ANSWERS

1. $18\frac{1}{16} = 18.0625 = \frac{289}{16}$
2. 673
3. $\frac{1}{13}$
4. 60
5. 56
6. $=$
7. B5
8. $\frac{57}{64}$
9. $\frac{1}{7}$
10. 143
11. $\frac{4}{3}(\sqrt{13}+2)$
12. 01
13. $\sqrt[3]{2019}$
14. 28
15. 5.5
16. 49
17. $\frac{\sqrt{3}}{3}$
18. 4
19. 8
20. 13.5
21. $\frac{6057}{10}$
22. 80
23. 1023
24. $\frac{3}{2}$
25. -9
26. $1, -2$
27. 12321
28. -72
29. 3600
30. $\frac{17}{42}$
31. 7
32. 0
33. $27\frac{1}{25} = 27.04 = \frac{676}{25}$
34. 81
35. 2020
36. 2018
37. $\frac{2021!}{2019!}$
38. $0.\overline{0198}$
39. 11
40. 714

1. Notice $4.25 = 4 + \frac{1}{4}$, when squared this is $16 + 2 + \frac{1}{16} = 18\frac{1}{16}$.

2. Notice 3 divides into 2019. Since there are only four factors 673 must be prime.

3. The first draw is irrelevant if unknown since all cards are equally likely, so the second draw remains at $\frac{1}{13}$ probability for an ace.

4. $24 = 2^3 * 3$. Sum of factors is 60.

5. This is just $\binom{n+2}{3}$ and $n = 6$, so $\binom{8}{3} = 56$.

6. Take the log of each side and they are equal.

7. We group the top 4 binary digits and the bottom 4 binary digits to obtain $B5_{16}$

8. Ew arithmetic. $\frac{19}{12} * \frac{9}{16} = \frac{57}{64}$.

9. That is $\frac{1}{4}$ of one square and there is total area $\frac{7}{4}$. (since one overlap). So probability is $\frac{1}{7}$.

10. The sum of the first n Fibonacci is $F_{n+2} - 1$. So $144 - 1 = 143$.

11. Rationalize and see $\frac{12(\sqrt{13}+2)}{9} = \frac{4}{3}(\sqrt{13} + 2)$.

12. Take mod100 for last two digits. Clearly $101^{101} \equiv 1 \bmod 100$. And thus the last two digits are 01.

13. There's only one real zero. $\sqrt[3]{2019}$

14. This is 28^2. So 28.

15. If he rerolls, the expected value is 4.5, so he'd only reroll 1-4, which is half of all possibilities. So overall expected value is $2.25+\frac{5+6+7+8}{4}=2.25+3.25=5.5$

16. This is a prime squared. We have 4, 9, 25, and then 49.

17. Side length is $\frac{2}{\sqrt{3}}$. So $\frac{1}{2} * 1 * \frac{2}{\sqrt{3}} = \frac{\sqrt{3}}{3}$.

18. 27 is 6 above the old mean and since the mean dropped by 2 when 27 was removed, this means that there is now 3 numbers. So there was 4 numbers.

19. 2 per side so 8.

20. Know powers of 2. 13.5

21. $30 * \frac{2019}{100} = \frac{6057}{10}$

22. This is 2222_3, which is 1 less than the 4th power of 3, which is 80.

23. Almost 2^{10}, but there's no 0 included, so it is 1023.

24. This is $2 - \frac{1}{2} = \frac{3}{2}$.

25. Should have years memorized from past. $63 * 32 = 2016$ and $45^2 = 2025$. So -9.

26. The inverse of (a, b) is (b, a), so this only works if $b = a$ and thus $f(x) = x$, so setting this equal, we have $x = 1, -2$.

27. Stack 'em, it's 12321.

28. This is $50 * 50 - 9 * 9 - 50 * 50 + 3 * 3 = -72$

29. Take 12^2 out and we have $3^2 + 4^2 = 25$, and $25 * 144 = 25 * 4 * 36 = 3600$

30. Bleh arithmetic, $\frac{17}{42}$

31. $x^2 - 8x + 7 = 0$, but make sure both are in the domain, which only 7 is.

32. This is clearly $(x^2 - 1)(x - 1)$, which has distinct zeroes $1, -1$ so sum is 0.

33. 5.2^2 is another chance for you to realize the gimmick for question 1. Squaring $5 + \frac{1}{5} = 25 + 2 + \frac{1}{25} = 27\frac{1}{25} = 27.04$.

34. This was supposed to hint again for previous questions. Raise to the 4th power and get 81.

35. 2020, something's matching.

36. Each game results in one loser, which is out of the tournament. So we need 2018 people out of the tournament so 2018 games are needed.

37. Since $\frac{2021!}{2019!} = \frac{2021}{2019} * \frac{2020}{2018} * \frac{2019!}{2017!}$, the former is clearly larger.

38. Multiply numerator and denominator by 99 to obtain $\frac{198}{9999}$, which is $0.\overline{0198}$.

39. 1235 so sum of digits is 11.

40. Sum of squares of first n Fibonacci numbers is $F_n F_{n+1}$, which is $F_8 F_9$. F_9 was given earlier as 34, and $F_8 = 21$. So this is $21 * 34 = 714$.