MC:	+12 for the correct answer,	−3 for a wrong answer,	0 for unanswered
T / F:	+3 for each correct answer,	−3 for each wrong answer,	0 for unanswered
NUM:	+12 for the correct answer,	0 for wrong or unanswered	

Question 1 (MC):

Which of the following computations yields the largest result?

A: 20×23

B: $20 + 23$

C: $202 + 3$

D: 202×3

E: $20 \times 2 \times 3$

Question 2 (MC):

Which is the smallest odd positive integer which is neither a square nor a prime number?

A: 1

B: 6

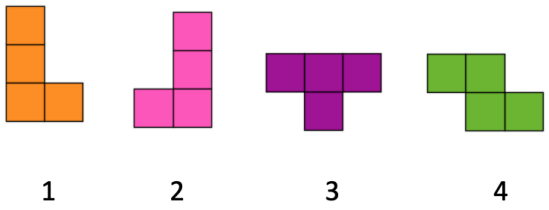
C: 9

D: 11

E: 15

Question 3 (MC):

Given the following 4 tetrominoes, Paul wants to create a 3×4-rectangle using three different tetrominoes. Which one can he not use?



A: Tetromino 1

B: Tetromino 2

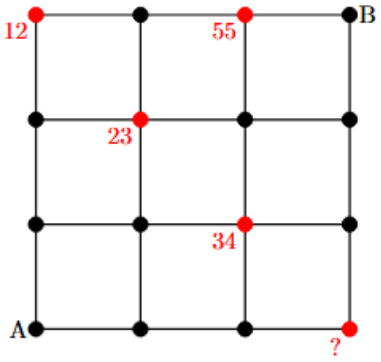
C: Tetromino 3

D: Tetromino 4

E: It is not possible to build a 3×4 rectangle using three of these tetrominoes

Question 4 (MC):

A hundred people are moving along the sides of the graph below from A to B. They are only allowed to move upwards or to the right. The numbers indicate how many people passed through that checkpoint. How many people passed the checkpoint indicated with the question mark?



A: 0
B: 17
C: 21
D: 31
E: 50

Question 5 (NUM):

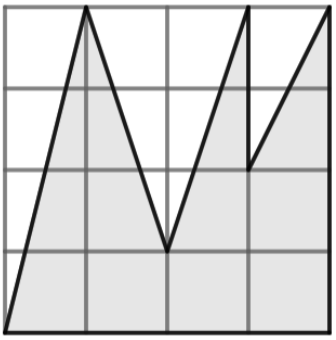
A father is 41 years old and his daughter is 10 years old. In how many years is the father twice as old as the daughter?

Question 6 (NUM):

Yanta has drawn a snowflake on a piece of paper. She notices that there are multiple ways to put a one-sided mirror on the drawing, such that a part of the drawing and its mirror image together look just like the original drawing.
How many ways are there to put the mirror?

Question 7 (NUM):

Given a square of side 20, we split every segment in 4 equal parts. What is the area of the grey region?



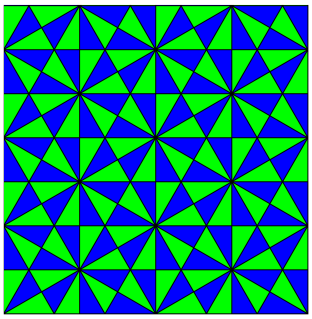
Question 8 (NUM):

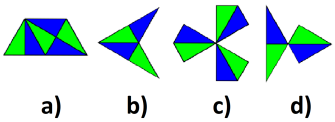
At ETH, Professor Angst is in a lecture hall and counts the number of students. It's a two-digit number such that he can rearrange the digits to obtain a square number. What is the largest possible number of students in the hall?

Question 9 (T/F):

Which shapes appear in this tiling?

A: a)
B: b)
C: c)
D: d)





Question 10 (T/F):

In a shop, there are a lot of candies in each of the colours red, yellow and green. All candy is either round or shaped like cube. Suppose that round candies are never green and yellow candies are always cube-shaped. Which of the following statements are necessarily true?

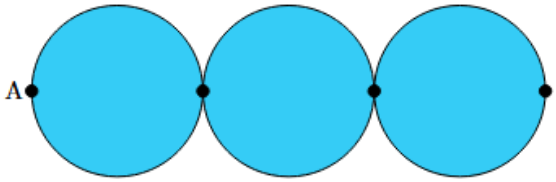
A: Red candies can be both shapes
B: Round candies are always red
C: Red candies are always round
D: Cube-shaped candies appear in at least 2 colours.

MC:	+16 for the correct answer,	−4 for a wrong answer,	0 for unanswered
T/F:	+4 for each correct answer,	−4 for each wrong answer,	0 for unanswered
NUM:	+16 for the correct answer,	0 for wrong or unanswered	

Question 11 (MC):

In a park, there are three round ponds. The shores of the ponds are partitioned into six segments in total, as depicted in the picture. Johann starts at point A and wants to walk along each of the six segments exactly once. How many different walks are possible?

A: 4
B: 6
C: 8
D: 10
E: 12



Question 12 (MC):

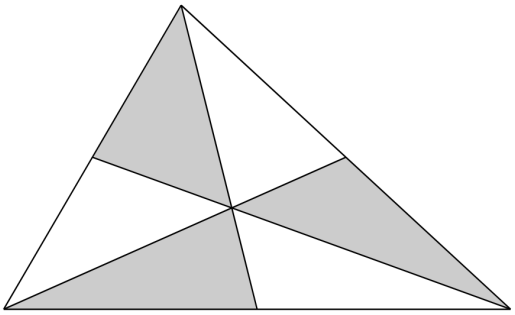
Jana creates a burger which has four layers between the buns: patty, cheese, salad and a tomato slice. How many ways are there to arrange the four layers if the cheese has to be somewhere (not necessarily directly) above the patty?

A: 3
B: 6
C: 8
D: 12
E: 16

Question 13 (MC):

Take an arbitrary triangle, which is divided by its medians into some regions. If the triangle has an area of 1, how big can the grey area be at most? (A median is a line connecting one vertex of a triangle with the midpoint of the opposite side.)

A: $\frac{1}{3}$
B: $\frac{1}{2}$
C: $\frac{3}{5}$
D: $\frac{2}{3}$
E: $\frac{3}{4}$



Question 14 (MC):

In a 2×2 grid Annalena writes down the numbers $1, 2, 3, 4$ in the four cells. For both rows, she calculates the product of the two numbers in that row. Then she does the same for the two columns and the diagonal from top left to bottom right. She then sums up the five values and gets the number k. Which of the following isn't a possible value for k?

A: 23

B: 25

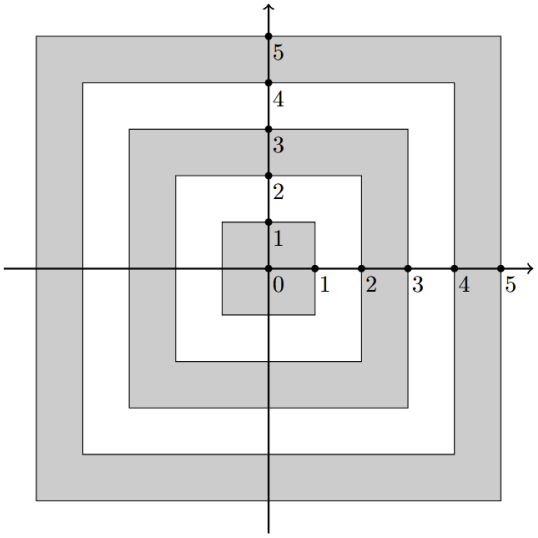
C: 27

D: 29

E: 31

Question 15 (NUM):

All of the quadrilaterals in the picture below are squares. How big is the grey area?



Question 16 (NUM):

What is the smallest value that the following expression can take on, over all integers $x \geq 42$?

$$\frac{2023}{1+\frac{1}{x}} + \frac{2023}{1+x}$$

Question 17 (NUM):

Anaëlle, Bibin, Clemens, David and Emily each got a paper with a number between 1 and 50. Their numbers are consecutive in some order. When comparing the numbers, they discover the following:

- Anaëlle: "My number is a prime number".
- Bibin: "Hey, mine too!".
- Clemens: "My number is right between Anaëlle's and Bibin's numbers, and it is divisible by 9".
- David: "My number is by 3 larger than Clemens' number".

What is Emily's number?

Question 18 (NUM):

The tap of Marco's bathtub is broken. Luckily, Marco has three buckets which measure 4, 5 and 16 litres respectively which he can use to fill the tub. What is the minimal number of times Marco has to fill up a bucket at the fountain to fill his tub with exactly 119 litres if he is not allowed to throw away any leftover water?

Question 19 (T/F):

Six people participated in a chess tournament, where everyone played against everyone else exactly once. The winner of each match got 2 points and the loser got 0 points. In a draw, both players got 1 point. On the final scoreboard, there are five consecutive people with $2, 3, 4, 5$ and 6 points respectively. How many points could the remaining person have?

A: 0

B: 1

C: 8

D: 9

Question 20 (T/F):

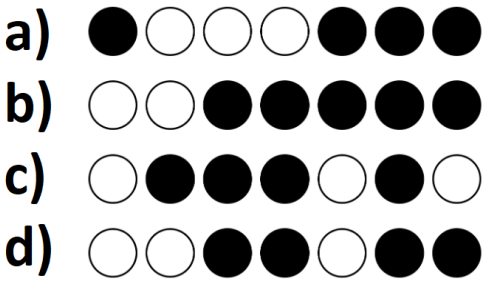
Valentin arranges 7 coins in a line, black on one side and white on the other. All the coins are black side up at the beginning. A move consists of Valentin picking a coin and flipping it and all the coins on its left. After precisely three moves, which of the following configurations are possible?

A: a)

B: b)

C: c)

D: d)



MC: +20 for the correct answer, –5 for a wrong answer, 0 for unanswered
T/F: +5 for each correct answer, –5 for each wrong answer, 0 for unanswered
NUM: +20 for the correct answer, 0 for wrong or unanswered

Question 21 (MC):

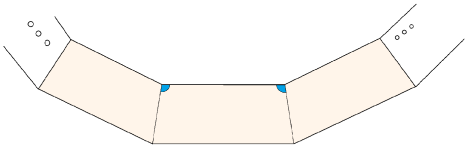
The number 1 is written on the blackboard. Matthew changes the number step by step. In each step he either multiplies it by 3 or he subtracts 1. What is the minimum number of steps needed to reach the number 2023?

A: 10
B: 11
C: 12
D: 13
E: 14

Question 22 (MC):

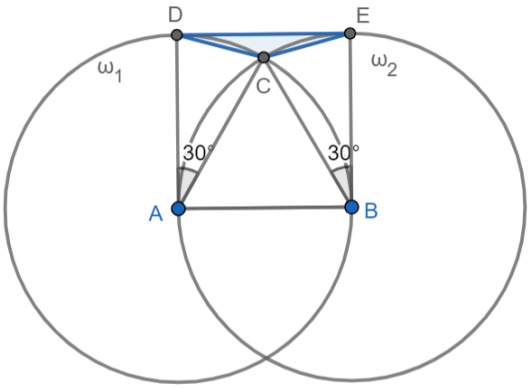
In a big room there are many tables with the shape of an isosceles trapezoid. One of the two bigger angles is 99°. Viviane wants to put together some of the tables along their two shortest sides, so that the tables form a closed ring. How many tables does she need?

A: 15
B: 18
C: 20
D: 24
E: 25



Question 23 (MC):

Let ω_1 be a circle of centre A and radius 2. Let B be a point on ω_1. Let ω_2 be a circle of centre B and radius 2. Let C be one of the intersections of both circles. Define D and E as the sketch presents. What is the area of triangle CDE?



A: $\pi - 3$
B: $2 - \sqrt{3}$
C: $\frac{1}{3}$
D: $\frac{1}{2}$
E: $\frac{\pi}{2} - \sqrt{3}$

Question 24 (MC):

How many times during a day (24 hours) are the minute hand and the hour hand of a clock opposite from each other?

A: 20

B: 22

C: 23

D: 24

E: 25

Question 25 (NUM):

Patrick forgot his 4-digit password, but he remembers the following properties:

- The two digit number formed by the first two digits, and the one formed by the last two digits are square numbers.
- The second and third digits are both prime numbers, and together they also form a two-digit prime number.

What is Patrick's password?

Question 26 (NUM):

In the following 6 boxes, the numbers 1 to 6 appear exactly once. What is the smallest possible value of the expression?

$$60 \cdot \left(\frac{\square}{\square\square} + \frac{\square}{\square\square} + \frac{\square}{\square\square} \right)$$

Question 27 (NUM):

On a blackboard there is a four-digit number. The digits are strictly decreasing when read from left to right and the middle two digits are each strictly smaller than the average of their neighbouring digits. What is the largest possible number on the blackboard?

Question 28 (NUM):

In a 4×4 grid, Henning wrote a number on each cell. Then, he observed that the sum of numbers in each column, in each row and in both main diagonals are the same. Call this number the magic sum. Unfortunately, Tanish was naughty and decided to erase some of the numbers, which leads to the displayed square. What is the magic sum?

7	27	29	
17		11	
9	21	19	
			25

Question 29 (T/F):

There are 10 distinct lines given in the two-dimensional plane. How many intersection points can there be in total?

A: 0

B: 1

C: 3

D: 45

Question 30 (T/F):

In a circle there are 2023 people. Each person is either a truth-teller or a liar. Each person in the circle says: "Both of my neighbours are liars!". Which of the following could be the number of truth-tellers?

A: 674

B: 675

C: 1011

D: 1012