2018 Ciphering Time Trials
Thursday, December 13th, 2018

Round 1

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1. 75 is 80% of what number?

2. What is the equation, in slope-intercept $(y = mx + b)$ form, of the line through the points $(6,1)$ and $(3, -11)$?

3. What is the prime factorization, in exponential form, of 11880?

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Round 2

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4. What are the coordinates, in the form (x, y), of the midpoint of the line segment from $(-68, 93)$ to $(78, -71)$?

5. Express in simplest radical form: $\sqrt[3]{540}$

6. What is the range of the median, mode, and mean of the data set {7, 38, 4, 28, 4, 18, 6}?

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Round 3

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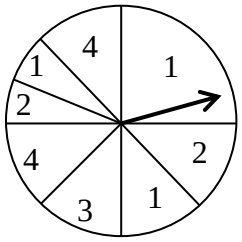
7. In the number 12,345.67809, what is the product of the digits in the thousands and thousandths places?

8. When the game spinner to the right is spun, what is the probability it points to a 1? Note that the central angles of the sectors are each 90°, 45°, or 22.5°.



9. Zilla swims from her lair to The City at a speed of 100 kilometers per hour, then destroys The City. She immediately returns to her lair over the same route, taking four hours for the return trip. If Zilla's average speed for all of her travel was 80 kilometers per hour, how many kilometers was The City from her lair?

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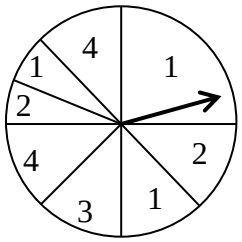

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Round 4

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10. What is the slope of a line perpendicular to the line $3x + 4y = 5$?

11. What is the area, in square meters, of a triangle with sides measuring $\sqrt{2}$ m, $\sqrt{5}$ m, and $\sqrt{13}$ m?

12. When eight fair coins are flipped, what is the probability that more of them show heads than tails?

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Round 5

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13. A bag contains 5 red, 9 orange, 9 yellow, 5 green, 4 blue, and 8 purple marbles. If you don't look, how many marbles must you remove to be sure you have at least three of a single color?

14. What is the circumference, in meters, of a circle circumscribed about a rectangle with sides measuring 6 m by 8 m?

15. The point $(2, -4)$ is rotated $7470°$ clockwise about the point $(4, 3)$ to point W, then point W is reflected across the line $y = 9$ to point V. What are the coordinates, in the form (x, y), of point V?

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Round 6

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16. What are the coordinates, in the form (x, y), of the center of the conic section with equation $2x^2 - 16x = 3y^2 + 54y$?

17. What is the missing term of the harmonic sequence beginning $35, 12, \_\_$?

18. A cow is tied to an external corner of a closed rectangular barn measuring 8 m by 6 m. If the cow's rope is 12 m long, what is the area the cow can graze, in square meters?

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Round 7

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19. In a solution to the system of equations $8s - 2t + 3u = 5$ and $-4s + t - u = -1$, what is the value of u?

20. If $k(j) = (2j - 1)^3(j + 1)^4$, evaluate $k'(1)$.

21. A right triangle has a hypotenuse measuring 81 m and a leg measuring 25 m. What is the length, in meters, of the other leg?

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Round 8

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22. What is the value of the discriminant of $12x^2 - 3x + 9 = 0$?

23. Consider the three types of triangle Scalene, Isosceles, and Equilateral. Of the three, one of them (A) can be considered a more specific form of another (B). As your answer, write the ordered pair (A, B) using words.

24. What is the smallest number greater than 1,000 that leaves a remainder of 5 when divided by 8 and a remainder of 1 when divided by 6?

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Round 9

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25. What is the sum of the number of vertices, edges, and faces on a regular octahedron?

26. How many positive integers are factors of 567?

27. What is the area of the ellipse with equation $2x^2 + y^2 + 8x - 6y = 8$?

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Round 10

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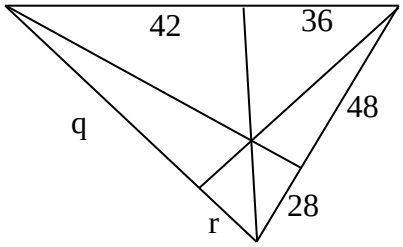
28. What are the coordinates, in the form (x, y), of the vertex of the parabola with equation $y = 3x^2 - 150x + 21$?

29. What is the cosine of the smallest angle in a right triangle with legs measuring 6 m and 9 m?

30. If all segment lengths in the figure to the right are integers, what is the largest possible value of r?



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