CHALLENGE ROUND

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Good luck. You'll need it.

- 1. Suppose I have a weighted coin, which has a p chance of flipping heads, where $p \le 0.5$. Suppose that if I flip it twice, there is a 0.42 chance of getting one head and one tail. What is the probability of getting two heads from two flips? Express your answer as a decimal to the nearest hundredth.
- 2. Chef Chris is making is a batch of his famed sodium-overdose Chrisserole casseroles. Suppose his batch contains 10 Chrisseroles and the number of cups of salt in each Chrisserole is an integer that ranges between 1 and 10 (inclusive). If Chris used a total of 59 cups of salt in the batch, what is the least possible value of the median of the number of cups of salt in each Chrisserole? Express your answer as a decimal to the nearest tenth.
- **3**. Max (short for Maxine) is playing a game with a pile of fair coins. Suppose she starts with 10 coins. In each round of the game, she flips each coin in her pile. If the coin lands heads, she removes the coin from the pile. If the coin lands tails, the coin duplicates, and she puts both coins back into the pile. Then, at the end of the round, Max adds a coin to her pile. At the end of the tenth round, what is the expected number of coins in her pile?
- 4. Walt Disney, a chemist, is cooking fried rice with his movie director friend, Walter White. Suppose the two each generate fried rice at a constant rate (don't ask how). If Walt takes 5 minutes to cook one plate's worth of fried rice and Walter takes 7 minutes to cook two plates' worth of fried rice, how long in minutes would it take for the two of them working together to cook three plates' worth of fried rice? Express your answer as a common fraction.
- 5. Suppose that

where each letter represents a (not necessarily distinct) base ten digit. What is the greatest value of the four-digit number BAYS?

6. Bowser is playing Etselec, a game in which he dies a lot. Each time he dies in the game, his fury grows. Suppose that his fury level starts at 0, and with each death his fury increases an amount proportional to the number of times he has died up to (and including) that death. (For example, his 10th death will increase his fury level by twice the amount of his 5th death.) Suppose that Bowser's 11th through 20th deaths (inclusive) increases his fury level by a total of 93. How much will his 21st through 40th deaths increase his fury level by?

- 7. Matt and Jared are playing with a garbage bin. First, Matt plays for a random amount of time between 0 and 1 minutes, then Jared plays for a random amount of time between 0 and 1 minutes, and then Matt plays for a random amount of time between 0 and 1 minutes again. What is the probability that between the two of them, Matt gets more bin time? Express your answer as a common fraction.
- 8. Suppose m is a positive number which has 120 positive integer divisors. What is the greatest number of positive integer divisors m^3 can have?
- **9**. Motthew is watching the hit show "Breaking Brad's Bones". Suppose that the show has 8 episodes, and that the number of bones broken in each episode is a positive integer. Motthew notices that the number of bones broken in the first four episodes form an arithmetic sequence, the number of bones broken in the middle four episodes (episodes 3 to 6) form a geometric sequence, and the number of bones broken in the last four episodes form an arithmetic sequence. If the sum of the number of bones broken in episodes 3 and 6 equals 378, what is the maximum total number of bones broken across all 8 episodes?
- 10. Math Minder has built 4 rovers that will explore the surface of Mars. Each rover weighs a positive integer number of pounds, and the sum of the reciprocals of the rovers' weights is exactly 1. Given that the largest of the rovers weighed n pounds, what is the largest possible value of n?
- **11**. A sphere is divided into pieces using five planes. What is the maximum possible number of pieces produced by the planes?
- **12**. Given a fixed 1:2:3 rectangular prism, in how many ways can three planes be placed so that each of the 12 midpoints of the sides of the prism is on at least one plane, and each plane contains at least three midpoints?

