the vertices of triangle ABC, which has a person at every point inside of it. Each person votes for the closest person to them, (and if there is a tie, restrains from voting). If $AB : AC : BC = 5 : 12 : 13$, then what is the ratio of the amount of votes for A to B to C?

4. 3 people are on a ballot, and there are 10 voters. If each voter sees the previous voter's ballot, and each voter does not want to vote for the same person as the voter before him, how many ways are there for there to be a winner (with no ties for first place), who has a total of 5 votes for him?

5. There are 7 people who are voting amongst themselves for who should become president (These 7 people are themselves the candidates). None of them can vote for themselves, but can vote for any of the other 6 people. In how many ways can there be a seven way tie, assuming the people are distinguishable?

3 Making the LMT

"Should we make an LMT "making the LMT" theme for the LMT theme round, or a "making the "making the LMT" theme for the LMT theme round" theme for the LMT theme round?"

1. The LMT consists of an individual round, a theme round, a team round, and a guts round. There are 20 problems on the LMT individual round. There are 3 themes with 5 problems a piece on the theme round. There are 10 potpourri problems and 1 proof problem on the team round, and 12 rounds of 3 problems on the guts round. How many problems are there in total?

2. In LMT, problem writers can be slackers or workers. Slackers write 3 questions per day, and workers write 7 questions per day. If in one day, 94 questions are written and the only writers of questions are either slackers or workers, how many possible numbers of people could have written questions that day?

3. *Note: It is strongly recommended that you read and solve Problem 2 on this theme before solving this problem.* Alan, who wrote the previous problem for the LMT, accidentally mis-wrote exactly one digit because his handwriting is so bad. If the intended answer was supposed to be 6, what is the sum of the digit that he was supposed to write and the digit that he did write instead?

4. In the annual Lazy Mathematicians Together (LMT) conference, Bob decided to use his calculator to calculate 2^{48} by typing in "$2 \cdot 2 \cdot 2 \cdots$", for a total of 48 2's. However, Bob's calculator has the property that whenever it tries to perform the operation $a \cdot b$, it gives back $a \cdot b - 1$. Bob's calculator eventually gives an answer of N, which can be written as $N = 2^{a_1}3^{a_2}5^{a_3}7^{a_4}M$, where M is an integer not divisible by any of 2, 3, 5, 7. Find $2^{a_1} + 3^{a_2} + 5^{a_3} + 7^{a_4}$.

5. The graders for this problem are really lazy, and will grade this problem as correct even if the digits of the answer (all of which are unique and nonzero) are put in the wrong order (really!). Assuming that there is more than one digit and there is at least one prime number which the graders will mark correctly, what is the average of all answers which the graders will mark as correct to this problem?