

2019 Four-by-Four Competition
Thursday, January 31st, 2019

Round 1

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1. If 5 Credenzas are equivalent to 7 Dalmatians and 4 Dalmatians are equivalent to 3 Eggs, how many Eggs are equivalent to 600 Credenzas?
2. When 89 people were surveyed, 47 said they liked Vanilla, 64 said they liked Chocolate, and 34 said they liked both. How many said they liked neither Vanilla nor Chocolate?
3. What is the smallest positive integer whose leftmost two digits can be read as a two-digit number which is the square of its rightmost digit?
4. What is the largest possible volume of a right rectangular prism with integer side lengths and a surface area of 100 m^2 ?

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Round 2

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5. If today is Thursday, what day of the week was it 823 days ago?

6. Evaluate: $\frac{2}{5 + \frac{2}{5 + \frac{2}{5 + \dots}}}$

7. Express the base 12 numeral $5A9B_{12}$ as a base 10 numeral.

8. What is the height, in meters, of a cylinder with a base radius of 9 m if the volume of the cylinder is twice the volume of a cone with a base radius of 6 m and a height of 6 m?

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9. Evaluate the value of the function $\text{Arctan}(-1)$ in radians.
10. What are the coordinates, in the form (x, y) , of the y -intercept of the line $8x - 7y = 112$?
11. What is the equation (in the form $Ax + By + Cz = D$ where A is positive and A, B, C , and D are collectively relatively prime) of the plane through the point $(9, -8, -3)$ and perpendicular to the vector $\langle -9, 4, 5 \rangle$?
12. What is the largest real value of p that can be part of a solution to $3p^2 + 8pq + 6q^2 = 216$?

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13. What is the distance between the points with coordinates $(4, 3)$ and $(-8, 5)$?
14. What is the largest palindrome less than 130987 which is a multiple of 3 but contains no digits which are positive multiples of 3?
15. Arrange the numbers below in increasing order (e.g. ABCD).
A. $\frac{5}{2}$ B. $\sqrt{6}$ C. $\frac{3\pi}{4}$ D. $\frac{44}{19}$
16. What is the sum of the even integers between 83 and 289?

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17. What is the area, in square meters, of a triangle with sides measuring 7 m, 8 m, and 5 m?
18. Evaluate in terms of i ($= \sqrt{-1}$): $(1 + 2i)(i)^{34}(5 - i) + (2i)^3$
19. Evaluate: $869946 \div 147$
20. What is the largest five-digit integer that can be “broken” into four two-digit numbers that are pairwise relatively prime? E.g. 12,345 can be “broken” into 12, 23, 34, and 45 (but not all pairs are relatively prime).

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21. How many liters of a 40% acid solution should you add to 9 liters of a 70% acid solution to produce a 60% acid solution?
22. What is the missing term of the sequence 1, 1, 3, 5, 11, 21, 43, 85, 171, ____, ...?
23. What is the perimeter, in meters, of an isosceles right triangle with an area of 3 m^2 ?
24. What is the sum of the 23 smallest positive perfect squares that are not also perfect fourth powers?

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25. What is the area, in square meters, of a parallelogram with sides measuring 4 m and 3 m and an internal angle measuring 150° ?
26. How many subsets of the set of counting numbers less than 10 contain at least two prime numbers?
27. What are the coordinates, in the form (x, y) , of the point of intersection of the lines $4x + 3y = 24$ and $y = -2x + 4$?
28. Arithmetic sequence Z has $z_1 = 31$ and $z_2 = 967$, while arithmetic sequence Y has $y_1 = 613$ and $y_2 = 2329$. What is the smallest positive difference between a term in sequence Z and a term in sequence Y?

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29. What is the name for the locus of points satisfying $9x^2 + 5xy - 4y^2 - 9x + 3y = 298$?
30. If it is currently 2:18:58 PM, what time will it be in 42398 seconds? Include AM or PM in your answer.
31. What is the largest possible area of a triangle with vertices at the vertex, the y-intercept, and an x-intercept of the parabola with equation $y = 3(x + 1)^2 - 12$?
32. If exactly one of the statements below is false, how many integer values less than 100 are possible for the secret number?
- A: Statement B is true and the secret number is less than 31.
B: Statement C is false or the secret number is more than 12.
C: Statement D is true or the secret number is less than 49.
D: Statement A is false and the secret number is more than 28.

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Round 9

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33. A cube of red plastic is painted blue on the outside, and then it is cut into 125 smaller cubes. How many of these smaller cubes are blue on at least two faces?

34. Andrea could do the job in 12 hours, and Bernie could do the job in 20 hours. How many minutes, to the nearest minute, would it take for Andrea and Bernie to do the job if they work together?

35. Evaluate: $\int_2^5 v\sqrt{v-1}dv$

36. When a group of three boys and three girls goes to the movies, every girl sits next to at least one other girl, and every boy sits next to at least one other boy. How many seating arrangements are possible if Ellie (a girl) sits directly to the right of Frank (a boy)?

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Round 10

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37. If $m(n) = 9n - 1$, evaluate $m^{-1}(-55)$.
38. What value of x satisfies the Mean Value Theorem for Derivatives for the function $h(x) = x^2 + 3$ on the interval $[1, 4]$?
39. Your gluttonous meal cost a total of \$123.75 after the 5% sales tax and your generous 20% tip. If the tip was calculated based on the pre-tax amount, how much (in dollars to the nearest hundredth) did you tip your server?
40. What is the missing term of the sequence 2187, 1782, 1458, 1336, 972, 890, 648, 444, ____, ...?

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