

2023

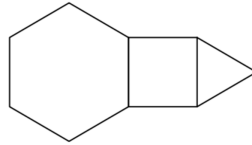


$NC(SMC)^2$
Speed Round

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Instructions: On this round, you will have 40 minutes to answer 30 questions. Each correct answer will contribute 1 point to your total score and questions that are incorrect or left blank will be marked as 0 points. Submit your answers here: <https://tinyurl.com/ncsmc2speed>. Good luck!

1. What is the sum of the digits of the difference $2023 - 513$?
2. A regular hexagon, square, and equilateral triangle are joined at their edges to form the diagram below. If the area of the square is 25, what is the perimeter of the figure?



3. Thomas makes a visit to the vending machine every day he is at school. He always buys his favorite snack – a Snickers candy bar for \$1.24. If he is at school 5 days a week, how much money in dollars does he spend at the vending machine weekly, rounded to the nearest dollar?
4. Sophia finds a dress on sale for 35% off, and purchases it for \$40.95. In dollars, what is the price of the dress before the sale?
5. A fruit store is selling apples for \$3 each and selling packages of three apples for \$8. What is the largest number of apples that a customer can buy from the fruit store with \$17?

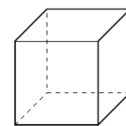


6. Last week, Ganning biked 6 miles a day from Sunday through Friday. On Saturday, he biked 20 miles. How many miles per day did Ganning bike last week on average?

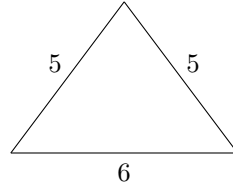



7. The expression $\frac{20}{22} + \frac{20}{23}$ can be written as one simplified fraction $\frac{m}{n}$ for relatively prime integers m, n . What is $m + n$?
8. Let $s(n)$ be the sum of the odd divisors of n . What is $s(9) + s(18)$?
9. What is the difference between the mean of the first 5 positive perfect squares and the median of the first 5 positive perfect squares?

10. A cube has surface area 150. What is the volume of the cube?



11. Find the value of x that satisfies this equation: $-3(x - 2)^3 = 81$.
12. Find the area of a triangle with side lengths 5, 5, and 6.



13.  At 2022 NC(SMC)², Samuel and Max tied for first, Calvin and Jason tied for third, and Anna, Brandon, and Avery tied for fifth. How many different possible ways could the 1st, 2nd, 3rd, 4th, and 5th place awards be given out after ties are broken if each award is given to exactly one person?

14. An arithmetic sequence has first few terms 20, 23, 26, 29, \dots . What is the 2023rd term?

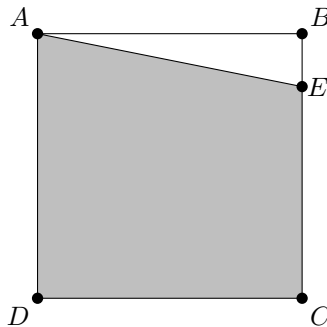
15. Two fair six-sided dice are rolled. The probability that both dice show odd prime numbers can be expressed as a common fraction $\frac{m}{n}$ for relatively prime integers m, n . What is $m + n$?



16. Emma originally planned to travel at 75 mph on a trip, which would have taken her 4 hours to complete. However, the NEED FOR SPEED calls for a 5 mph increase. How many minutes would Emma save by driving 5 mph faster?

17. Eli and Nicole are in a classroom, with an unknown number written on the whiteboard. The teacher asks everyone to take that number, add 4, divide by 2, multiply by 3, and subtract 5. However, Eli forgets to follow the order of operations and performs his operations in the order they were said in. Nicole remembers the order of operations, and gets an answer of 35. What was Eli's incorrect answer?

18. Square $ABCD$ has side length 10. Point E is on side BC such that $BE : EC = 1 : 4$. What is the area of quadrilateral $AECD$?

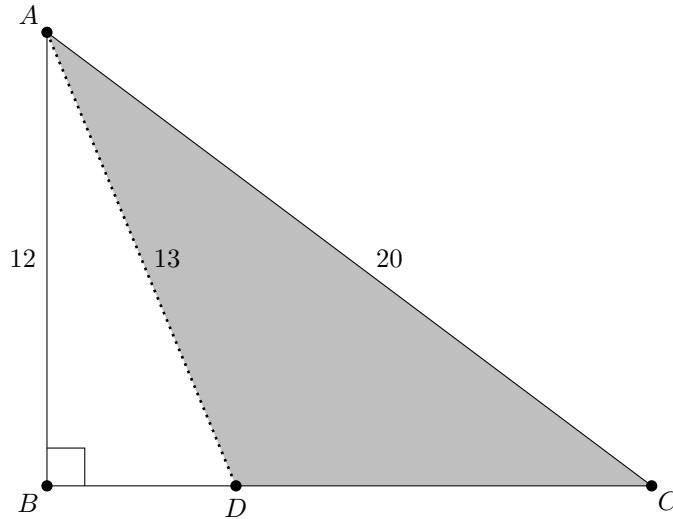


19. How many positive integers less than 100 are both odd and not a perfect square?

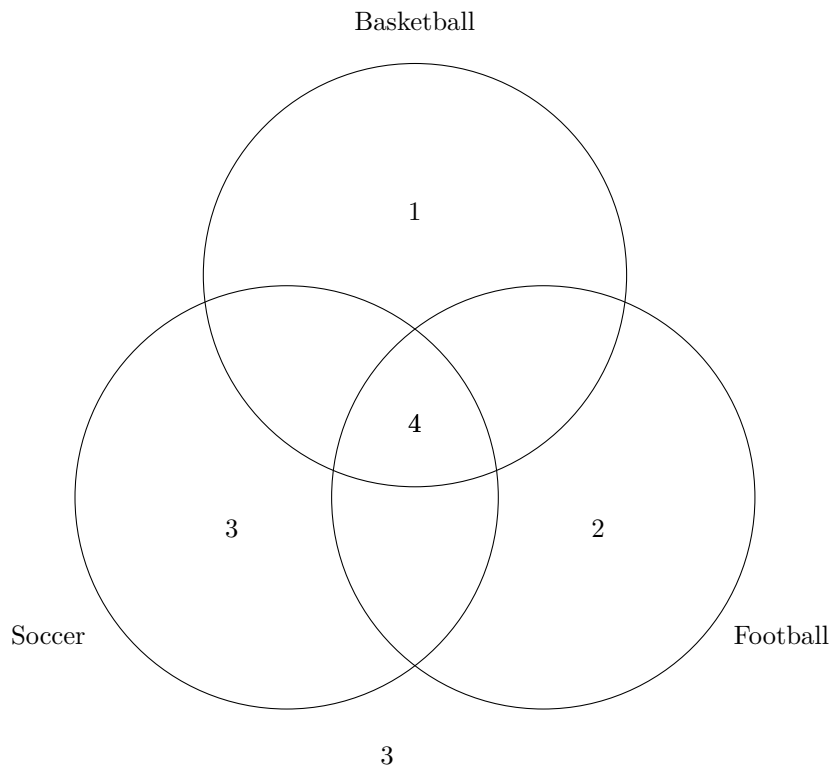
20. A *common* football game is a game where only some combination of 7 point touchdowns and 3 point field goals are scored by both teams. Which of the following Super Bowls must not have been a common game? Do not write your answer in Roman Numerals.

- Super Bowl 46: Giants 21 - 17 Patriots
- Super Bowl 48: Seahawks 43 - 8 Broncos
- Super Bowl 50: Broncos 24 - 10 Panthers
- Super Bowl 52: Eagles 43 - 38 Patriots
- Super Bowl 54: Chiefs 31 - 20 49ers

21. Find the number of positive even factors of 216.
22. There is a triangle ABC such that $\angle ABC = 90^\circ$, $AB = 12$, and $AC = 20$. There is a point D on segment BC such that $AD = 13$. Find the area of triangle ADC .



23. Paul's shadow is 9 feet long. He then stands on 2 feet stilts, which makes his shadow 12 feet long. How tall is Paul in feet?
24. Alice, Alina, and Vikas are standing in line in random order. Given Alice is the second tallest in the group, the probability that Alice is taller than everyone in front of her can be expressed as $\frac{m}{n}$ for relatively prime positive integers m, n . What is $m + n$?
25. A set of 40 students responded to a survey on whether they like to watch basketball, football, and/or soccer. Each student responded with one or more sports, and each sport was liked by the same number of students. Some of the data is provided in the Venn diagram below. How many people said they liked to watch basketball and football?



26. Compute the sum of all positive integer divisors of 108.
27. There are positive integers x, y such that $y = \sqrt{x^2 + 13}$. Find y .
28. There is a list of 6 positive integers. The median of this list is 3 and the unique mode is 4. The smallest possible average of the 6 integers can be expressed as $\frac{m}{n}$ for relatively prime positive integers m, n . Find $m + n$.
29. Nikhil can climb stairs 1, 2, or 3 stairs at a time. How many different ways are there for him to climb a staircase of 7 stairs?



30. Michelle is playing an altered game of chess where she only plays with knights. Find the maximum number of knights Michelle can place on the standard 8 by 8 chess board so that no two of her knights attack each other.
Note: The knight is only able to attack squares that are 2 squares in one direction and 1 square in a perpendicular direction.

