



2004 AMC 12B

For more practice and resources, visit ziml.aretteam.org

The problems in the AMC-Series Contests are copyrighted by American Mathematics Competitions at Mathematical Association of America (www.maa.org).



Question 1

Not yet answered

Points out of 6

At each basketball practice last week, Jenny made twice as many free throws as she made at the previous practice. At her fifth practice she made 48 free throws. How many free throws did she make at the first practice?

- (A) 3 (B) 6 (C) 9 (D) 12 (E) 15

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 2

Not yet answered

Points out of 6

In the expression $c \cdot a^b - d$, the values of a , b , c , and d are 0, 1, 2, and 3, although not necessarily in that order. What is the maximum possible value of the result?

- (A) 5 (B) 6 (C) 8 (D) 9 (E) 10

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 3

Not yet answered

Points out of 6

If x and y are positive integers for which $2^x 3^y = 1296$, what is the value of $x + y$?

- (A) 8 (B) 9 (C) 10 (D) 11 (E) 12

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 4

Not yet answered

Points out of 6

An integer x , with $10 \leq x \leq 99$, is to be chosen. If all choices are equally likely, what is the probability that at least one digit of x is a 7?

- (A) $\frac{1}{9}$ (B) $\frac{1}{5}$ (C) $\frac{19}{90}$ (D) $\frac{2}{9}$ (E) $\frac{1}{3}$

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 5

Not yet answered

Points out of 6

On a trip from the United States to Canada, Isabella took d U.S. dollars. At the border she exchanged them all, receiving 10 Canadian dollars for every 7 U.S. dollars. After spending 60 Canadian dollars, she had d Canadian dollars left. What is the sum of the digits of d ?

- (A) 5 (B) 6 (C) 7 (D) 8 (E) 9

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 6

Not yet answered

Points out of 6

Minneapolis-St. Paul International Airport is 8 miles southwest of downtown St. Paul and 10 miles southeast of downtown Minneapolis. Which of the following is closest to the number of miles between downtown St. Paul and downtown Minneapolis?

- (A) 13 (B) 14 (C) 15 (D) 16 (E) 17

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 7

Not yet answered

Points out of 6

A square has sides of length 10, and a circle centered at one of its vertices has radius 10. What is the area of the union of the regions enclosed by the square and the circle?

(A) $200 + 25\pi$ (B) $100 + 75\pi$ (C) $75 + 100\pi$ (D) $100 + 100\pi$ (E) $100 + 125\pi$

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 8

Not yet answered

Points out of 6

A grocer makes a display of cans in which the top row has one can and each lower row has two more cans than the row above it. If the display contains 100 cans, how many rows does it contain?

(A) 5 (B) 8 (C) 9 (D) 10 (E) 11

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 9

Not yet answered

Points out of 6

The point $(-3, 2)$ is rotated 90° clockwise around the origin to point B . Point B is then reflected over the line $x = y$ to point C . What are the coordinates of C ?

(A) $(-3, -2)$ (B) $(-2, -3)$ (C) $(2, -3)$ (D) $(2, 3)$ (E) $(3, 2)$

Select one:

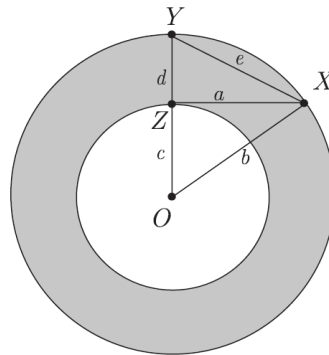
- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 10

Not yet answered

Points out of 6

An annulus is the region between two concentric circles. The concentric circles in the figure have radii b and c , with $b > c$. Let OX be a radius of the larger circle, let XZ be tangent to the smaller circle at Z , and let OY be the radius of the larger circle that contains Z . Let $a = XZ$, $d = YZ$, and $e = XY$.



What is the area of the annulus?

- (A) πa^2 (B) πb^2 (C) πc^2 (D) πd^2 (E) πe^2

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 11

Not yet answered

Points out of 6

All the students in an algebra class took a 100-point test. Five students scored 100, each student scored at least 60, and the mean score was 76. What is the smallest possible number of students in the class?

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

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 12

Not yet answered

Points out of 6

In the sequence 2001, 2002, 2003, . . . , each term after the third is found by subtracting the previous term from the sum of the two terms that precede that term. For example, the fourth term is $2001 + 2002 - 2003 = 2000$. What is the 2004th term in this sequence?

(A) -2004 (B) -2 (C) 0 (D) 4003 (E) 6007

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 13

Not yet answered

Points out of 6

If $f(x) = ax + b$ and $f^{-1}(x) = bx + a$ with a and b real, what is the value of $a + b$?

(A) -2 (B) -1 (C) 0 (D) 1 (E) 2

Select one:

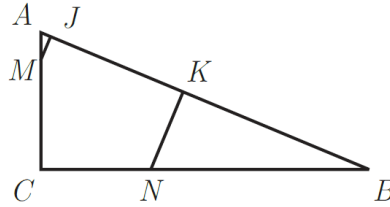
- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 14

Not yet answered

Points out of 6

In $\triangle ABC$, $AB = 13$, $AC = 5$, and $BC = 12$. Points M and N lie on AC and BC , respectively, with $CM = CN = 4$. Points J and K are on AB so that MJ and NK are perpendicular to AB .



What is the area of pentagon $CMJKN$?

- (A) 15 (B) $\frac{81}{5}$ (C) $\frac{205}{12}$ (D) $\frac{240}{13}$ (E) 20

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 15

Not yet answered

Points out of 6

The two digits in Jack's age are the same as the digits in Bill's age, but in reverse order. In five years Jack will be twice as old as Bill will be then. What is the difference in their current ages?

- (A) 9 (B) 18 (C) 27 (D) 36 (E) 45

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 16

Not yet answered

Points out of 6

A function f is defined by $f(z) = i\bar{z}$, where $i = \sqrt{-1}$ and \bar{z} is the complex conjugate of z . How many values of z satisfy both $|z| = 5$ and $f(z) = z$?

- (A) 0 (B) 1 (C) 2 (D) 4 (E) 8

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 17

Not yet answered

Points out of 6

For some real numbers a and b , the equation

$$8x^3 + 4ax^2 + 2bx + a = 0$$

has three distinct positive roots. If the sum of the base-2 logarithms of the roots is 5, what is the value of a ?

- (A) -256 (B) -64 (C) -8 (D) 64 (E) 256

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 18

Not yet answered

Points out of 6

Points A and B are on the parabola $y = 4x^2 + 7x - 1$, and the origin is the midpoint of AB . What is the length of AB ?

- (A) $2\sqrt{5}$ (B) $5 + \frac{\sqrt{2}}{2}$ (C) $5 + \sqrt{2}$ (D) 7 (E) $5\sqrt{2}$

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 19

Not yet answered

Points out of 6

A truncated cone has horizontal bases with radii 18 and 2. A sphere is tangent to the top, bottom, and lateral surface of the truncated cone. What is the radius of the sphere?

- (A) 6 (B) $4\sqrt{5}$ (C) 9 (D) 10 (E) $6\sqrt{3}$

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 20

Not yet answered

Points out of 6

Each face of a cube is painted either red or blue, each with probability $1/2$. The color of each face is determined independently. What is the probability that the painted cube can be placed on a horizontal surface so that the four vertical faces are all the same color?

- (A) $\frac{1}{4}$ (B) $\frac{5}{16}$ (C) $\frac{3}{8}$ (D) $\frac{7}{16}$ (E) $\frac{1}{2}$

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 21

Not yet answered

Points out of 6

The graph of $2x^2 + xy + 3y^2 - 11x - 20y + 40 = 0$ is an ellipse in the first quadrant of the xy -plane. Let a and b be the maximum and minimum values of $\frac{y}{x}$ over all points (x, y) on the ellipse. What is the value of $a + b$?

- (A) 3 (B) $\sqrt{10}$ (C) $\frac{7}{2}$ (D) $\frac{9}{2}$ (E) $2\sqrt{14}$

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 22

Not yet answered

Points out of 6

The square

50	b	c
d	e	f
g	h	2

is a multiplicative magic square. That is, the product of the numbers in each row, column, and diagonal is the same. If all the entries are positive integers, what is the sum of the possible values of g ?

- (A) 10 (B) 25 (C) 35 (D) 62 (E) 136

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 23

Not yet answered

Points out of 6

The polynomial $x^3 - 2004x^2 + mx + n$ has integer coefficients and three distinct positive zeros. Exactly one of these is an integer, and it is the sum of the other two. How many values of n are possible?

- (A) 250,000 (B) 250,250 (C) 250,500 (D) 250,750 (E) 251,000

Select one:

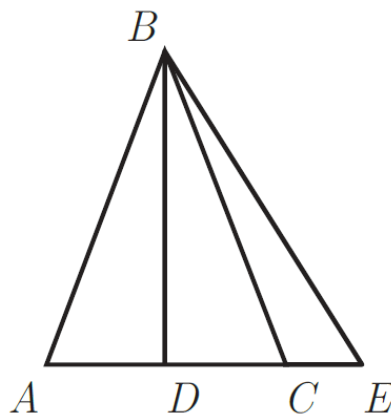
- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 24

Not yet answered

Points out of 6

In $\triangle ABC$, $AB = BC$, and \overline{BD} is an altitude. Point E is on the extension of \overline{AC} such that $BE = 10$. The values of $\tan \angle CBE$, $\tan \angle DBE$, and $\tan \angle ABE$ form a geometric progression, and the values of $\cot \angle DBE$, $\cot \angle CBE$, $\cot \angle DBC$ form an arithmetic progression.



What is the area of $\triangle ABC$?

- (A) 16 (B) $\frac{50}{3}$ (C) $10\sqrt{3}$ (D) $8\sqrt{5}$ (E) 18

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)

Question 25

Not yet answered

Points out of 6

Given that 2^{2004} is a 604-digit number whose first digit is 1, how many elements of the set $S = \{2^0, 2^1, 2^2, \dots, 2^{2003}\}$ have a first digit of 4?

(A) 194 (B) 195 (C) 196 (D) 197 (E) 198

Select one:

- A
- B
- C
- D
- E
- Leave blank (1.5 points)