2023 AMC 10A

Try this exam as a timed Mock Exam on the
[ZIML Practice Page (click here)]

View answers and concepts tested in our
[2023 AMC 10A+12A Blog Post (click here)]

Question 1

Not yet answered

Points out of 6

Cities A and B are 45 miles apart. Alicia lives in A and Beth lives in B. Alicia bikes towards B at 18 miles per hour. Leaving at the same time, Beth bikes toward A at 12 miles per hour. How many miles from City A will they be when they meet?

$\textbf{(A)}\ 20 \qquad \textbf{(B)}\ 24 \qquad \textbf{(C)}\ 25 \qquad \textbf{(D)}\ 26 \qquad \textbf{(E)}\ 27$

Select one:

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

Question 2

Not yet answered

Points out of 6

The weight of $\frac{1}{3}$ of a large pizza together with $3\frac{1}{2}$ cups of orange slices is the same as the weight of $\frac{3}{4}$ of a large pizza together with $\frac{1}{2}$ cup of orange slices. A cup of orange slices weighs $\frac{1}{4}$ of a pound. What is the weight, in pounds, of a large pizza?

$\textbf{(A)}\ 1\frac{4}{5} \qquad \textbf{(B)}\ 2 \qquad \textbf{(C)}\ 2\frac{2}{5} \qquad \textbf{(D)}\ 3 \qquad \textbf{(E)}\ 3\frac{3}{5}$

Select one:

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

Question 3

Not yet answered

Points out of 6

How many positive perfect squares less than 2023 are divisible by 5?

$\textbf{(A)}\ 8 \qquad \textbf{(B)}\ 9 \qquad \textbf{(C)}\ 10 \qquad \textbf{(D)}\ 11 \qquad \textbf{(E)}\ 12$

Select one:

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

Question 4

Not yet answered

Points out of 6

A quadrilateral has all integer sides lengths, a perimeter of 26, and one side of length 4. What is the greatest possible length of one side of this quadrilateral?

$\textbf{(A)}\ 9 \qquad \textbf{(B)}\ 10 \qquad \textbf{(C)}\ 11 \qquad \textbf{(D)}\ 12 \qquad \textbf{(E)}\ 13$

Select one:

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

Question 5

Not yet answered

Points out of 6

How many digits are in the base-ten representation of $8^5 \cdot 5^{10} \cdot 15^5$?

$\textbf{(A)}\ 14 \qquad \textbf{(B)}\ 15 \qquad \textbf{(C)}\ 16 \qquad \textbf{(D)}\ 17 \qquad \textbf{(E)}\ 18$

Select one:

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

Question 6

Not yet answered

Points out of 6

An integer is assigned to each vertex of a cube. The value of an edge is defined to be the sum of the values of the two vertices it touches, and the value of a face is defined to be the sum of the values of the four edges surrounding it. The value of the cube is defined as the sum of the values of its six faces. Suppose the sum of the integers assigned to the vertices is 21. What is the value of the cube?

$\textbf{(A)}\ 42 \qquad \textbf{(B)}\ 63 \qquad \textbf{(C)}\ 84 \qquad \textbf{(D)}\ 126 \qquad \textbf{(E)}\ 252$

Select one:

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

Question 7

Not yet answered

Points out of 6

Janet rolls a standard 6-sided die 4 times and keeps a running total of the numbers she rolls. What is the probability that at some point, her running total will equal 3?

$\textbf{(A)}\ \frac{2}{9} \qquad \textbf{(B)}\ \frac{49}{216} \qquad \textbf{(C)}\ \frac{25}{108} \qquad \textbf{(D)}\ \frac{17}{72} \qquad \textbf{(E)}\ \frac{13}{54}$

Select one:

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

Question 8

Not yet answered

Points out of 6

Barb the baker has developed a new temperature scale for her bakery called the Breadus scale, which is a linear function of the Fahrenheit scale. Bread rises at 110 degrees Fahrenheit, which is 0 degrees on the Breadus scale. Bread is baked at 350 degrees Fahrenheit, which is 100 degrees on the Breadus scale. Bread is done when its internal temperature is 200 degrees Fahrenheit. What is this in degrees on the Breadus scale?

$\textbf{(A)}\ 33 \qquad \textbf{(B)}\ 34.5 \qquad \textbf{(C)}\ 36 \qquad \textbf{(D)}\ 37.5 \qquad \textbf{(E)}\ 39$

Select one:

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

Question 9

Not yet answered

Points out of 6

A digital display shows the current date as an 8-digit integer consisting of a 4-digit year, followed by a 2-digit month, followed by a 2-digit date within the month. For example, Arbor Day this year is displayed as 20230428. For how many dates in 2023 will each digit appear an even number of times in the 8-digital display for that date?

$\textbf{(A)}\ 5 \qquad \textbf{(B)}\ 6 \qquad \textbf{(C)}\ 7 \qquad \textbf{(D)}\ 8 \qquad \textbf{(E)}\ 9$

Select one:

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

Question **10**

Not yet answered

Points out of 6

Maureen is keeping track of the mean of her quiz scores this semester. If Maureen scores an 11 on the next quiz, her mean will increase by 1. If she scores an 11 on each of the next three quizzes, her mean will increase by 2. What is the mean of her quiz scores currently?

$\textbf{(A)}\ 4 \qquad \textbf{(B)}\ 5 \qquad \textbf{(C)}\ 6 \qquad \textbf{(D)}\ 7 \qquad \textbf{(E)}\ 8$

Select one:

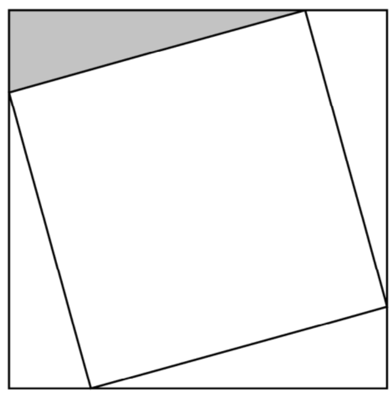
- **A**
- **B**
- **C**
- **D**
- **E**
- **Leave blank (1.5 points)**

Question **11**

Not yet answered

Points out of 6

A square of area 2 is inscribed in a square of area 3, creating four congruent triangles, as shown below. What is the ratio of the shorter leg to the longer leg in the shaded right triangle?



$\textbf{(A)}\ \frac{1}{5} \qquad \textbf{(B)}\ \frac{1}{4} \qquad \textbf{(C)}\ 2-\sqrt{3}$

$\textbf{(D)}\ \sqrt{3}-\sqrt{2} \qquad \textbf{(E)}\ \sqrt{2}-1$

Select one:

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

Question 12

Not yet answered

Points out of 6

How many three-digit positive integers N satisfy the following properties?

- The number N is divisible by 7.
- The number formed by reversing the digits of N is divisible by 5.

$\textbf{(A)}\ 13 \qquad \textbf{(B)}\ 14 \qquad \textbf{(C)}\ 15 \qquad \textbf{(D)}\ 16 \qquad \textbf{(E)}\ 17$

Select one:

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

Question 13

Not yet answered

Points out of 6

Abdul and Chiang are standing 48 feet apart in a field. Bharat is standing in the same field as far from Abdul as possible so that the angle formed by his lines of sight to Abdul and Chiang measures 60°. What is the square of the distance (in feet) between Abdul and Bharat?

$\textbf{(A)}\ 1728 \qquad \textbf{(B)}\ 2601 \qquad \textbf{(C)}\ 3072 \qquad \textbf{(D)}\ 4608 \qquad \textbf{(E)}\ 6912$

Select one:

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

Question 14

Not yet answered

Points out of 6

A number is chosen at random from among the first 100 positive integers, and a positive integer divisor of that number is then chosen at random. What is the probability that the chosen divisor is divisible by 11?

$\textbf{(A)}\ \frac{4}{100} \qquad \textbf{(B)}\ \frac{9}{200} \qquad \textbf{(C)}\ \frac{1}{20} \qquad \textbf{(D)}\ \frac{11}{200} \qquad \textbf{(E)}\ \frac{3}{50}$

Select one:

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

Question 15

Not yet answered

Points out of 6

An even number of circles are nested, starting with a radius of 1 and increasing by 1 each time, all sharing a common point. The region between every other circle is shaded, starting with the region inside the circle of radius 2 but outside the circle of radius 1. An example showing 8 circles is displayed below. What is the least number of circles needed to make the total shaded area at least 2023π?

$\textbf{(A)}\ 46 \qquad \textbf{(B)}\ 48 \qquad \textbf{(C)}\ 56 \qquad \textbf{(D)}\ 60 \qquad \textbf{(E)}\ 64$

Select one:

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

Question 16

Not yet answered

Points out of 6

In a table tennis tournament every participant played every other participant exactly once. Although there were twice as many right-handed players as left-handed players, the number of games won by left-handed players was 40% more than the number of games won by right-handed players. (There were no ties and no ambidextrous players.) What is the total number of games played?

$\textbf{(A)}\ 15 \qquad \textbf{(B)}\ 36 \qquad \textbf{(C)}\ 45 \qquad \textbf{(D)}\ 48 \qquad \textbf{(E)}\ 66$

Select one:

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

Question 17

Not yet answered

Points out of 6

Let $ABCD$ be a rectangle with $AB = 30$ and $BC = 28$. Point P and Q lie on $\overline{BC}$ and $\overline{CD}$, respectively, so that all sides of $\triangle ABP$, $\triangle PCQ$, and $\triangle QDA$ have integer lengths. What is the perimeter of $\triangle APQ$?

$\textbf{(A)}\ 84 \qquad \textbf{(B)}\ 86 \qquad \textbf{(C)}\ 88 \qquad \textbf{(D)}\ 90 \qquad \textbf{(E)}\ 92$

Select one:

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

Question 18

Not yet answered

Points out of 6

A rhombic dodecahedron is a solid with 12 congruent rhombus faces. At every vertex, 3 or 4 edges meet, depending on the vertex. How many vertices have exactly 3 edges meet?

$\textbf{(A)}\ 5 \qquad \textbf{(B)}\ 6 \qquad \textbf{(C)}\ 7 \qquad \textbf{(D)}\ 8 \qquad \textbf{(E)}\ 9$

Select one:

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

Question 19

Not yet answered

Points out of 6

The line segment formed by $A(1,2)$ and $B(3,3)$ is rotated to the line segment formed by $A'(3,1)$ and $B'(4,3)$ about the point $P(r,s)$. What is $|r-s|$?

$\textbf{(A)}\ \frac{1}{4} \qquad \textbf{(B)}\ \frac{1}{2} \qquad \textbf{(C)}\ \frac{3}{4} \qquad \textbf{(D)}\ \frac{2}{3} \qquad \textbf{(E)}\ 1$

Select one:

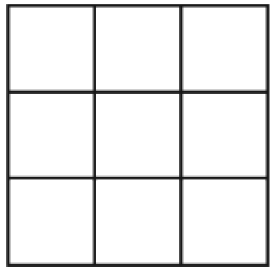
- A
- B
- C
- D
- E
- **Leave blank (1.5 points)**

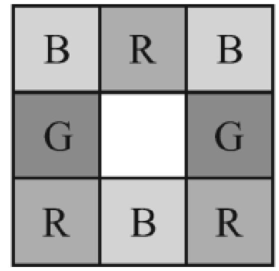
Question **20**

Not yet answered

Points out of 6

Each square in a 3×3 grid of squares is colored red, white, blue, or green so that every 2×2 square contains one square of each color. One such coloring is shown on the right below. How many different colorings are possible?





$\textbf{(A)}\ 24 \qquad \textbf{(B)}\ 48 \qquad \textbf{(C)}\ 60 \qquad \textbf{(D)}\ 72 \qquad \textbf{(E)}\ 96$

Select one:

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

Question **21**

Not yet answered

Points out of 6

Let $P(x)$ be the unique polynomial of minimal degree with the following properties:

- $P(x)$ has a leading coefficient 1,
- 1 is a root of $P(x) - 1$,
- 2 is a root of $P(x-2)$,
- 3 is a root of $P(3x)$, and
- 4 is a root of $4P(x)$.

The roots of $P(x)$ are integers, with one exception. The root that is not an integer can be written as $\frac{m}{n}$, where m and n are relatively prime integers. What is $m+n$?

$\textbf{(A)}\ 41 \qquad \textbf{(B)}\ 43 \qquad \textbf{(C)}\ 45 \qquad \textbf{(D)}\ 47 \qquad \textbf{(E)}\ 49$

Select one:

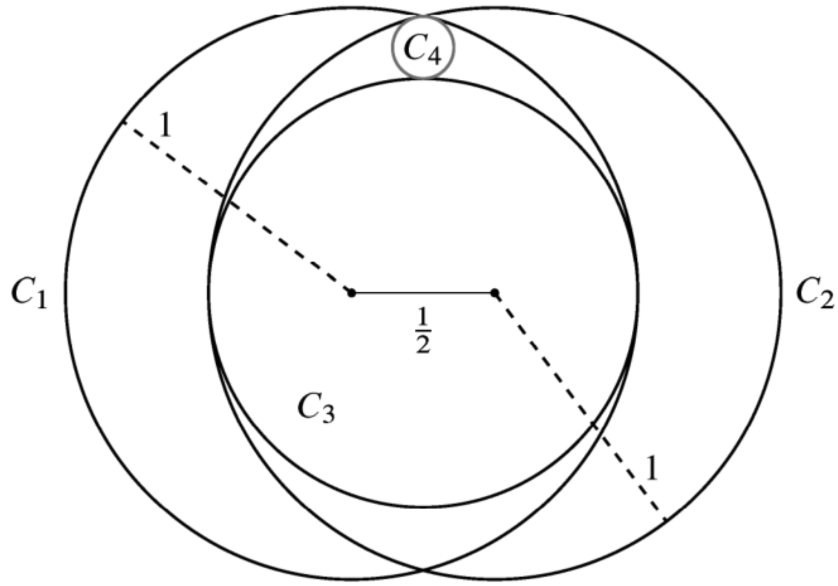
- ○ **A**
- ○ **B**
- ○ **C**
- ○ **D**
- ○ **E**
- ○ **Leave blank (1.5 points)**

Question **22**

Not yet answered

Points out of 6

Circle C_1 and C_2 each have radius 1, and the distance between their centers is $\frac{1}{2}$. Circle C_3 is the largest circle internally tangent to both C_1 and C_2. Circle C_4 is internally tangent to both C_1 and C_2 and externally tangent to C_3. What is the radius of C_4?



(A) $\frac{1}{14}$ **(B)** $\frac{1}{12}$ **(C)** $\frac{1}{10}$ **(D)** $\frac{3}{28}$ **(E)** $\frac{1}{9}$

Select one:

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

Question **23**

Not yet answered

Points out of 6

If the positive integer c has positive integer divisors a and b with $c = ab$, then a and b are said to be *complementary* divisors of c. Suppose that N is a positive integer that has one complementary pair of divisors that differ by 20 and another pair of complementary divisors that differ by 23. What is the sum of the digits of N?

$\textbf{(A)}\ 9 \qquad \textbf{(B)}\ 13 \qquad \textbf{(C)}\ 15 \qquad \textbf{(D)}\ 17 \qquad \textbf{(E)}\ 19$

Select one:

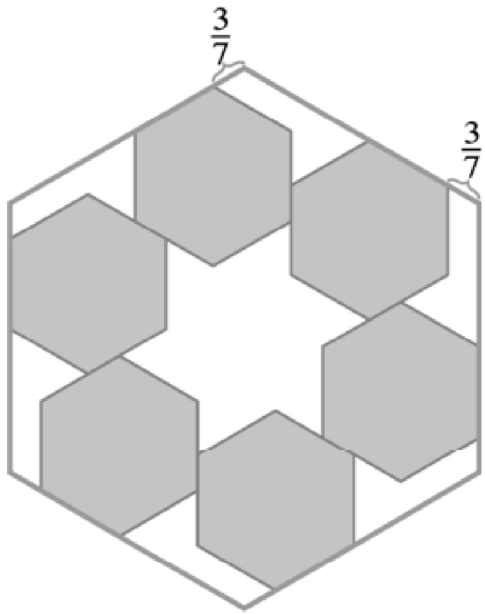
- **A**
- **B**
- **C**
- **D**
- **E**
- **Leave blank (1.5 points)**

Question 24

Not yet answered

Points out of 6

Six regular hexagonal blocks of side length 1 unit are arranged inside a regular hexagonal frame. Each block lies along an inside edge of the frame and is aligned with two other blocks, as shown in the figure below. The distance from any corner of the frame to the nearest vertex of a block is $\frac{3}{7}$ unit. What is the area of the region inside the frame not occupied by the blocks?



(A) $\frac{13\sqrt{3}}{3}$ **(B)** $\frac{216\sqrt{3}}{49}$ **(C)** $\frac{9\sqrt{3}}{2}$

(D) $\frac{14\sqrt{3}}{3}$ **(E)** $\frac{243\sqrt{3}}{49}$

Select one:

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

Question 25

Not yet answered

Points out of 6

If A and B are vertices of a polyhedron, define the *distance* $d(A, B)$ to be the minimum number of edges of the polyhedron one must traverse in order to connect A and B. For example, if $\overline{AB}$ is an edge of the polyhedron, then $d(A, B) = 1$, but if $\overline{AC}$ and $\overline{CB}$ are edges and $\overline{AB}$ is not an edge, then $d(A, B) = 2$. Let Q, R, and S be randomly chosen distinct vertices of a regular icosahedron (regular polyhedron made up of 20 equilateral triangles). What is the probability that $d(Q, R) > d(R, S)$?

$\textbf{(A)}\ \frac{7}{22} \qquad \textbf{(B)}\ \frac{1}{3} \qquad \textbf{(C)}\ \frac{3}{8} \qquad \textbf{(D)}\ \frac{5}{12} \qquad \textbf{(E)}\ \frac{1}{2}$

Select one:

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