



## Mad Hatter (7)

1 minute per question, 45 questions

1. Write  $17^2 * 2$  in Roman numerals.
2. Alice, the Mad Hatter, the Cheshire Cat, and the Queen of Hearts are playing cricket and must stand in a line. However, the Queen of Hearts refuses to stand next to Alice. How many different ways can they line up? Example: M A C Q.
3. Continuing from #2, let's say they lined up in a certain order. During their cricket game, the four of them decided to change the order that they had lined up in and afterwards, Alice noticed that no one was standing in the position they previously were in, and they were now standing in alphabetical order. What is one possible order they previously were in?
4. What is the 21st smallest prime number?
5. What is the smaller angle between the two clock hands when it is 6:30?
6. What fraction of 1 kilometer is 180 centimeters? Express your answer in the lowest terms.
7. If each letter in the alphabet corresponded to a number, where A = 1, B = 2, C = 3, etc., what is the sum of the letters in the word, "HAND"?
8. Continuing with question 7, what is the sum of the letters in "FOOT" divided by the sum of the letter in "HAND"?
9. What is the units digit of  $2017^{2017}$ ?
10. What is the tens digit of  $2017^{2017}$ ? Hint: Only the units and tens digits will matter.
11. When drawing one M&M at a time without replacement, what is the probability of choosing one red, one blue, and one green M&M, in that order, from a pile of 10 red, 13 blue, and 2 white M&Ms?
12. Alice ran to the Queen's palace from her house at a rate of 5 mph to deliver some tea. After doing so, she walked back to her house at a rate of 2 mph. She traveled a total distance of 20 miles. What was her average speed?
13. A cylinder has a volume of 3141.5 cubed meters. It has a radius of 10 meters. What is the height of the cylinder? Round your answer to the nearest integer.
14. What is the area of an triangle with vertices at the following points: (0,0), (4, 0), (0, 6)?



## Mad Hatter (7)

15. What is the volume of a cube with side length  $\frac{10^2}{5}$  meters?
16. What is the absolute value  $(976 - 5811) * 2$  of ?
17. Write .67676767...repeated in the lowest terms.  $\frac{1}{99} = .010101$ Hint: .
18. The Mad Hatter visits Alice every day. Every time he visits, it takes 1 more minute than the previous visit for Alice to get out of bed and talk to him (In their first meeting, Alice took 1 minute). Regardless of the time it takes for him to travel back and forth, how many visits can the Mad Hatter make in 2017 minutes?
19. The Mad Hatter brought  $7^7$  buns to a tea party, but only Alice, Bunny, and the Cheshire Cat came to the party. If they ate the same amount of buns and as much as they could, how many buns will there be left?
20. What  $312 * (1 - \frac{1}{2})(1 - \frac{1}{3})(1 - \frac{1}{4})(1 - \frac{1}{13})$  is ?
21. Alice, Bunny, and the Cheshire Cat go on a picnic and they have just finished eating 7 identical gummy bunnies. How many possible ways could they have eaten bunnies?
22. It takes the Mad Hatter and Alice 3 and 5 hours each to finish the homework by themselves, respectively. If the Mad Hatter and Alice work together, how long will it take them to finish the homework?
23. Alice has only three distinct shirts and three distinct skirts of colors red, blue, and yellow in her wardrobe. If Alice doesn't want to wear a shirt and skirt of the same color, how many different ways are there for her to dress?
24. For polynomial  $x^2 + x - 6$  with respect to  $x$ , Alice chooses one number from the set  $\{1, -1, 2, -2, 3, -3\}$ . What is the probability that the number she chose is a zero of the polynomial?
25. What is the remainder after dividing  $2017^3 + 7$  with 2016?
26. The Duchess gracefully divides  $(x^2 + 2x + 3)$  with  $(x - 2)$  and the quotient is  $(x + 1)$ , and the remainder is 3. When she divided  $(x^2 + 3x + 6)$  with  $(x + 3)$ , the remainder was -2. What is the remainder when she divides  $(x^2 + 5x + 6)$  with  $(x^2 + 2x - 6)$ ?
27. What is  $107^2 + 13^2$ ?



## Mad Hatter (7)

28. 8 identical mice ride on the Cheshire the Cat to take them to the White Queen's castle. If there must be at least two mice on each trip, how many different ways are there to get to the castle?
29. The Frog Footman has a regular six-sided dice. He throws the dice two times and he wishes that the the two numbers he sees on the top add up to an odd number. What is the probability that his wish is granted?
30. The Fish Footman is planning to leave on a trip from Monday to Thursday next week. If at least two consecutive days must rain for him to survive during his trip and the probability to rain in a single day is  $\frac{1}{2}$ , what is the probability that he will survive?
31. For nonzero real numbers  $a, b, c$ , if  $a - 5 = b - 3$  and  $2c = a + b$ , write  $a, b$ , and  $c$  in increasing order.
32. Alice, Bill the Lizard, and the Caterpillar are sitting around a round table. If the Mouse and the Dodo came to join their tea party, how many ways are there for them to sit around the table?
33. Mad Hatter Middle School has two after-school activities, swimming and solving math problems. If all students must do at least one activity, 170 students swim, and 130 students solve math problems, what is the difference between the maximum and minimum number of students in the school?
34. Bill the Lizard is climbing a ladder of length 2017 units. Bill is 10 units long, and he climbs at a rate 2 units/minute.  $t$  minutes after Bill starts climbing, the Dormouse, 5 units long, climbs the ladder after Bill, at a rate of 4 units/ minute, and catches up after 6 minutes. What is  $t$  ?
35. Alice sees three talking numbers named Bob, Charlie, and the Dodo walking in the given order. When Bob and the Dodo are multiplied together and then squared, they become Charlie. Bob and the Dodo are irrational numbers and they add up to 0. If Charlie is the second smallest positive square, what is the sum of Bob, Charlie, and the Dodo?
36. The March Hare is sleeping on  $(5,0)$  on the coordinate plane. The Knave of Hearts draws a segment across the plane that goes through the origin and the Mad Hatter quickly moves the March Hare to  $(-3, 4)$ . His positions before and after are symmetric over the drawn segment. What is the slope of the segment?
37. The Mock Turtle holds  $n$  number of cards. Every "huxle", the number of cards he grabs is the sum of the cards he grabbed the two previous huxles. In the first two huxles, he grabbed 1 card each. The cards he grabbed out are left out. If the Mock



## Mad Hatter (7)

Turtle was able to huxle 8 times until he had no more cards in his paw, what is the area of a regular triangle with side length  $x$ ?

38. From the previous question, if the Mock Turtle pulled out 1 card every huxle and put the rest back to the deck on his paw, what is the area of a circle with radius  $x$  to the nearest whole number?
39. Alice has a scale of justice. Using that, she is supposed to find the lying dwarf among 14 other identical dwarves. Upon the scale of justice, the dwarf who is lying will weigh more than the other dwarves. Every time Alice uses the scale, she must pay one coin. What is the minimum number of coins she needs to pay?
40. Alice has sandglasses that can measure 3 minutes and 5 minutes. what is the minimum number of times Alice needs to flip the sandglasses to measure 7 minutes?
41. What is the largest possible side of a triangle if its two other sides are 31 and 16?
42. If the White Queen can cast spells at the rate of 10 spells per minute, how many hours would it take her to cast 599 spells? Round to the nearest integer.
43. Rita can paint an 8 by 8 wall in fifteen minutes. Raquel can paint an 8 by 8 wall in 30 minutes. How long will it take them to paint an 8 by 16 wall together?
44. Write  $\frac{9}{17}$  in decimal form to the hundredth place.
45. A circle of diameter  $x$  is inscribed in a square. What is the side length of the square?



## Mad Hatter (7) Solutions

### Answers

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|-----|---|-----|-----------------|
| 1.  | DLXXVIII  | 26. | $-2x+7$         |
| 2.  | 12  | 27. | 11618           |
| 3.  | Possible answers: CAQM,<br>CQAM, CMQA, QMCA,<br>QMAC, QACM, MQCA,<br>MQAC, MAQC | 28. | 22              |
| 4.  | 73  | 29. | 0.5             |
| 5.  | 15  | 30. | $7/16$          |
| 6.  | $9/5000$  | 31. | B, c, a         |
| 7.  | 27  | 32. | 24              |
| 8.  | $56/27$   | 33. | 130             |
| 9.  | 7   | 34. | 6               |
| 10. | 7   | 35. | 4               |
| 11. | $13/690$  | 36. | 2               |
| 12. | $20/7$  | 37. | $2079 \sqrt{3}$ |
| 13. | 10  | 38. | 9161            |
| 14. | 12  | 39. | 3               |
| 15. | 8000  | 40. | 3               |
| 16. | 9670  | 41. | 14              |
| 17. | $67/99$   | 42. | 1               |
| 18. | 63  | 43. | 20              |
| 19. | 1   | 44. | 0.52            |
| 20. | 72  | 45. | x               |
| 21. | 36  |     |                 |
| 22. | $15/8$  |     |                 |
| 23. | 6   |     |                 |
| 24. |   |     |                 |
| 25. | 8   |     |                 |