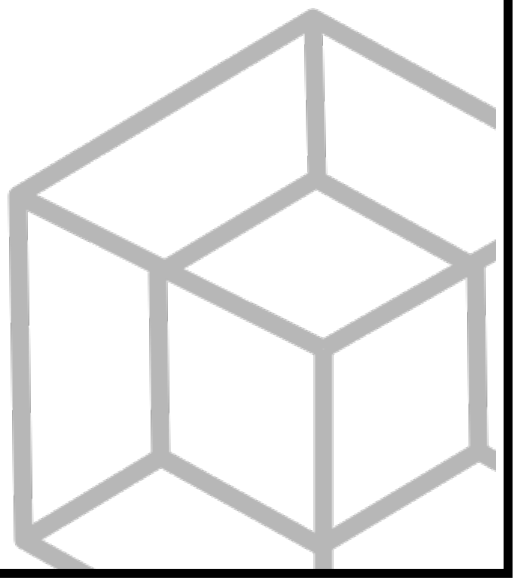
Ze Committee ZeMC

Ze Committee Ze Math Competition

2nd Annual

ZeMC 8

Sunday, January 1st, 2023



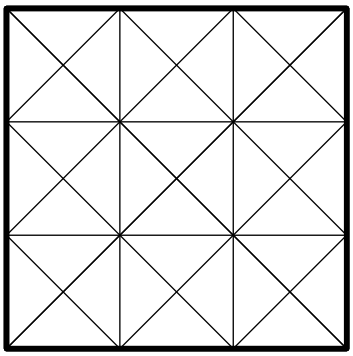
INSTRUCTIONS

1. DO NOT OPEN THIS BOOKLET UNTIL YOU TELL YOU TO BEGIN.
2. This is a 25 question multiple choice contest. For each question, only one answer choice is correct.
3. Submit your answers by PMing them through AoPS to "ihatemath123", or DMing them through Discord to "imagine dragon#3311". If you use Discord, please specify your AoPS username.
   You may format your answers in any way, as long as it is clear which problem each answer corresponds to.
   If you wish to remain anonymous on the leaderboard, or wish to remain anonymous if your score is below a certain threshold, make sure to specify this in your message.
   DO NOT edit your message; you may be considered for cheating.
4. You should receive a response with your score and distribution within 24 hours, in addition to a link with access to a private discussion forum.
5. SCORING: You will receive 1 point for each correct answer, 0 points for each problem left unanswered, and 0 points for each incorrect answer.
6. Only blank scratch paper, rulers, and erasers are allowed as aids. Prohibited materials include calculators, smartwatches, phones, computing devices, compasses, protractors, and graph paper. No problems on the contest require the use of a calculator.
7. Figures are not necessarily drawn to scale.
8. You will have 40 minutes to complete the contest once you tell you to begin.

The Ze Committee ZeMC Office reserves the right to disqualify scores from an individual if it determines that the rules or the nonexistent required security procedures were not followed.

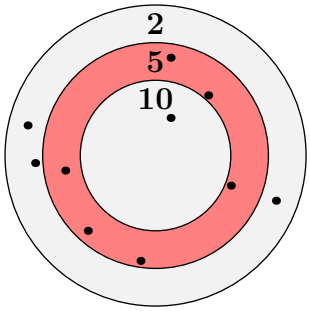
The publication, reproduction, or communication of the problems or solutions of this exam during the period when students are eligible to participate seriously jeopardizes the integrity of the results. Dissemination via phone, email, or digital media of any type during this period is a violation of the competition rules.

1. Shelly cuts a square sheet of paper into triangular pieces, shown below. How many pieces does she cut the paper into?



(A) 33 **(B)** 34 **(C)** 35 **(D)** 36 **(E)** 37

2. Ten darts are thrown at a dartboard. The darts land in the following marked locations:



The point value of each region is shown. What is the average score earned from all ten darts?

(A) 4.0 **(B)** 4.2 **(C)** 4.4 **(D)** 4.6 **(E)** 4.8

3. Luke glues two rectangles along one side, forming a square. If one of the rectangles has a width of 7 inches and a height of 5 inches, what is the perimeter, in inches, of the other rectangle?

(A) 16 **(B)** 18 **(C)** 20 **(D)** 22 **(E)** 24

4. Asha is three times older than Beth and Beth is two times older than Chloe. If Asha is 24 years older than Beth, how many years older is Beth than Chloe?

(A) 4 **(B)** 6 **(C)** 8 **(D)** 12 **(E)** 16

5. What is the product of the mixed fractions shown below?

$$1\frac{1}{2} \qquad 2\frac{2}{3} \qquad 3\frac{3}{4}$$

(A) 12 **(B)** 15 **(C)** 16 **(D)** 18 **(E)** 20

6. The "?" in the equation below represents a single nonzero digit. What is that digit?

$$\mathbf{508 \times ?97 = 303{,}276}$$

(A) 3 **(B)** 4 **(C)** 5 **(D)** 6 **(E)** 7

7. The table below shows the sunset and sunrise times for the longest and shortest days of 2023 in Honolulu. How many minutes longer is the longest day than the shortest day?

	Sunrise	Sunset
June 21, 2023	5:50 AM	7:16 PM
Dec 21, 2023	7:04 AM	5:55 PM

(A) 135 **(B)** 145 **(C)** 155 **(D)** 165 **(E)** 175

8. Anthony has 20 quarters and Bill has some dimes. The value of Anthony's quarters is twice as much as the value of Bill's dimes. How many coins does Bill have?

(A) 15 **(B)** 16 **(C)** 20 **(D)** 24 **(E)** 25

9. If a and b are positive integers such that $(a+1) \times (b+1) = 77$, what is $(a-1) \times (b-1)$?

(A) 27 **(B)** 35 **(C)** 39 **(D)** 45 **(E)** 49

10. Jake and Jessica each pick a real number. The average of 20 and Jake's number is Jessica's number. The average of 23 and Jessica's number is Jake's number. How much larger is Jake's number than Jessica's number?

(A) 1 **(B)** 2 **(C)** 3 **(D)** 4 **(E)** 5

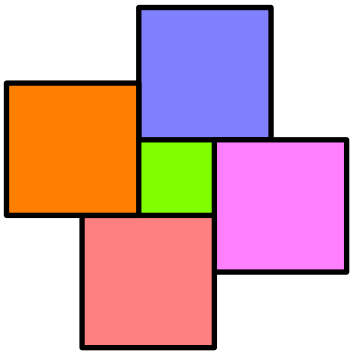
11. Enya rolls a fair six-sided die four times, rolling a different number each time. She notices that the product of the first two rolls is equal to the product of the last two rolls. If the sum of the first two rolls is 8, what is the sum of the last two rolls?

(A) 6 **(B)** 7 **(C)** 8 **(D)** 9 **(E)** 10

12. A tax on candy bars is raised from 2% to 20%. A candy store offers a k% discount on candy bars so that they cost as much as they did before the tax raise. What is k?

(A) 10 **(B)** 12 **(C)** 15 **(D)** 18 **(E)** 20

13. In the figure below, a unit square is surrounded by four, larger, congruent squares, such that each of the larger squares partially shares an edge with the unit square and two of the other larger squares. If the resulting figure has a perimeter of 48, what is its area?



(A) 120 **(B)** 122 **(C)** 124 **(D)** 126 **(E)** 128

14. A farmer is milking and feeding 40 cows. Whenever a cow has been both fed and milked, she receives a ribbon. After the farmer milks 40% and feeding 75% of the cows, there are 11 cows with ribbons. How many cows have not been fed or milked?

(A) 1 **(B)** 2 **(C)** 3 **(D)** 4 **(E)** 5

15. Landon wrote an expression, shown below, using the four standard operations (addition, subtraction, multiplication, division) and no parentheses. His brother erased all of the operations. However, Landon remembers that the expression was equal to an odd single-digit number. What is this number?

$$4 _ 6 _ 2 _ 8 = ?$$

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

16. Jason took ten quizzes in one semester of a class. The scores he earned are below, listed in the order he took the quizzes:

$$87, 90, 83, 95, 96, 92, 75, 89, 99, 91.$$

After receiving which grade was Jason's average quiz score the highest?

(A) 91 **(B)** 92 **(C)** 95 **(D)** 96 **(E)** 99

17. Six students were assigned a summer reading list, consisting of five books, titled A, B, C, D and E. The school librarian made a chart of which books each student read. A corner of the chart was accidentally ripped off.

	A	B	C	D	E
Ray			X		X
Victor	X	X	X		X
Charlie	X		X	X	
Adi		X	X		
Osvaldo		X			
Alexandre	X	X			

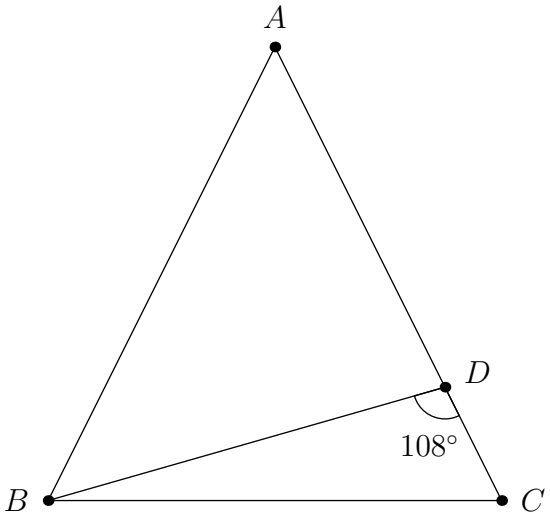
However, the librarian recalls the following information:

- More students read book E than any other book.
- Victor read more books than any other student.
- Ray read less books than any other student.

If c, d and e are the number of students that read books C, D and E, respectively, what is $c \times d \times e$?

(A) 20 **(B)** 30 **(C)** 40 **(D)** 50 **(E)** 60

18. In isosceles triangle ABC with $AB = AC$, let D be the unique point on side $\overline{AC}$ for which $AD = BD$. If $\angle BDC = 108°$, what is the measure of $\angle BCD$?



(A) 54° **(B)** 57° **(C)** 60° **(D)** 63° **(E)** 66°

19. Mr. Bacon leaves his house to go to work at the same time every day. When he drives to work at 60 miles per hour, he arrives at 8:29 AM. When he drives to work at 50 miles per hour, he arrives at 8:32 AM. What time does Mr. Bacon leave his house every day?

(A) 8:11 AM **(B)** 8:12 AM **(C)** 8:13 AM **(D)** 8:14 AM **(E)** 8:15 AM

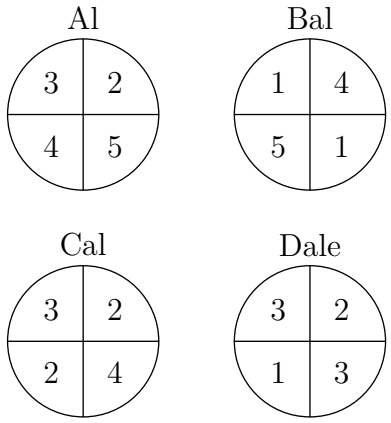
20. Ann, Binh, Cara, Don, Erian, and Finn sat in a circle in that order, each holding a number. Each person reported the sum of the two numbers held by themselves and the person to the right of them:

Ann: 29. Binh: 32. Cara: 14. Don: 5. Erian: 26.

What number did Finn report?

(A) 28 **(B)** 29 **(C)** 30 **(D)** 31 **(E)** 32

21. Al, Bal, Cal and Dale each have a spinner, shown below. If each of them spin their spinner twice and sum the two numbers they get, who is the most likely to get a sum of 6?

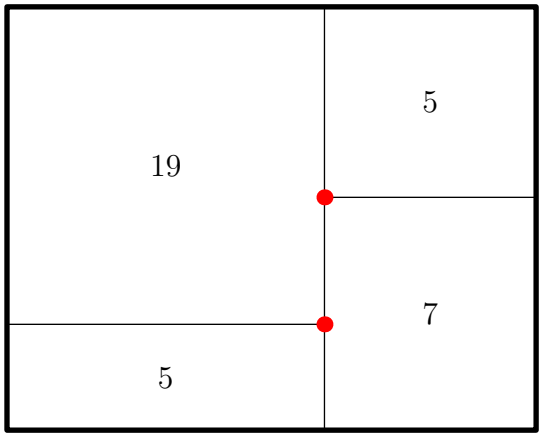


(A) Al **(B)** Cal **(C)** Dale **(D)** Al & Bal are equally likely
(E) Bal & Dale are equally likely

22. Forrest takes a two digit integer, finds the sum of its digits, and adds 36 to the result. When he reverses the digits of this sum, he gets the same number that he started with. What is the sum of all possible numbers that Forrest could have started with?

(A) 405 **(B)** 444 **(C)** 445 **(D)** 486 **(E)** 495

23. A rectangular window is constructed out of four rectangular panes, whose areas are shown in the diagram below. If the distance between the two marked points is 3, what is the perimeter of the entire window?



(A) 22 **(B)** 23 **(C)** 24 **(D)** 25 **(E)** 26

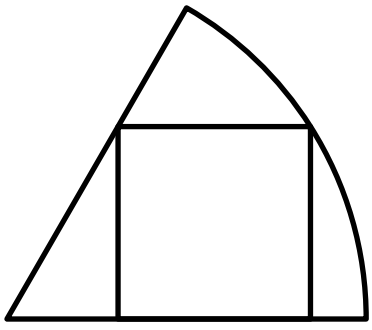
24. There are three clubs at a school: the math club, the physics club and the biology club. The following information is known:

- Among the fifteen students in the math club, seven of them participate in at least one other club.
- Among the twelve students in the physics club, three of them participate in at least one other club.
- Among the ten students in the biology club, nine participate in at least one other club.

How many students participate in at least one of these clubs?

(A) 23 **(B)** 24 **(C)** 25 **(D)** 26 **(E)** 27

25. In the diagram below, a square is inscribed in a circular sector with a measure of $60°$. If the area of the square is 36 and the area of the circular sector is $A\pi$, what is A?



(A) $12+6\sqrt{2}$ **(B)** $18+2\sqrt{2}$ **(C)** $16+2\sqrt{6}$ **(D)** $14+4\sqrt{3}$ **(E)** $18+2\sqrt{3}$

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DO NOT OPEN UNTIL Sunday, January 1st, 2023

Administration will disqualify your school's results.

- None of the information needed to administer this competition is contained in the ZeMC 8 Teacher's Manual. PLEASE DO NOT READ THE MANUAL AS IT DOES NOT EXIST.
- Answer sheets must be returned to the Ze Committee ZeMC office within 2.9 seconds of the competition administration. Use an overnight or 2-day shipping service, with a tracking number, to guarantee the timely arrival of these answer sheets. If you wish for all of the answer sheets to get thrown in an incinerator, USPS overnight is strongly recommended.
- The publication, reproduction or communication of the problems or solutions of this competition during the period when students are eligible to participate seriously jeopardizes the integrity of the results. Dissemination via phone, email, friends (if you have them), or digital media of any type during this period is a violation of competition rules.

The ZeMC competition series is made possible by the contributions of the following problem-writers and test-solvers:

Anchovy, asbodke, bissue, contactbibliophile, Geometry285, iamhungry, ihatemath123, Jiseop55406, kante314, Lasitha_Jayasinghe, mahaler, Olympushero, peace09, P_Groudon, raagavbala, RithwikGupta, Significant, smileymittens and themathboi101.

Thank you for taking our mock AMC!