AMC 12A

78th Annual AMC 12A

Thursday, November 5, 2026

DO NOT TURN THE PAGE until your Competition Manager tells you to begin.
Please review the following information:

The basics



Figures not always drawn to scale.

How scoring works

Allowed

- Blank scratch paper provided by the Competition Manager
- Rulers and compasses
- Writing utensils and erasers

Not allowed

- Calculators
- Protractors
- Graph paper
- Any device that can send or receive information, such as cell phones, smart watches and smart glasses

Before you begin

1. Confirm that your name is on the answer sheet provided by your Competition Manager.
2. Mark your answers by completely filling the appropriate circles with a No. 2 pencil.
3. Double check for accuracy and erase errors completely. Only answers that are properly marked on the answer sheet and appear sufficiently dark can be scored.

> *Keep it fair:* **Don't share** or discuss the problems or answers until **November 6, 2026**.

Official rules and policies

By participating in this competition, students agree to comply with AMC rules and policies, including the academic integrity policy, which can be found here: **https://maa.org/student-programs/amc/maa-american-mathematics-competitions-policies/**

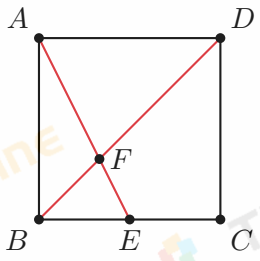
The problems and solutions for this AMC 12A were prepared by the AMC 10/12 Editorial Board under the direction of Gary Gordon and Carl Yerger, co-Editors-in-Chief.

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1. A sign in a parking lot states that the total price includes a 27% tax. To the nearest whole number, what percentage of the amount a customer pays is this tax?

   (A) 21% **(B)** 22% **(C)** 27% **(D)** 37% **(E)** 73%

2. Square $ABCD$ has side length 24. Let E be the midpoint of $\overline{BC}$, and let F be the intersection of $\overline{AE}$ and $\overline{BD}$.



   What is the area of $\triangle BEF$?

   (A) 36 **(B)** 40 **(C)** 45 **(D)** 48 **(E)** 52

3. Half of the internal angles of a polygon measure 150° each, and the other half of its internal angles measure 190° each. How many sides does the polygon have?

   (A) 36 **(B)** 40 **(C)** 60 **(D)** 72 **(E)** 180

4. Let $a_1, a_2, a_3, \ldots$ be a sequence with $a_1 = 94$, $a_2 = 190$, and a_n equal to the arithmetic mean of the previous $n-1$ terms for $n \geq 3$. What is the value of a_{10}?

   (A) 47 **(B)** 95 **(C)** 142 **(D)** 284 **(E)** 564

5. How many ordered triples of positive integers (x, y, z) satisfy both of the following equations?

$$x + y + z = 31$$
$$x + 3y + 3z = 41$$

   (A) 4 **(B)** 5 **(C)** 6 **(D)** 7 **(E)** 8

6. For what odd positive integer n is the mean of $1, 4, 9, 16, \ldots, n^2$ exactly 32% greater than its median?

   (A) 19 **(B)** 39 **(C)** 49 **(D)** 89 **(E)** 169

7. What is the value of $(1+i)^{20} + (1-i)^{20}$, where $i = \sqrt{-1}$?

   (A) -2048 **(B)** -1024 **(C)** 0 **(D)** 1024 **(E)** 2048

8. At Euclid High School, 25 students registered to take the AMC 10 and 75 students registered to take the AMC 12. (No student registered to take both.) However, not all 100 students showed up on test day. To compute the percentage of those students who actually took one of the exams, Euclid High School performed the following incorrect two-step process:

   Step 1: The school computed both the percentage of AMC 10 registrants who actually took that exam and the percentage of AMC 12 registrants who actually took that exam.

   Step 2: The school took the average of the previous two numbers to obtain a final percentage.

   Suppose that Euclid High School's process yielded an answer of 60%. What is the minimum number of students who might have actually taken one of the exams?

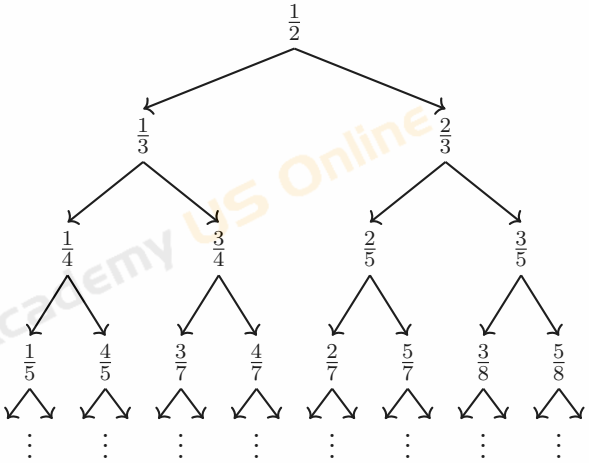
   (A) 30 **(B)** 35 **(C)** 40 **(D)** 50 **(E)** 60

9. How many ordered pairs (x, y) of real numbers satisfy the following system of equations?

$$\begin{aligned} |x^2 - y^2| &= 4 \\ \frac{16x}{y} &= xy \end{aligned}$$

   (A) 2 **(B)** 4 **(C)** 6 **(D)** 8 **(E)** 10

10. The tree diagram below has nodes labeled with rational numbers. The top node, at level 0, is $\frac{1}{2}$. Each node $\frac{a}{b}$ sprouts two nodes in the level below it, $\frac{a}{a+b}$ and $\frac{b}{a+b}$. For example, level 1 has nodes $\frac{1}{1+2} = \frac{1}{3}$ and $\frac{2}{1+2} = \frac{2}{3}$.



   At what level does the node $\frac{20}{27}$ appear in the diagram?

   (A) 5 **(B)** 8 **(C)** 12 **(D)** 26 **(E)** The node $\dfrac{20}{27}$ does not appear in the diagram.

11. An urn contains 6 red balls, 4 black balls, and 4 white balls. Suppose 7 balls are drawn at random without replacement and a score is computed as follows:

    - 1 point is given for each red ball up to a maximum of 3 points.
    - 1 point is given for each black ball up to a maximum of 2 points.
    - 1 point is given for each white ball up to a maximum of 2 points.

    For example, drawing 1 red ball, 4 black balls, and 2 white balls would earn a score of $1+2+2=5$. What is the probability of getting the lowest possible score?

    (A) $\frac{1}{858}$ **(B)** $\frac{5}{3432}$ **(C)** $\frac{1}{312}$ **(D)** $\frac{2}{429}$ **(E)** $\frac{5}{264}$

12. Ethan writes down five congruences:

    $$x \equiv 0 \pmod 2,\ x \equiv 0 \pmod 3,\ x \equiv 1 \pmod 4,\ x \equiv 5 \pmod 6,\ x \equiv 7 \pmod{12}.$$

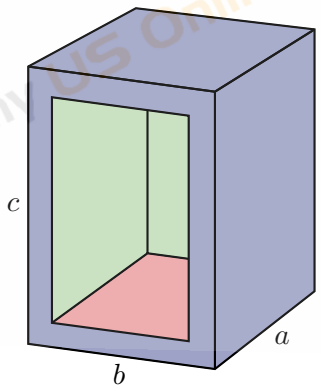
    How many positive integers less than or equal to 2026 satisfy at least one of these five congruences?

    (A) 1688 **(B)** 1856 **(C)** 1857 **(D)** 2025 **(E)** 2026

13. A board has 4 spaces in a row, which can be filled with numbers. The sides of a fair, 8-sided die are numbered 1 through 8. David rolls the die 4 times. After each roll, he randomly chooses an empty spot to write the number shown on the die. What is the probability that the numbers on the board form a strictly increasing sequence when read from left to right?

    (A) $\frac{1}{128}$ **(B)** $\frac{5}{432}$ **(C)** $\frac{35}{2048}$ **(D)** $\frac{35}{1024}$ **(E)** $\frac{1}{24}$

14. Three identical boxes, each with one open face, are made from 1-inch-thick wood. The outer dimensions of each box are a, b, and c inches, where $a < b < c$, and each open face appears on a face with outer dimensions $b \times c$.

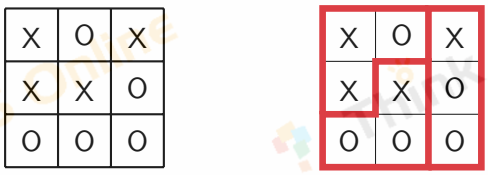
    It happens that if the open faces of two of the boxes are held together, then the space inside can exactly contain the (rotated) third box, with no room to spare. What is $a+b+c$?

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

15. Suppose that $\sin a = \frac{1}{4}$ and $\sin b = \frac{1}{8}$ with $0 \le b < a \le \frac{\pi}{2}$. What is the greatest integer less than $\log_2\big(\sin(a+b) \cdot \sin(a-b)\big)$?

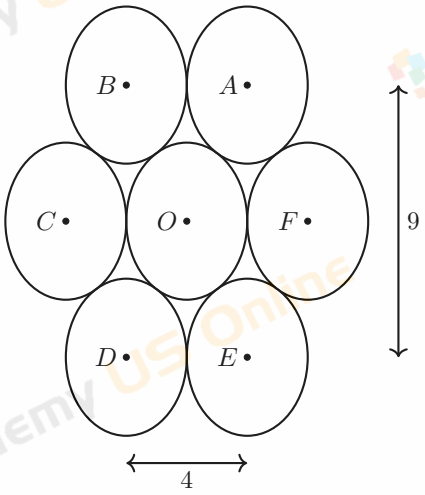
(A) -5 **(B)** -4 **(C)** 0 **(D)** 1 **(E)** 5

16. Gerry is playing the Triples Game. Her task is to partition the 3×3 grid of squares shown on the left into three sections, each containing three adjoining squares. (Three squares are adjoining if each shares an edge with at least one of the other two.) One point will be awarded for each section containing more X's than O's. Shown on the right is a sample partition that will earn one point in total. A partition that earns two or more points will win the game. What fraction of the possible partitions of this particular grid will result in a win for Gerry?



(A) $\frac{3}{10}$ **(B)** $\frac{1}{3}$ **(C)** $\frac{2}{5}$ **(D)** $\frac{4}{9}$ **(E)** $\frac{1}{2}$

17. An engineer is designing a closely packed field of 7 wind turbines for electricity production. Each turbine, whose center is marked by a labeled dot in the figure, occupies one of 7 congruent elliptical regions. Turbines in the same row have centers that are 4 units apart, and turbines in the same column have centers that are 9 units apart, as shown in the figure below.



The major axis of each ellipse is $m\sqrt{p}$, where m and p are positive integers and p is not divisible by the square of any prime. What is $m+p$?

(A) 6 **(B)** 8 **(C)** 9 **(D)** 10 **(E)** 12

18. A sphere with center O and radius 9 cuts three mutually perpendicular planes that meet at point P, forming three circular cross-sections on these planes, which have radii 7, 4, and 3. What is OP?

(A) 10 **(B)** 11 **(C)** 12 **(D)** 13 **(E)** 14

19. How many values of x between 0 and 2π, inclusive, satisfy the equation

$$\sin x + \sin(2x) + \sin(3x) = 1 + \cos x + \cos(2x)\,?$$

(A) 1 **(B)** 2 **(C)** 4 **(D)** 6 **(E)** 8

20. How many polynomials $f(x)$ of degree 3 satisfying

$$f\left(3+\sqrt{5}\right) = f\left(3-\sqrt{5}\right)$$

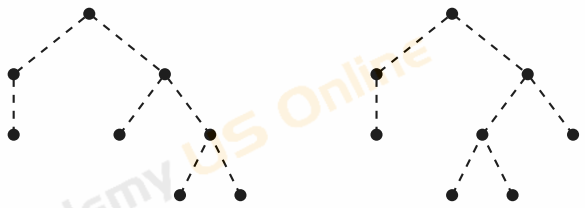
are there that have leading coefficient equal to 1 and all of whose coefficients are integers between -10 and 10, inclusive?

(A) 21 **(B)** 42 **(C)** 63 **(D)** 84 **(E)** 105

21. Six dogs find a large cookie in the shape of a regular hexagon $ABCDEF$. To divide the cookie, the dogs agree to choose a point P uniformly at random in the interior of the hexagon. The dogs will then cut out the segments $\overline{PA}$, $\overline{PB}$, $\overline{PC}$, $\overline{PD}$, $\overline{PE}$, and $\overline{PF}$, dividing the cookie into six triangles, one for each dog. A dog will be happy if and only if its piece has at least $\frac{1}{10}$ of the total area of the hexagon. What is the probability that all six dogs will be happy?

(A) $\frac{\sqrt{3}}{50}$ **(B)** $\frac{1}{25}$ **(C)** $\frac{3\sqrt{3}}{50}$ **(D)** $\frac{4}{25}$ **(E)** $\frac{2}{5}$

22. A flock of 8 birds is flying in formation, led by a single leader bird, which has exactly 2 followers immediately behind. Each non-leader bird follows exactly one bird, and has 0, 1, or 2 followers immediately behind. Two possible formations are shown in the figure below. (When a bird has two followers, swapping its left and right subflocks can produce a different formation, as shown in the figure.)



What is the total number of possible formations?

(A) 48 **(B)** 52 **(C)** 76 **(D)** 132 **(E)** 196

23. There is a unique real number x between 0 and 1 such that $x^3 + x^2 = 1$. For that x, there exist unique integers a, b, and c such that the infinite product

$$(x+1)(x^2+1)(x^4+1)(x^8+1)(x^{16}+1)\cdots$$

equals $ax^2 + bx + c$. What is $a + b + c$?

(A) 2 **(B)** 3 **(C)** 4 **(D)** 5 **(E)** 6

24. Trapezoid $ABCD$ has $AB = 4$, $CD = 5$, and $\angle DAB = \angle ABC = 90°$. Circles ω_1 and ω_2 lie inside the trapezoid as follows: ω_1 is tangent to $\overline{AB}$, $\overline{AD}$, and $\overline{DC}$; ω_2 is tangent to $\overline{AB}$, $\overline{BC}$, and $\overline{DC}$; and ω_1 and ω_2 are externally tangent to each other. The distance between the centers of ω_1 and ω_2 is $m - n\sqrt{p}$, where m, n, and p are positive integers such that p is not divisible by the square of any prime. What is $m + n + p$?

(A) 30 **(B)** 47 **(C)** 53 **(D)** 62 **(E)** 74

25. Let m be a positive integer such that there are at least 50 positive integers x less than m for which $x^2 - 1$ is a multiple of m. What is the sum of the digits of the least possible value of m?

(A) 12 **(B)** 15 **(C)** 16 **(D)** 18 **(E)** 22