Senior 1

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):

Arnaud, Luna and Rada have invented a system in which every letter in the alphabet has a whole number value and every word is worth the sum of its letters. ARNAUD is worth 15 and LUNA is worth 17. Given that A is worth 1 and L is worth 10, how much is RADA worth?

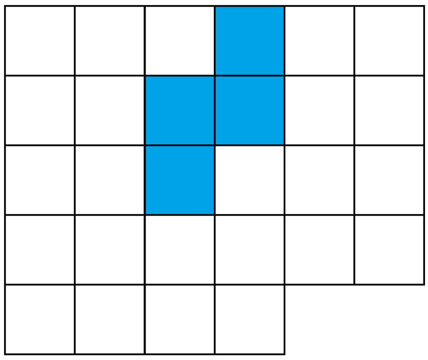
A: 5 B: 6 C: 7 D: 8 E: 9

Question 2 (INT):

What is the minimal number of cookies that can be evenly split (so that everyone receives an equal whole number of cookies) among $3, 4, 5$ or 6 people?

Question 3 (MC):

Viviane wants to paint the square tiles of her bathroom. She already coloured four of the tiles blue and would like to proceed painting the remaining tiles with other colours, such that every colour is used for exactly four tiles and these four tiles make the same shape as the blue tiles (the shape may be rotated and mirrored). What is the smallest possible number of tiles that have to remain uncoloured?



A: 0
B: 2
C: 4
D: 6
E: 8

Question 4 (INT):

Jana thinks of a five digit number and Tim wants to guess it. The first time he guesses 20489 and Jana tells him that exactly two digits are correct and in their right place. The next time he guesses 15673 and Jana says that exactly three digits are correct and in their right place. Given this information, what is the largest possible number that Jana could have thought of?

Question 5 (MC):

Iman draws a triangle on a piece of paper. She then measures the side lengths in centimeters and writes down the three numbers. One of the following triples she could not possibly obtain. Which one is it?

A: $1, 2, 2$ B: $1, 1, 3$ C: $2, 3, 3$ D: $3, 4, 5$ E: $2, 4, 5$

Question 6 (INT):

1000 inhabitants of Moutier filled out a survey. 625 said that they like to drink coffee. 462 said that they like to drink tea. 333 said they don't like either of the two.
How many of them like to drink both coffee and tea?

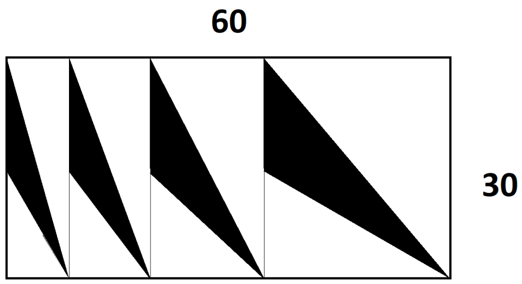
Question 7 (MC):

Quirin writes a single-digit number. Lia sees him and smiles. He then adds a second digit to the left of it, and Lia says "Wow! That's your previous number squared." He then adds a third digit to the left of it, and Lia exclaims "Amazing! That's your previous number squared again!". What number did Quirin write down originally?

A: 4 B: 5 C: 6 D: 7 E: 8

Question 8 (INT):

For his art project, Ivan subdivided a 30×60 canvas into parallel rectangles and painted a black triangle in each rectangle, as shown in the image. Given that the leftmost side of each triangle has length 15, what is the area of the canvas that remained white?



Question 9 (MTF):

Let a and b be positive integers. Which of the following statements are possible?

A: $a + b = 100$ and $a - b = 4$

B: $a \times b = 100$ and $a - b = 4$

C: $a + b = 100$ and $a/b = 4$

D: $a \times b = 100$ and $a/b = 4$

Question 10 (MTF):

There are four doors in a row, labelled A, B, C and D in this order. A door may lead to a room full of strawberries, but otherwise it leads to an empty room. Through his scientific investigations, Roger figured out four facts about the doors:

- At least one of the doors A, B and C leads to strawberries.
- There are two doors next to each other that both don't lead to strawberries.
- If A leads to strawberries, C leads to strawberries as well.
- B and D lead to the same room.

Behind which doors will Roger certainly find strawberries?

A: A B: B C: C D: D

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):

Anaëlle, Bibin, Cyril, David and Ema play a ping pong tournament. Two players play exactly once against each other. If Anaëlle and Bibin both won three times, what is the biggest possible number of wins that David and Ema can have combined?

A: 3 B: 4 C: 5 D: 6 E: 7

Question 12 (INT):

Each second, Barbara's broken clock randomly either jumps forward by 2 seconds or backwards by 1 second. If the clock initially shows the correct time, how many possible times could it show 1 minute later?

Question 13 (MC):

Viola, Alain, Ueli, Simonetta and Guy sit on a bench. Alain sits in the middle. How many seating arrangements are there so that Viola sits next to Simonetta?

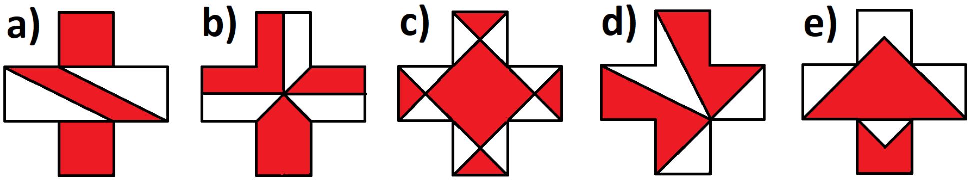
A: 2 B: 4 C: 8 D: 12 E: 16

Question 14 (INT):

On a blackboard there are 10 different positive integers. Exactly six of them are divisible by 9 and exactly seven of them are divisible by 7. How big must the biggest of those numbers be at least?

Question 15 (MC):

Beat proposed some alternative Logos for the Swiss Mathematical Olympiad. One of them has a bigger coloured area than the rest. Which one is it?



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

Question 16 (INT):

On a blackboard there are multiple positive integers and no number appears twice. Romina computes the product of the two smallest numbers and gets 49. She then computes the product of the two largest numbers and gets 2550. What is the sum of all the numbers on the blackboard?

Question 17 (MC):

David gives Julia a riddle about his birthday. He says: "If I add the number of the day and the number of the month, I get a third power. And if I add 1 to the number of the day, I get exactly three times the number of the month". When is David's birthday?

A: winter B: spring C: summer D: autumn E: not enough information

Question 18 (INT):

There are 5 light bulbs arranged in a circle. Touching one of them changes its and both its neighbours states, from off to on and vice versa. If all bulbs are initially off, what is the minimal number of times you have to touch a bulb to end up with all bulbs on?

Question 19 (MTF):

Let a, b and c be distinct positive integers. Which of the following are possible?

A: $a+b$, $b+c$ and $c+a$ are all prime numbers.

B: $a \times b$, $b \times c$ and $c \times a$ are all square numbers.

C: a/b, b/c and c/a are all integers.

D: $|a-b|$, $|b-c|$ and $|c-a|$ are all equal.

Question 20 (MTF):

Yann the goalkeeper is playing a football match every day from Monday to Friday. Yann made at least 10 saves every match and on each day, he made a different number of saves. On Monday, Yann made two more saves than on Tuesday and Wednesday combined. On Thursday, Yann made twice as many saves as on Monday and on Friday, Yann made 23 saves. Which of the following statements have to be true?

A: On Monday, Yann made more saves than on Friday.

B: Yann made the most saves on Thursday.

C: Yann made more than 110 saves during the whole week.

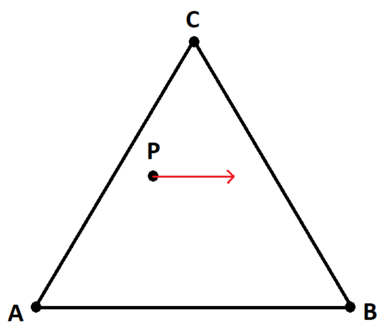
D: Yann made an odd number of saves in total.

Senior 3

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):

A beam of light starts at some point P inside an equilateral triangle ABC whose sides are mirrors. If the beam initially travels parallel to the bottom side, which of the 4 points does the beam hit first?



A: A

B: B

C: C

D: P

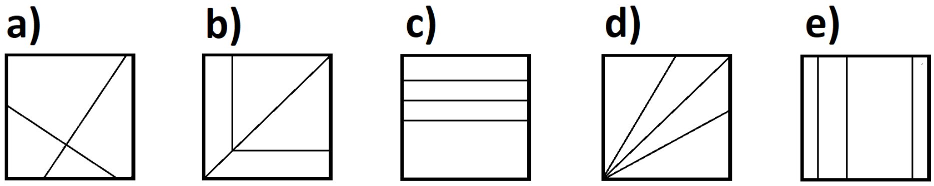
E: None

Question 22 (INT):

A tortoise is running a 100-metre race. It starts at a pace of 1 metre per second but gets tired rather quickly and its speed halves whenever it is exactly a multiple of 11 metres in. How many seconds have passed when it finishes?

Question 23 (MC):

Viera takes a square paper, folds it once and then folds the resulting flat shape once again. Then she opens the paper. What pattern can't she possibly see?



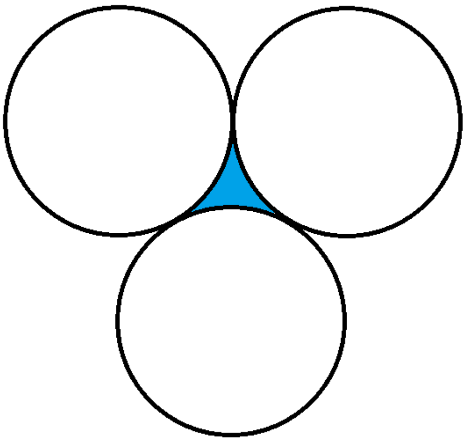
A: a) B: b) C: c) D: d) E: e)

Question 24 (INT):

There are 179 cans of Rösti to numbered from 1 to 179 on a shelf in the Migros. First Tanish enters and takes away all the cans with multiples of 4 on them. Then Valentina comes and takes all the remaining cans with a multiple of 6 on them. Lastly George visits and takes the all the cans with multiples of 9 on them. How many Rösti cans are still on the shelf?

Question 25 (MC):

Three circles of radius 1 are pairwise externally tangent. How large is the small area in the centre of this shape?



A: $\sqrt{3}-1$

B: $\sqrt{3}-\pi/2$

C: $\pi/2-1$

D: π^2-9

E: $\pi-3$

Question 26 (INT):

There is a football tournament being held between Aarau, Basel, Geneva, Sion and Winterthur. In the case of a draw both teams get one point; otherwise, the winner gets 3 points, while the loser gets 0. Each team plays against each other team exactly once. Aarau has 9, Basel has 4, Geneva has 8 and Sion has 2 points. How many points does Winterthur have?

Question 27 (MC):

For a cube of side length 1, how long is the shortest path on its surface that connects two opposite corners?

A: $1+\sqrt{2}$ B: $3/2$ C: $\sqrt{3}$ D: 2 E: $\sqrt{5}$

Question 28 (INT):

Four monkeys try to climb a big tree. Each monkey starts on the ground and initially carries 12 bananas. In order to move a monkey has to eat bananas. After a monkey eats a banana it can move up to 3 metres upward before having to eat the next one. If they do not eat they get tired and cannot climb any further. If two monkeys are at the same height, one of them can give any number of bananas to the other, but no monkey can ever carry more than 12 bananas. The monkeys do not come back down.
At most how many metres tall can the tree be if at least one of the monkeys can reach the top (with a sufficiently intelligent strategy)?

Question 29 (MTF):

Let x be a positive integer that is not divisible by 10 and let y be the number we get by reversing the order of its digits. Which of the following are true?

A: If x is divisible by 3, then y is also divisible by 3.

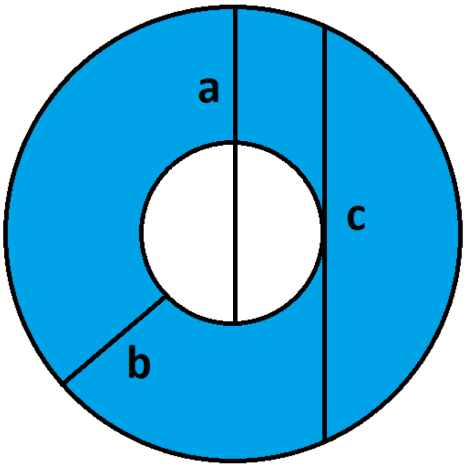
B: We always have $8 \cdot y \geq x$.

C: There are infinitely many x such that x and y are both squares.

D: We always either have $x = y$ or $|x - y| \geq 9$.

Question 30 (MTF):

Which of the following formulas for the area of the coloured region are correct?



A: $\pi \times c^2/4$

B: $2\pi \times b$

C: $\pi \times a \times b$

D: $\pi \times (c - b)^2$