RMSMC
Redmond Middle School Math Club

2425M

2024-2025 MATHCOUNTS Exam

Wednesday, January 15, 2025

INSTRUCTIONS

1. DO NOT BEGIN THIS EXAM UNTIL YOUR PROCTOR TELLS YOU.

2. This is a thirty question SHORT ANSWER test. All answers must be recorded in the correct location on the separate answer sheet.

3. SCORING: You will receive 1 point for each correct answer, 0 points for each problem left unanswered, and 0 points for each incorrect answer. Ties will be broken for top placement positions based on the highest numbered question answered correctly. If students are still tied, the process is repeated for the remainder of questions in reverse order. Exact ties will be broken at the sole discretion of the Math Club chair.

4. No aids are permitted other than scratch paper, graph paper, rulers, compass, protractors, and erasers. No calculators, smartwatches, or computing devices are allowed. No problems on the test will require the use of a calculator.

5. Figures are not necessarily drawn to scale.

6. Units are not necessary unless the question asks for time, where AM or PM should be specified.

7. Give all answers in simplest form, rationalizing the denominator if necessary. If you get a fractional answer, express it as a common fraction unless otherwise indicated. If the answer is dealing with money, then round to the nearest hundredth.

8. Please make sure to write your name where indicated.

9. When your proctor gives the signal, begin working on the problems. You will have 40 minutes to finish your exam.

10. When you finish the exam, please go over your answers again to check your work.

Questions for this exam were authored by Layla Kaim, Emma Li and Jian Li.

ANSWER SHEET

Name		Score 1	Score 2	Final
Grade		Initial 1	Initial 2	

Do not write in shaded regions.

	Answer	1 or 0	1 or 0			Answer	1 or 0	1 or 0
1					16			
2					17			
3					18			
4					19			
5					20			
6					21			
7					22			
8					23			
9					24			
10					25			
11					26			
12					27			
13					28			
14					29			
15					30			
1-15 Total					**16-30 Total**			

1. If 4 students can complete 24 worksheets in 6 hours, how many worksheets can 2 students complete in 9 hours?

2. If $\sqrt{2^x} = 16^6$, what is the value of x?

3. Sally is the 20th person in line from the front and the 25th person in line from the back. How many people are in the line altogether?

4. What is the unit's digit (one's digit) of the product of any six consecutive positive whole numbers?

5. The difference between the squares of two consecutive positive integers is 15. What is the sum of the two squares?

6. A plane flying $800\,mph$ takes off in the same direction as another plane flying at $600\,mph$, which left $2\,hours$ earlier from the same location. How long will it take for the faster plane to catch up?

7. If $(5x - 7)^2 = ax^2 + bx + c$, what is $a + b + c$?

8. If $x - 4$ is a factor of $x^2 + 13x - 12c + 4$, what is c?

9. Ailee, Bailey, Camie and Demi grew up on the same street and have been best friends since elementary school. The girls are all different ages ranging from 14 to 17 years old. Bailey is younger than Camie, but older than Demi. Demi, who is not 15 years old, is a year younger than Ailee. What is Ailee's age?

10. Simplify $\dfrac{1}{1+\dfrac{2}{1+\dfrac{3}{1+\dfrac{4}{1+5}}}}$

11. What fraction is $\frac{1}{3}$ of the way between $\frac{2}{3}$ and $\frac{3}{4}$?

12. What is the remainder when 7^{2025} is divided by 100?

13. The lines $x = \frac{1}{4}y + a$ and $y = \frac{1}{4}x + b$ intersect at the point $(1,2)$. What is $a + b$?

14. If $\angle A = 60°, \angle E = 40°, and\ \angle C = 30°$. What is the value of $\angle BDC$?
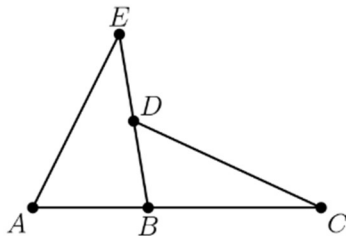
15. Consider a weighted coin with 60% probability of landing on heads. What is the probability it will land tails at least twice in three tosses?

16. If x, y and z are distinct primes, how many distinct positive divisors does $x^3 y^5 z^2$ have?

17. If x is an integer such that $log_{3x} 729 = x$, what is x?

18. What number should be removed from the list 1,2,3,4,5,6,7,8,9,10,11 so that the average of the remaining numbers is 6.1?

19. If $x + y + 3xy = 5$ and $2x + 2y + 4xy = 8$, what is $x + y - xy$?

20. If two fair six-sided die are rolled, what is the sum of all the possible (not necessarily distinct) sums of the two numbers rolled?

21. The line $y = 2x + 3$ is parallel to a line that goes through (3,2) and (7,c). What is the value of c?

22. Simplify $\frac{(2025^2 - 2023^2) \cdot (2025^2 - 2022^2) \cdot (2025^2 - 2021^2) \ldots (2025^2 - 1) \cdot 2025^2}{(2024^2 - 2023^2) \cdot (2024^2 - 2022^2) \cdot (2024^2 - 2021^2) \ldots (2024^2 - 1) \cdot 2024^2}$

23. In triangle LMN, point O and P are midpoints of segments LM and MN respectively. If the area of quadrilateral LOPN is $36 in^2$, what is the area of triangle LMN?

24. How many ways are there to choose three people from a line of 10 people such that no three are standing next to each other?

25. If a and b are the roots of the equation $x^2 - 5x + p^2 - 2p + 1 = 0$, where p is a real number, find the value of p that minimizes the product $a \cdot b$.

26. Two workers, A and B, can complete a job together in 3 hours. If worker A alone can complete the same job in 5 hours, how long will it take worker B alone to complete the job, expressed as a mixed number?

27. In how many ways can 47 be written as the sum of two primes?

28. In ΔABC, we have AC=BC=7 and AB=2. Suppose that D is a point on line AB such that B lies between A and D and CD=8. What is BD?

29. There are three types of cards: 8 cards with two red faces, 10 cards with one red and one black face, and 12 cards with two black faces. If a random card is drawn and the side facing up is red, what is the probability that the other face of the card is also red?

30. In triangle ABC, point D is on AC such that $\frac{AD}{DC} = \frac{3}{2}$, point E is on BC such that $\frac{BE}{EC} = \frac{3}{5}$, and point F is the midpoint of AB. Line DE intersects line CF at point G. What is the ratio of length DG to length GE?