77th Annual
American Mathematics Competitions

AMC 12 B

Thursday, November 13, 2025

INSTRUCTIONS

1. DO NOT TURN TO THE NEXT PAGE UNTIL YOUR COMPETITION MANAGER TELLS YOU TO BEGIN.
2. This is a 25-question multiple-choice competition. For each question, only one answer choice is correct.
3. Mark your answer to each problem on the answer sheet by completely filling the circle with a #2 pencil. Check blackened answers for accuracy and erase errors completely. Only answers that are properly marked on the answer sheet and appear sufficiently dark will be scored.
4. SCORING: You will receive 6 points for each correct answer, 1.5 points for each problem left unanswered, and 0 points for each incorrect answer.
5. Only blank scratch paper, rulers, compasses, and erasers are allowed as aids. No calculators, smartwatches, phones, computing devices, protractors, or graph paper are allowed. No problems in the competition will require the use of a calculator.
6. Figures are not necessarily drawn to scale.
7. You will have 75 minutes to complete the competition once your competition manager tells you to begin.
8. When you finish with the competition, please follow the directions of your competition manager.

The problems and solutions for this AMC 12 B were prepared
by the MAA AMC 10/12 Editorial Board under the direction of
Gary Gordon and Carl Yerger, co-Editors-in-Chief.

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1. The instructions on a 350-gram bag of coffee beans say that proper brewing of a large mug of pour-over coffee requires 20 grams of coffee beans. What is the greatest number of properly brewed large mugs of coffee that can be made from the coffee beans in that bag?

   (A) 16 **(B)** 17 **(C)** 18 **(D)** 19 **(E)** 20

2. Jerry wrote down the ones digit of each of the first 2025 positive squares: $1, 4, 9, 6, 5, 6, \ldots$. What is the sum of all the numbers Jerry wrote down?

   (A) 9025 **(B)** 9070 **(C)** 9090 **(D)** 9115 **(E)** 9160

3. What is the value of $i(i-1)(i-2)(i-3)$, where $i = \sqrt{-1}$?

   (A) $6 - 5i$ **(B)** $-10i$ **(C)** $10i$ **(D)** -10 **(E)** 10

4. The value of the two-digit number $\underline{a}\,\underline{b}$ in base seven equals the value of the two-digit number $\underline{b}\,\underline{a}$ in base nine. What is $a + b$?

   (A) 7 **(B)** 9 **(C)** 10 **(D)** 11 **(E)** 14

5. Positive integers x and y satisfy the equation $57x + 22y = 400$. What is the least possible value of $x + y$?

   (A) 10 **(B)** 11 **(C)** 13 **(D)** 14 **(E)** 15

6. Emmy says to Max, "I ordered 36 math club sweatshirts today." Max asks, "How much did each shirt cost?" Emmy responds, "I'll give you a hint. The total cost was $\$\underline{A}\,\underline{B}\,\underline{B}.\underline{B}\,\underline{A}$, where A and B are digits and $A \neq 0$." After a pause, Max says, "That was a good price." What is $A + B$?

   (A) 7 **(B)** 8 **(C)** 11 **(D)** 14 **(E)** 15

7. What is the value of
$$\sum_{n=2}^{255} \frac{\log_2\left(1 + \frac{1}{n}\right)}{(\log_2 n)(\log_2 (n+1))}\,?$$

   (A) $\frac{3}{4}$ **(B)** $1 - \frac{1}{\log_2 255}$ **(C)** $\frac{7}{8}$ **(D)** $\frac{15}{16}$ **(E)** 1

8. There are integers a and b such that the polynomial $x^3 - 5x^2 + ax + b$ has $4 + \sqrt{5}$ as a root. What is $a + b$?

   (A) 13 **(B)** 17 **(C)** 20 **(D)** 30 **(E)** 68

9. What is the tens digit of 6^{6^6} ?

   (A) 1 **(B)** 3 **(C)** 5 **(D)** 7 **(E)** 9

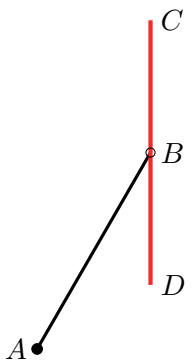
10. The altitude to the hypotenuse of a $30-60-90^\circ$ right triangle is divided into two segments of lengths $x < y$ by the median to the shortest side of the triangle. What is the ratio $\frac{x}{x+y}$?

    (A) $\frac{3}{7}$ **(B)** $\frac{\sqrt{3}}{4}$ **(C)** $\frac{4}{9}$ **(D)** $\frac{5}{11}$ **(E)** $\frac{4\sqrt{3}}{15}$

11. Nine athletes, no two of whom are the same height, try out for the basketball team. One at a time, they draw a wristband at random, without replacement, from a bag containing 3 blue bands, 3 red bands, and 3 green bands. They are divided into a blue group, a red group, and a green group. The tallest member of each group is named the group captain. What is the probability that the group captains are the three tallest athletes?

    (A) $\frac{2}{9}$ **(B)** $\frac{2}{7}$ **(C)** $\frac{9}{28}$ **(D)** $\frac{1}{3}$ **(E)** $\frac{3}{8}$

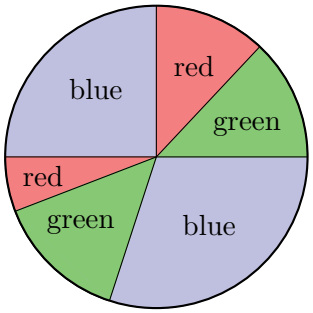
12. The windshield wiper on the driver's side of a large bus is depicted below.



    Arm $\overline{AB}$ pivots back and forth around point A, sweeping out an arc of 60°, symmetric about the vertical line through A. The wiper blade $\overline{CD}$ is attached to B at its midpoint and stays vertical as the arm moves. The arm is 3 feet long, and the wiper blade is 3.5 feet tall. What is the area of windshield cleaned by the wiper, in square feet, to the nearest hundredth? (Assume that the windshield is a flat vertical surface.)

    (A) 9.68 **(B)** 10.14 **(C)** 10.50 **(D)** 11.32 **(E)** 12.00

13. A circle has been divided into 6 sectors of 6 different sizes. Then 2 of the sectors are painted red, 2 painted green, and 2 painted blue so that no two neighboring sectors are painted the same color. One such coloring is shown below.



How many different colorings are possible?

(A) 12 **(B)** 16 **(C)** 18 **(D)** 24 **(E)** 28

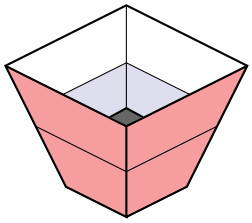
14. Consider a decreasing sequence of n positive integers $x_1 > x_2 > x_3 > \cdots > x_n$ that satisfies the following two conditions:

- The average (arithmetic mean) of the first 3 terms in the sequence is 2025.
- For all $4 \leq k \leq n$, the average of the first k terms in the sequence is 1 less than the average of the first $k-1$ terms in the sequence.

What is the greatest possible value of n?

(A) 1013 **(B)** 1014 **(C)** 1016 **(D)** 2016 **(E)** 2025

15. A container has a 1×1 square bottom, a 3×3 open square top, and four congruent trapezoidal sides, as shown. Starting when the container is empty, a hose that runs water at a constant rate takes 35 minutes to fill the container up to the midline of the trapezoids.



How many more minutes will it take to fill the remainder of the container?

(A) 70 **(B)** 85 **(C)** 90 **(D)** 95 **(E)** 105

16. An analog clock starts at midnight and runs for 2025 minutes before stopping. What is the tangent of the acute angle between the hour hand and the minute hand when the clock stops?

(A) 0 **(B)** $\sqrt{2}-1$ **(C)** $2-\sqrt{2}$ **(D)** $\frac{\sqrt{2}}{2}$ **(E)** $3-\sqrt{2}$

17. Each of the 9 squares in a 3×3 grid is to be colored red, blue, or yellow in such a way that each red square shares an edge with at least one blue square, each blue square shares an edge with at least one yellow square, and each yellow square shares an edge with at least one red square. Colorings that can be obtained from one another by rotations and/or reflections are to be considered the same. How many different colorings are possible?

(A) 3 **(B)** 9 **(C)** 12 **(D)** 18 **(E)** 27

18. Awnik repeatedly plays a game that has a probability of winning of $\frac{1}{3}$. The outcomes of the games are independent. What is the expected value of the number of games he will play until he has both won and lost at least once?

(A) $\frac{5}{2}$ **(B)** 3 **(C)** $\frac{16}{5}$ **(D)** $\frac{7}{2}$ **(E)** $\frac{15}{4}$

19. A rectangular grid of squares has 141 rows and 91 columns. Each square has room for two numbers. Horace and Vera each fill in the grid by putting the numbers from 1 through $141 \times 91 = 12{,}831$ into the squares. Horace fills the grid horizontally: he puts 1 through 91 in order from left to right into row 1, puts 92 through 182 into row 2 in order from left to right, and continues similarly through row 141. Vera fills the grid vertically: she puts 1 through 141 in order from top to bottom into column 1, then 142 through 282 into column 2 in order from top to bottom, and continues similarly through column 91. How many squares get two copies of the same number?

(A) 7 **(B)** 10 **(C)** 11 **(D)** 12 **(E)** 19

20. A frog hops along the number line according to the following rules.

- It starts at 0.
- If it is at 0, then it moves to 1 with probability $\frac{1}{2}$ and it disappears with probability $\frac{1}{2}$.
- For $n = 1$, 2, or 3, if it is at n, then it moves to $n+1$ with probability $\frac{1}{4}$, it moves to $n-1$ with probability $\frac{1}{4}$, and it disappears with probability $\frac{1}{2}$.

What is the probability that the frog reaches 4?

(A) $\frac{1}{101}$ **(B)** $\frac{1}{100}$ **(C)** $\frac{1}{99}$ **(D)** $\frac{1}{98}$ **(E)** $\frac{1}{97}$

21. Two non-congruent triangles have the same area. Each triangle has sides of length 8 and 9, and the third side of each triangle has integer length. What is the sum of the lengths of the third sides?

(A) 20 **(B)** 22 **(C)** 24 **(D)** 26 **(E)** 28

22. What is the greatest possible area of the triangle in the complex plane with vertices $2z$, $(1+i)z$, and $(1-i)z$, where z is a complex number satisfying $|4z-2|=1$?

(A) $\frac{1}{4}$ **(B)** $\frac{1}{2}$ **(C)** $\frac{9}{16}$ **(D)** $\frac{3}{4}$ **(E)** 1

23. Let S be the set of all integers $z>1$ such that for all pairs of nonnegative integers (x,y) with $x<y<z$, the remainder when $2025x$ is divided by z is less than the remainder when $2025y$ is divided by z. What is the sum of the elements of S?

(A) 3041 **(B)** 3542 **(C)** 3750 **(D)** 4044 **(E)** 4319

24. How many real numbers satisfy the equation $\sin(20\pi x)=\log_{20} x$?

(A) 199 **(B)** 200 **(C)** 398 **(D)** 399 **(E)** 400

25. Three concentric circles have radii 1, 2, and 3. An equilateral triangle with side length s has one vertex on each circle. What is s^2?

(A) 6 **(B)** $\frac{25}{4}$ **(C)** $\frac{13}{2}$ **(D)** $\frac{27}{4}$ **(E)** 7