wizEXPERT 2022

Good luck and most of all have fun.!

- calculators are not allowed
- you may use 75 minutes
- only a pencil, an eraser and scribbling paper are allowed
- results and prizes will arrive at school at the end of May
- answers will be posted on the website about March 29th
- solutions will be posted on the website about April 20th

wizEXPERT
WO students
HBO students

1. *Bella* is older than *Charlie* and younger than *Lily*.

If *Teddy* is older than *Bella*, which two persons could be the same age?

A. *Charlie* and *Teddy* **B.** *Teddy* and *Lily* **C.** *Lily* and *Charlie*
D. *Bella* and *Lily* **E.** *Teddy* and *Bella*

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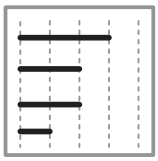
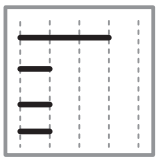
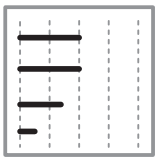
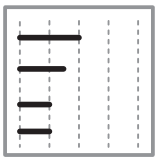
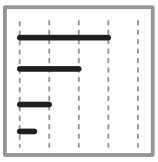
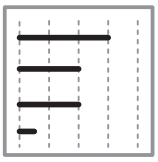
2. The diagram shows how much time Henry spent on four apps on his smartphone last week.
The apps are ordered from most to least time spent.
This week he spent half the time on two apps compared to last week.
On the other two the same amount of time.



What **cannot** be the diagram for this week?

A.  **B.**  **C.**  **D.**  **E.** 

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3. The product of the digits of a 10-digit integer is 15.

What is the sum of the digits of this number?

A. 8 **B.** 12 **C.** 15 **D.** 16 **E.** 20

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4. How many positive three-digit integers are divisible by 13?

A. 68 **B.** 69 **C.** 70 **D.** 76 **E.** 77

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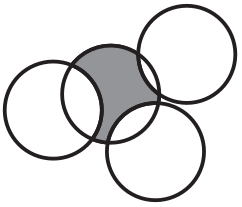
5. Four circles, each of radius 1, intersect as shown.



What is the perimeter of the grey region?

A. π **B.** $\frac{3\pi}{2}$ **C.** a number between $\frac{3\pi}{2}$ and 2π
D. 2π **E.** π^2

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6. If you write, in increasing order, all the integers from 2 to 2022 which use only 0s and 2s, what is the number in the middle of your list?

A. 200 **B.** 220 **C.** 222 **D.** 2000 **E.** 2002

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7. Looking at the water meter in the bathroom *Tony* notices that all digits are different.

How much water will be used until all digits are different again for the first time?

A. 0.006 m³ **B.** 0.034 m³ **C.** 0.086 m³ **D.** 0.137 m³ **E.** 1.048 m³

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8. How many real solutions does the equation $(x - 2)^2 + (x + 2)^2 = 0$ have?

A. 0 **B.** 1 **C.** 2 **D.** 3 **E.** 4

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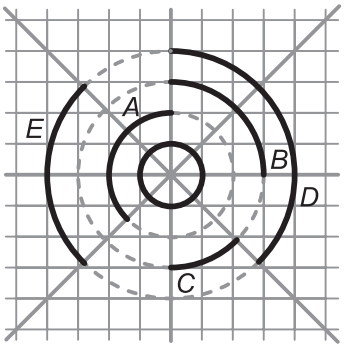
9. Four lines intersect, forming eight equal angles.



Which arc has the same length as the circle in the middle?

A. A **B.** B **C.** C **D.** D **E.** E

10. Let a, b and c be non zero numbers.
It is known that the numbers $-2a^4b^3c^2$ and $3a^3b^5c^{-4}$ have the same sign.

Which of the following is definitely true?

A. $ab > 0$ **B.** $b < 0$ **C.** $c > 0$ **D.** $bc > 0$ **E.** $a < 0$

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11. n a straight line we have marked the points A, B, C and D in this order, as seen in the figure.

We know that the distance between A and C is 12 cm and between B and D 18 cm.

What is the distance between the midpoints of the segments AB and CD?

A. 6 cm **B.** 9 cm **C.** 12 cm **D.** 15 cm **E.** 18 cm

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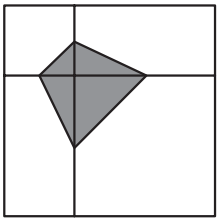
12. The big square is divided into two smaller squares and two equal rectangles.
The vertices of the grey quadrilateral of area 3 are the midpoints of the sides of the squares.



What is the area of the part of the big square that is not grey?

A. 12 **B.** 15 **C.** 18 **D.** 21 **E.** 24

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13. What is the greatest common divisor of $2^{2021} + 2^{2022}$ and $3^{2021} + 3^{2022}$?

A. 1 **B.** 2 **C.** 6 **D.** 12 **E.** 2^{2021}

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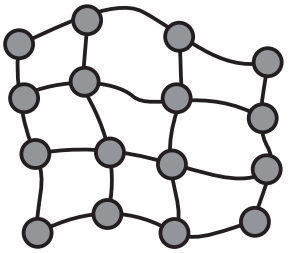
14. The map shows a region with 16 cities connected by roads.
The government wants to build power plants in some of the cities to generate enough electricity for all of the cities.
Each power plant can provide enough electricity for both its own citizens and for the citizens of neighbouring cities (the ones that are directly connected by a single road).



What is the fewest number of power plants that must be built?

A. 3 **B.** 4 **C.** 5 **D.** 6 **E.** 7

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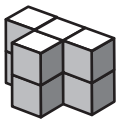
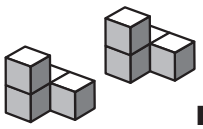
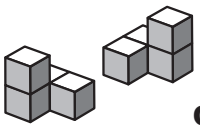
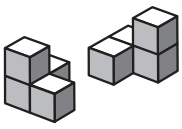
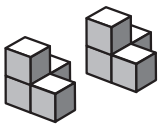
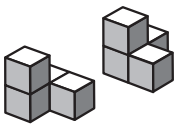
15. Which two pieces can be put together to build a shape that looks like this?



A.  **B.**  **C.**  **D.**  **E.** 

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16. *Martina* is playing in an 8 player tournament.
She knows she will beat everyone except *Ash*, who will beat everybody.
In the first round, players are classified randomly into four pairs, and the winner of each match proceeds to the second round.
In the second round, there are two matches and the winners of these matches proceed to the final.

What is the probability that *Martina* gets to the final?

A. $\frac{2}{7}$ **B.** $\frac{3}{7}$ **C.** $\frac{1}{2}$ **D.** $\frac{4}{7}$ **E.** 1

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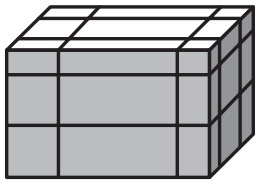
17. A cuboid of surface area S is cut by six planes as shown.
Each plane is parallel to a face, but its distance from the face is random.
Now the cuboid is separated in 27 smaller parts.



What is, in terms of S, the total surface area of all 27 smaller parts?

A. $2\,S$ **B.** $\frac{5}{2}S$ **C.** $3\,S$ **D.** $4\,S$ **E.** none of the foregoing

18. Five numbers have a mean of 24.
The mean of the three smallest numbers is 19 and the mean of the three largest numbers is 28.

What is the median of the five numbers?

A. 20 **B.** 21 **C.** 22 **D.** 23 **E.** 24

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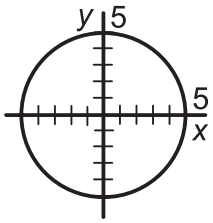
19. A circle centered at (0, 0) has radius 5.



For how many points on the perimeter of the circle are both coordinates integers?

A. 5 **B.** 8 **C.** 12 **D.** 16 **E.** 20

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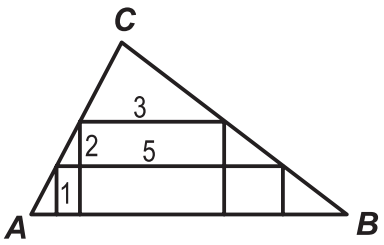
20. Two rectangles are inscribed inside a triangle *ABC*.
The dimensions of the rectangles are 1 × 5 and 2 × 3, respectively, as shown.



How long is the triangle's altitude from *C*?

A. $\frac{6}{5}$ **B.** $\frac{8}{3}$ **C.** 3 **D.** $\frac{7}{2}$ **E.** geen van de voorgaande

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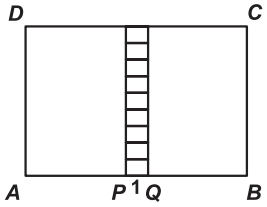
21. Rectangle *ABCD* is divided into nine small rectangles and two somewhat larger rectangles, as shown in the figure.
All these eleven rectangles are similar to the original large rectangle.
The orientation of the smallest rectangles is the same as that of the largest.



If the length of *PQ* is equal to 1, what is the perimeter of rectangle *ABCD* ?

A. 20 **B.** 24 **C.** 27 **D.** 30 **E.** 36

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22. How many positive 3-digit numbers are there that are equal to 5 times the product of their digits?

A. 1 **B.** 2 **C.** 3 **D.** 4 **E.** 5

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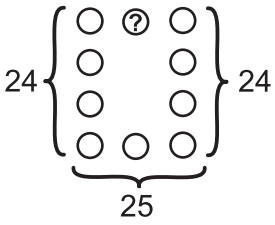
23. The numbers 1 to 10 are placed, once each, in the circles of the figure shown.
The sum of the numbers in the left column is 24, the sum of the numbers in the right column is also 24 and the sum of the numbers in the bottom row is 25.



Which number is in the circle with the question mark?

A. 1 **B.** 2 **C.** 4 **D.** 5 **E.** 6

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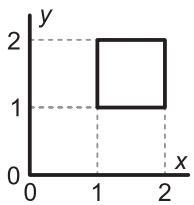
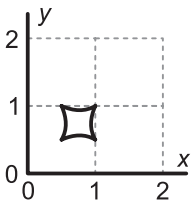
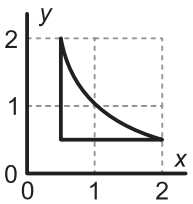
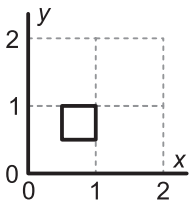
24. A square lies in a coordinate system as shown.
Each point (x,y) on the square is moved to $(\frac{1}{x}, \frac{1}{y})$.

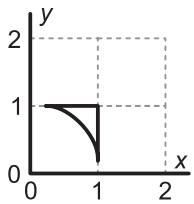


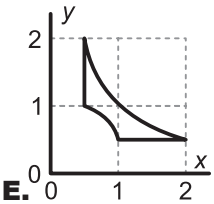
What will the resulting figure look like?

A. 

B. 

C. 

D. 

E. 

25. If N is a positive integer, how many integers are between $\sqrt{N^2 + N + 1}$ and $\sqrt{9N^2 + N + 1}$?

A. $N + 1$ **B.** $2N - 1$ **C.** $2N$ **D.** $2N + 1$ **E.** $3N$

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26. The vertices of a 20-gon are numbered from 1 to 20 in such a way that the numbers of adjacent vertices differ by 1 or 2.
The sides of the 20-gon whose ends differ only by 1 are colored red.

How many red sides are there?

A. 1 **B.** 2 **C.** 5 **D.** 10
E. there are several options

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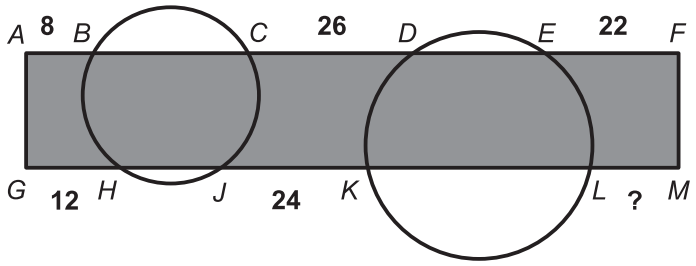
27. Two circles cut a rectangle $AFMG$, as shown.



The line segments outside the circles have length:
$AB = 8$, $CD = 26$, $EF = 22$, $GH = 12$ and $JK = 24$.

What is the length of LM?

A. 14 **B.** 15 **C.** 16 **D.** 17 **E.** 18

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28. Of a sequence a_n is given that $0 < a_1 < 1$.
For all $n \geq 1$, $a_{2n} = a_2 \cdot a_n + 1$ and $a_{2n+1} = a_2 \cdot a_n - 2$.
Given that $a_7 = 2$.

What is the value of a_2?

A. the same as a_1 **B.** 1 **C.** 2
D. 3 **E.** 4

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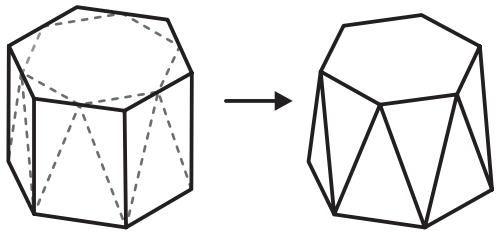
29. A regular hexagonal prism has its top corners shaved off, as shown.



The top face becomes a smaller regular hexagon and the six rectangular faces around the middle become twelve isosceles triangles of two different sizes.

What fraction of the original prism's volume has been lost?

A. $\frac{1}{12}$ **B.** $\frac{1}{6}$ **C.** $\frac{1}{6\sqrt{2}}$ **D.** $\frac{1}{6\sqrt{3}}$ **E.** $\frac{1}{4\sqrt{3}}$

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30. A volleyball match between teams from North Berracan and South Berracan is played in a sports hall with a rectangular stand. There are seats for the spectators in the stand.
There are 14 North Berracan supporters in each row and 11 South Berracan supporters in each column.
17 empty seats remain.

What is the smallest possible number of seats in the stand?

A. 500 **B.** 660 **C.** 690 **D.** 840 **E.** 994