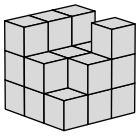
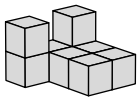
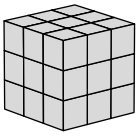
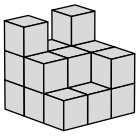
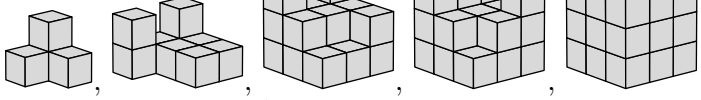
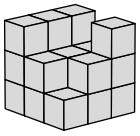
Ecolier

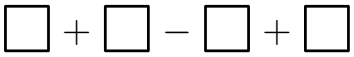
3 points

1 (Germany). Mia is joining small cubes, adding one at a time, to build a $3 \times 3 \times 3$ cube.
She took pictures at 5 different moments.
What does Mia's fourth picture look like?

(**A**)  (**B**)  (**C**)  (**D**)  (**E**) 

SOLUTION: While Mia builds the big cube, the numbers of small cubes becomes larger and larger. So, her photos show this order:  , or: D, B, E, A, C in this order. Her fourth picture looks like  (A).

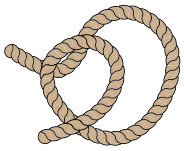
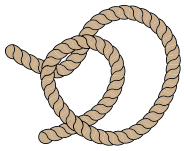
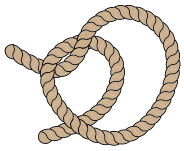
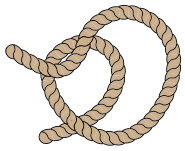
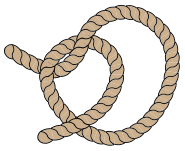
2 (Germany). Simona writes the four digits 2, 0, 2, 5 in the four boxes.
Which order would give her the largest result?



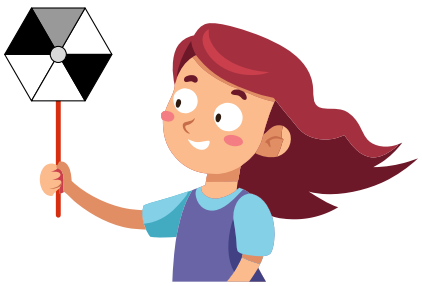
(**A**) 0, 2, 2, 5 (**B**) 0, 5, 2, 2 (**C**) 2, 5, 2, 0 (**D**) 5, 0, 2, 2 (**E**) 5, 2, 0, 2

SOLUTION: One of the digits is subtracted, and the other three digits are added. So, the result is the largest when the digit that is subtracted is the smallest, i.e. 0.
It is also possible to calculate all five results to find the largest:
$0 + 2 - 2 + 5 = 5$
$0 + 5 - 2 + 2 = 5$
$2 + 5 - 2 + 0 = 5$
$5 + 0 - 2 + 2 = 5$
$5 + 2 - 0 + 2 = 9$

3 (Russia). Which rope ties into a knot when the ends are pulled?

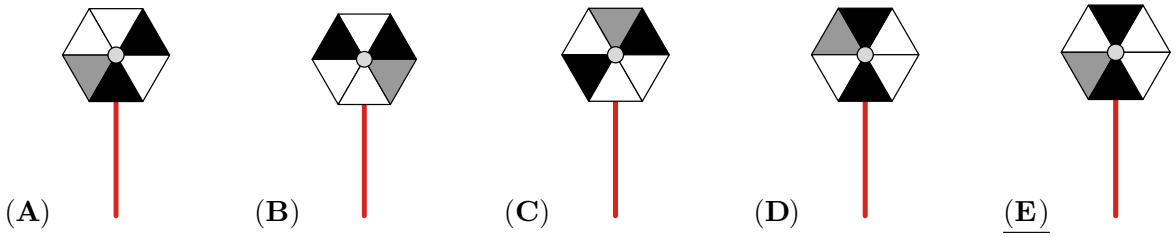
(**A**)  (**B**)  (**C**)  (**D**)  (**E**) 

SOLUTION: To form a knot, the rope must create a tightening loop (one end goes under the other, then over, and then under again). This is only fulfilled by rope E.



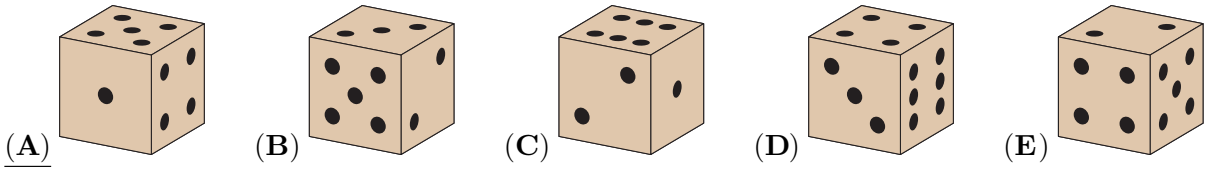
4 (Germany). Larissa spins her sail. Which of the sails below

is hers?



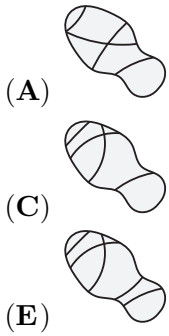
SOLUTION: In Larissa's sail there are two black fields opposite each other. This can only be seen in (C), (D) and (E). The gray field in Larissa's sail is clockwise next to a black field. This can only be seen in (E) which is, therefore, the solution.

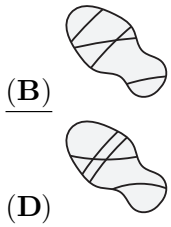
5 (France). On a normal dice, the total number of spots on two opposite faces is always 7. Which one of the dice shown could be a normal dice?

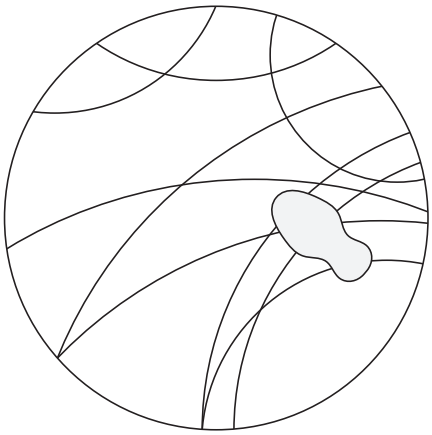


SOLUTION: On a normal dice the total number of spots on two opposite faces is always 7. That means that 1 and 6 are on opposite faces, 2 and 5 are on opposite faces, and 3 and 4 are on opposite faces. In (B) and (E), 2 and 5 are on neighbouring faces. In (C) 1 and 6 are on neighbouring faces, so 1 and 6 are not on opposite faces and hence this is not a normal dice and in (D) 3 and 4 are on neighbouring faces, so these are also not normal dice. In (A) we see only one of the numbers 1 and 6, 2 and 5, and 3 and 4, so for each of these pairs the other number can be on the opposite face. Only (A) can be a normal dice.

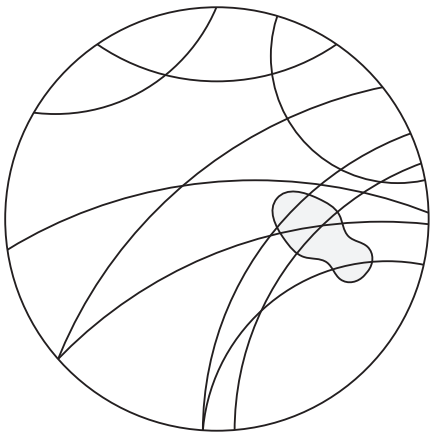
6 (Iran). Alex stepped on some tracks on the ground. What is beneath her shoe?



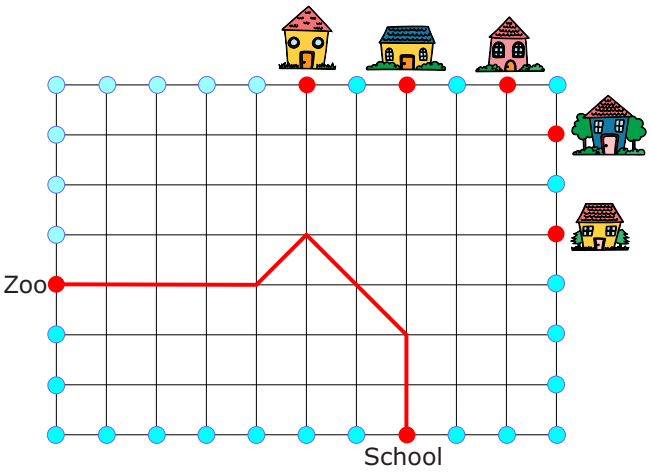




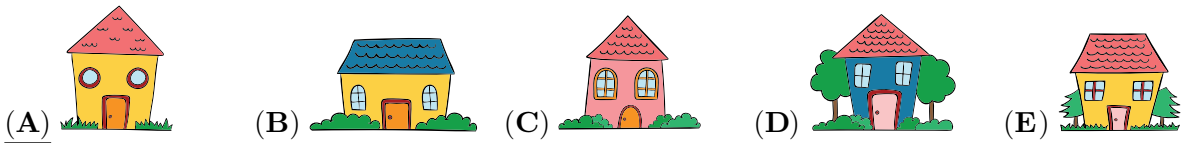
SOLUTION: If we connect the tracks as in the picture, we recognize that (B) is the answer.



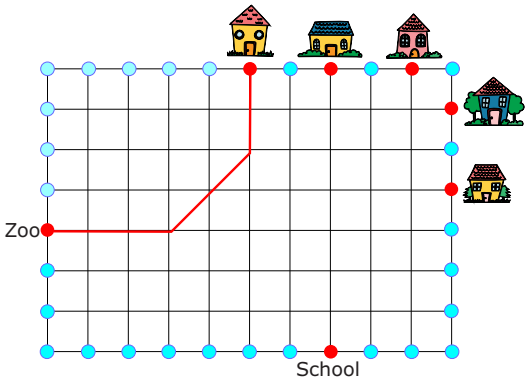
7 (Slovakia). Kenny the Kangaroo jumps from the School to the Zoo as follows: ↑ 2, ↖ 2, ↙ 1, ← 4, as shown in the picture.



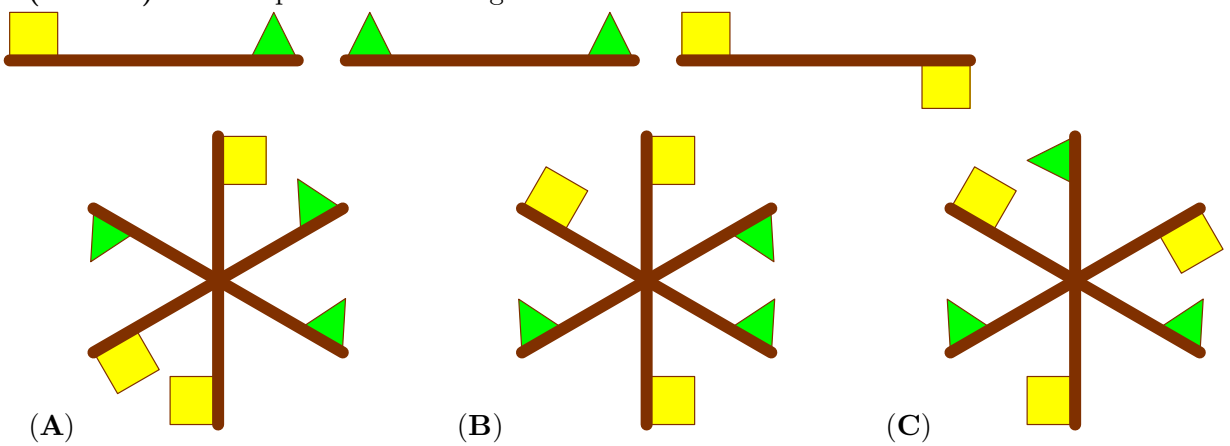
Then, he jumps from the Zoo as follows: → 3, ↗ 2, ↑ 2.
Which house will he get to?

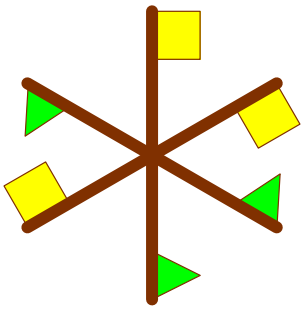


SOLUTION: We start at the Zoo and draw the path that Kangaroo covers according to the instructions (see picture). It gets to house A.

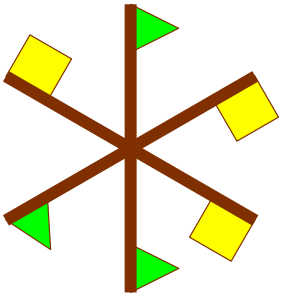


8 (Poland). Which pinwheel can Jorge build with these 3 rods?





(**D**)

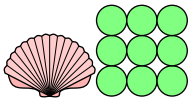
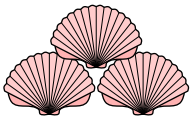
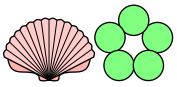
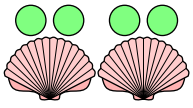


(**E**)

SOLUTION: The rod with the two green triangles has both triangles on the same side. We find the rod with the two green triangles in all five options. In (A), (B), (C) and (D), the triangles are on different side of this rod, so these pinwheels are not possible. Only (E) is made from the 3 rods that Jorge has.

4 points

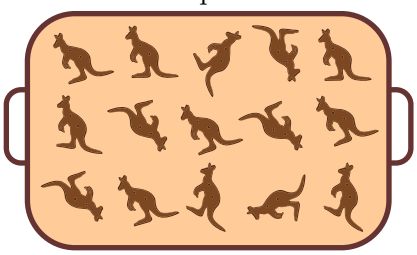
9 (Germany). Nico and his little sister pay with shells and marbles in their playshop.
Each shell has a value of 6 and each marble has a value of 1.
Which of the following has a total value of 16?

(**A**)  (**B**)  (**C**)  (**D**)  (**E**) 

SOLUTION: We calculate the value for each collection.
In (A) the 2 shells have a value of $2 \times 6 = 12$, so the total value is $12 + 1 = 13$.
In (B) the shell has a value of 6, so the total value is $6 + 9 = 15$.
In (C) the 3 shells have a value of $3 \times 6 = 18$.
In (D) the shell has a value of 6, so the total value is $6 + 5 = 11$.
In (E) the 2 shells have a value of $2 \times 6 = 12$, so the total value is $12 + 4 = 16$.
(E) is the solution.

10 (Germany). Anna, Bonnie and Caspar have some kangaroo cookies on their plates, as shown.

They then share the remaining 15 cookies on the tray so that everyone now has the same number of cookies on their plates.

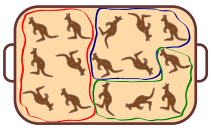


How many more cookies does Anna get?

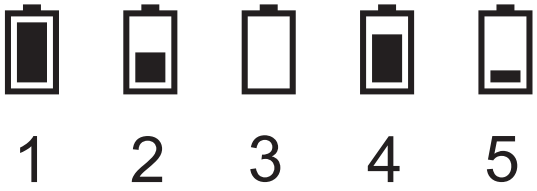
(**A**) 4 (**B**) 5 (**C**) 6 (**D**) 7 (**E**) 8

SOLUTION: Anna, Bonnie and Caspar have 3, 4 and 5 cookies already. If we put 2 more cookies on Anna's plate and 1 more cookie on Bonnie's plate, they all have the same number of cookies on their

plates. Now, there are still $15 - 2 - 1 = 12$ cookies left which must be equally divided among the three children. So, each of them gets $12 : 3 = 4$ cookies more. Than means, in total Anna must get $2 + 4 = 6$ cookies more.
Another solution is to first calculate how many cookies each child receives in total. They already have 3, 4 and 5 cookies. Together with the 15 cookies there are $3 + 4 + 5 + 15 = 27$ cookies in total. So, at the end each child should have $27 : 3 = 9$ cookies. That means, Anna must get $9 - 3 = 6$ more cookies.



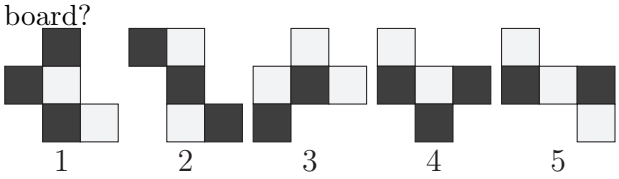
11 (Slovenia). In the morning, 5 friends had identical fully-charged mobile phones.
By the evening, Bob had spoken on the phone as much as Ann and Cristina together.
Bob ran out of power. David had not used his phone at all. Which phone belonged to Edward?

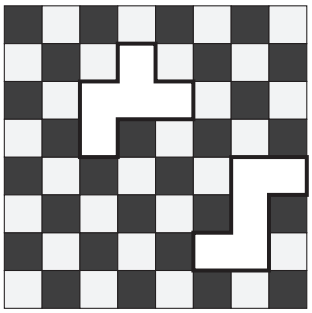


(**A**) 1 (**B**) 2 (**C**) 3 (**D**) 4 (**E**) 5

Solution: As Bob ran out of power, his phone is phone 3. David has not used his phone at all, so his phone is phone 1. Only for phones 4 and 5 the battery usage add up to a whole battery loading as Bob used it, so they must belong to Ann and Cristina. Phone 2 remains, this belongs to Edward.

12 (Catalonia). Which two of the pieces shown below complete the chessboard?





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

Solution: We turn the pieces 1, 3 and 4 so that the 3 squares in row are horizontal. This way we see that only 1 and 3 fit in the hole on the top and only 1 has the correct coloring. Similarly, we turn the pieces 2 and 5 so that the 3 squares in row are vertical. This way we see that only 5 fits in the hole on the right (and that the correct coloring is correct). So the pieces 1 and 5 complete the chessboard.

13 (Germany). In the petting zoo, Renée feeds 6 sheep.
She gives them a total of 210 grams of dry food for lunch.
She gives the smallest sheep twice as much food as she gives to each of the others.
How much does the smallest sheep get?

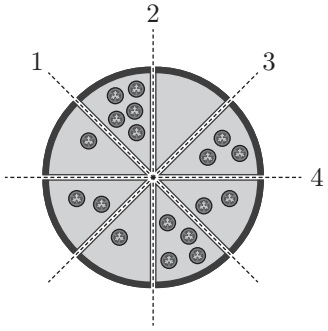
(**A**) 55 grams (**B**) 60 grams (**C**) 70 grams (**D**) 75 grams (**E**) 80 grams

Solution: The smallest sheep gets twice the amount of food, so we count this sheep as two sheep. Then we have $5 + 2 = 7$ "sheep". As $210 : 7 = 30$, each "sheep" gets 30 grams of food. That meachs

that the smallest sheep gets $2 \times 3 = 60$ grams of food.

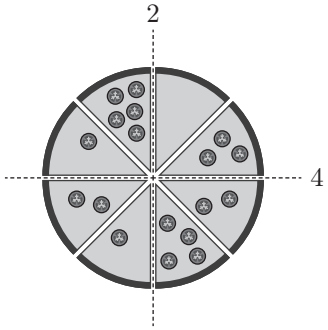
Another solution is to start with giving each sheep 10 grams. The smallest sheep gets 20 grams. Then the total amount given is now: $20 + 10 + 10 + 10 + 10 + 10 = 70$ grams. We do this again and have now given $70 + 70 = 140$ grams in total. We do this one more time and have now given $140 + 70 = 210$ grams. So, in total we gave the big sheeps $3 \times 10 = 30$ grams and the smallest sheep $2 \times 30 = 60$ grams of food.

14 (Norway). Tom wishes to slice a pizza into 2 halves.
He also wishes to have the same number of tomatoes on each half.
It is possible for him to do this with two different cuts.
Along which lines could he cut?

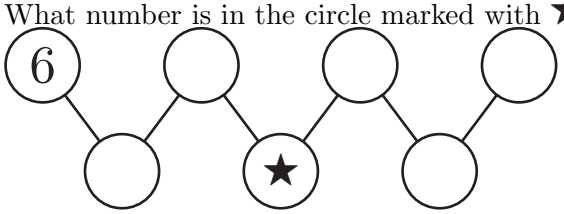


(**A**) 1 and 3 (**B**) 1 and 4 (**C**) 2 and 3 (**D**) 2 and 4 (**E**) 3 and 4

Solution: We start with cut 1 and count the tomatoes on both sides. Above it are $5 + 3 + 2 = 10$ tomatoes and below it are $4+1+2+1 = 8$ tomatoes. Cut 2 gives $5+1+2+1 = 9$ and $0+3+2+4 = 9$ tomatoes on each half. Cut 3 gives 8 and 10. Cut 4 results in 9 and 9 tomatoes on each half. Note that knowing that there are 18 tomatoes in total allows us to check that there are 9 tomatoes on one half only.



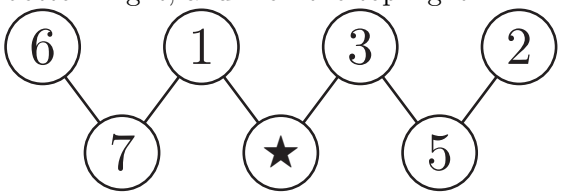
15 (China). Maria fills the circles with the numbers 1, 2, 3, 4, 5, 6 and 7.
The number in each of the lower circles is equal to the sum of the two numbers in the connected circles above it.
What number is in the circle marked with ★?



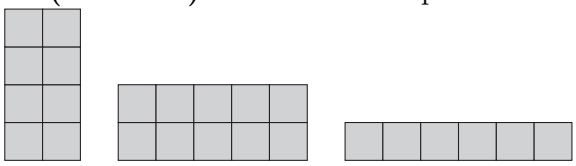
(**A**) 2 (**B**) 3 (**C**) 4 (**D**) 5 (**E**) 7

Solution: 1, 2, 3, 4, 5, 6, 7 are the numbers to fill in. 6 is already there. Below the 6, the sum should be higher than 6, so that could only be the 7. The 7 is now at the bottom left circle. We have

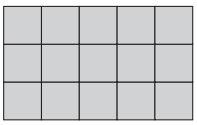
to find the answer for 6 + ... = 7, so, this could only be 1. We now have left 2, 3, 4, 5. The two highest numbers should be sums, so, go in the bottom row. The 4 cannot be formed with summing a pair out of 2, 3, or 5. Therefore, the 4 has to come from 1 + ... = 4. This gives the position of 4 in the bottom middle, which is the correct answer (the star), and the 3 in the top. Then, the 5 is on the bottom right, and 2 on the top right.



16 (Vietnam). Bob makes a square from 4 rectangular pieces. 3 of the pieces he uses are shown.

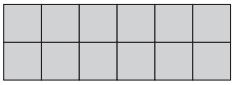


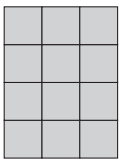
Which of the following is the fourth piece he uses?

(**A**) 

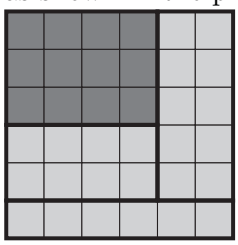
(**B**) 

(**C**) 

(**D**) 

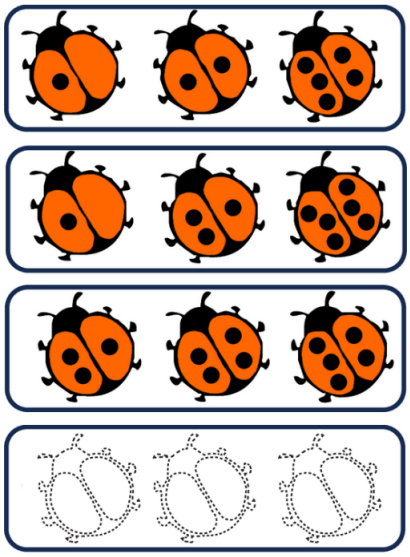
(**E**) 

Solution: The largest side length of one of the pieces is 6 squares, so the large square has a side length of at least 6 squares. The large square therefore consists of either $6 \times 6 = 36$ or $7 \times 7 = 49$ or ... squares. The three given pieces consist of $8 + 10 + 6 = 24$ small squares in total. So, the fourth piece must consist of either $36 - 24 = 12$ or $49 - 24 = 25$ or ... squares. None of the pieces in the options consists of 25 or more squares. So, the large square consists of 36 squares and has a side length of 6 squares. In order to find the correct shape of the missing piece, we must puzzle. The second piece must be rotated as well as the first piece. The missing rectangle is 4 squares wide and 3 squares heigh as shown in the picture. So, the fourth piece is shown in option (E).



5 points

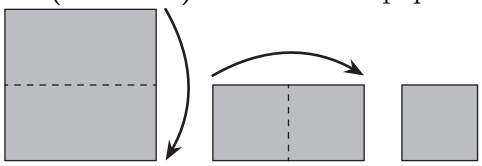
17 (Greece). 6 ladybirds have 1, 2, 3, 4, 5 or 6 spots each. Marta took 4 photos of them in groups of 3.
Each ladybird appeared the same number of times in the photos.
3 of the photos, along with the outline of the fourth photo, are shown here.
How many spots do the three ladybirds in Marta's fourth photo have in total?



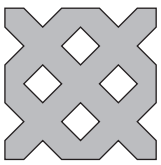
(**A**) 9 (**B**) 10 (**C**) 11 (**D**) 12 (**E**) 23

SOLUTION: Each of the ladybirds with 1, 3 and 5 spots appears twice in the first three photos, and those with 2, 4, 6 appear once. So the 4th photo has ladybirds with 2, 4 and 6 spots, a total of 12 spots.

18 (Slovakia). Nela folds a paper square in half and then in half again, as shown.



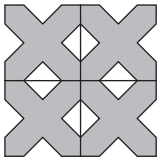
Next she cuts pieces out of the folded paper.
After unfolding she sees a paper snowflake.



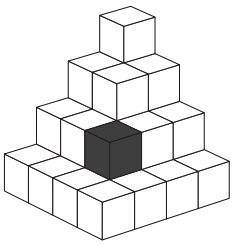
How did she cut the folded piece of paper?

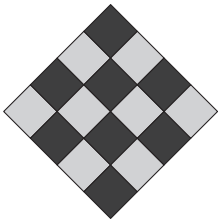
(**A**)  (**B**)  (**C**)  (**D**)  (**E**) 

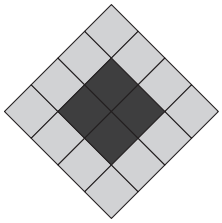
SOLUTION: If the two folding lines are added to the snowflake (as here), one can see that each quarter resembles the pattern shown in option B - it must have been this cutting pattern that Nela used.

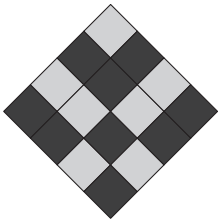


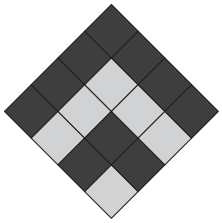
19 (Poland). Leonia has built a pyramid using black and grey cubes.
She arranges each cube so each face does not touch a face of another cube with the same colour.
One of the black cubes is shown in the figure.
What will Leonia's pyramid look like from above?

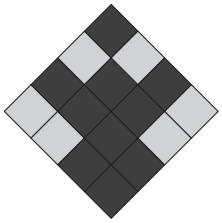


(**A**) 

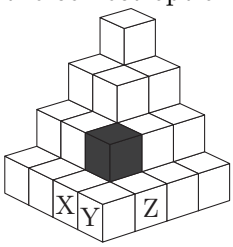
(**B**) 

(**C**) 

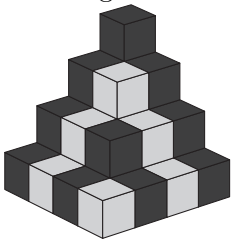
(**D**) 

(**E**) 

Solution: You can start by thinking about the colour of the cube directly underneath the black cube - it must be grey. This means that cubes X and Z which touch this grey cube in the bottom layer must be both black, and hence cube Y must be grey. The only one of the five options to show this is option D. By considering neighbouring cubes to these, one can quickly find that option D is indeed the correct option.



Alternative solution: As a first step we colour the blocks so that blocks of the same colour have no touching faces. There is only one possibility:



If we look at the structure from above, we see that the correct solution is alternative D

20 (Greece). The picture shows the page for one month of a calendar, without any of the dates.

Mon	Tue	Wed	Thu	Fri	Sat	Sun

The total of the dates for the 2 shaded days is 29.

On what day of the week does the first day of the month fall?

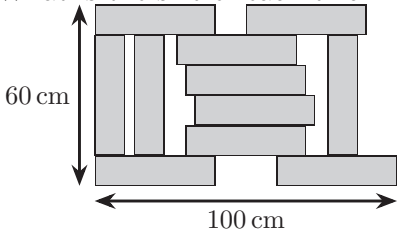
(**A**) Monday (**B**) Tuesday (**C**) Wednesday

(**D**) Thursday (**E**) Sunday

SOLUTION: Counting the number of days from the first shaded square to the second, we see that the second date is 13 days later than the first. So we need two numbers that differ by 13 and their sum is 29. By systematic work we find that these two numbers must be 8 and 21. The first day of the month is exactly one week before the 8th day, so the respective days of the week are the same, and that is Thursday.

Mon	Tue	Wed	Thu	Fri	Sat	Sun
			1	2	3	4
5	6	7	8			
		21				

21 (Greece). The construction uses 11 identical bricks.
The construction has length 100 cm and width 60 cm.
What is the size of each brick?

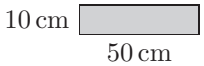


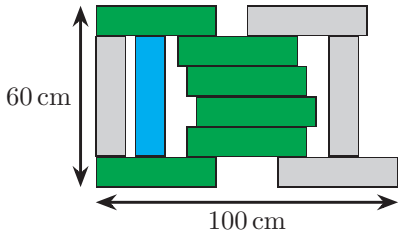
(**A**) 

(**B**) 

(**C**) 

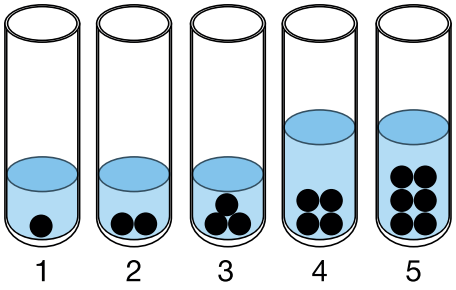
(**D**) 

(**E**) 



SOLUTION:
From the 6 green bricks we see that the height of the construction is 6 times the height of each brick. Because $60 : 6 = 10$, the height of each brick is 10 cm. From the blue brick we see that the length of each brick is 4 times its height. Because $4 \times 10 = 40$, each brick is 40 cm long. Each brick is 40 cm $\times$ 10 cm.
We cannot use the width of the construction as it gives no information because of the gaps.

22 (Russia). Identical balls have been placed in 5 identical test tubes, as shown.
Then, water is added to each of these test tubes.



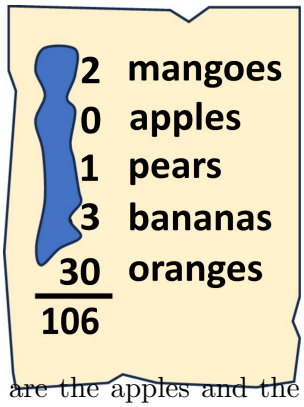
The water levels in test tubes 1, 2, and 3 are the same.
The water levels in test tubes 4 and 5 are also the same and twice as high as in the first 3 test tubes.
Then, all the balls are removed.
Which test tube has the least water?

(**A**) Test tube 1 (**B**) Test tube 2 (**C**) Test tube 3

(**D**) Test tube 4 (**E**) Test tube 5

SOLUTION: The amount of water in tube 3 is less than in 1 and 2 because it contains more balls and the water level is the same. Similarly, the amount of water in tube 5 is less than in 4. It remains to compare tubes 3 and 5. If we take two test tubes 3 and pour the content into one tube, we get the content of tube 5. Thus, tube 5 contains not only twice as many balls as test tube 3 but also twice as much water. Therefore test tube 3 has the least amount of water.

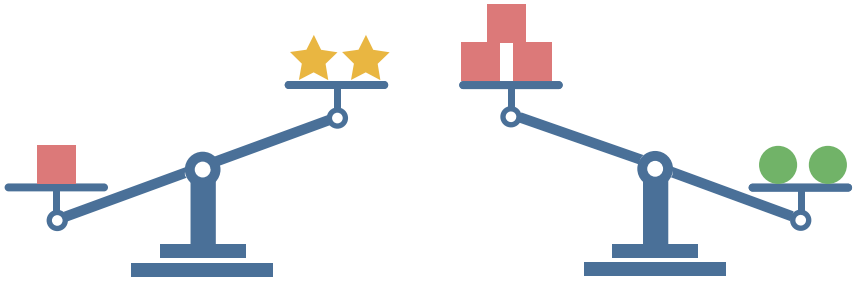
23 (Greece). Rossitza has written down the number of pieces of different fruit that she has.
Unfortunately, some digits have been covered by paint.
In total, she has 106 pieces of fruit. The number of pieces of two of the types of fruit she has are equal.
She has twice as many of one type of fruit as she does of some other type.
She has more than 10 pieces of each type of fruit.
How many bananas does she have?



(**A**) 13 (**B**) 23 (**C**) 43 (**D**) 53 (**E**) 63

SOLUTION: The fruit that are equal in number, judging from the last digit, are the apples and the oranges, each 30. Also from the last digits we conclude that the fruit that are double the number of another are the mangoes (*2) and the pears (*1). Because each type of fruit has more than 10 pieces, the number of pears is 11 or 21 or 31 or ..., and the number of mangoes is 22 or 42 or 62 or ... Mangoes, apples, pears and oranges are in total at least $22 + 30 + 11 + 30 = 93$. So, bananas are at most $106 - 93 = 13$. Because each type of fruit has more than 10 pieces, there are 13 bananas.

24 (China). A pair of scales is used to weigh 3 different objects, and the results are shown below.



Each type of object has a different mass. The masses can be 1, 2, 3, 4, or 5 kg.
What is the mass of one ■ in kilograms?

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

SOLUTION: The smallest possible mass for a star is 1 kg.
The first weighing shows that one square is heavier than two stars. Because of this, the square must be greater than 2 kg; in other words 3 kg, 4 kg or 5 kg.
The second weighing shows that two circles are heavier than three squares. The three squares weigh at least 9 kg, which means that two circles must weigh at least 9 kg. We know that the masses of each of the three objects are 1 kg, 2 kg, 3 kg, 4 kg or 5kg, and so one circle must weigh 5 kg.
Now the mass of one square can be only 3 kg or 4 kg. If one square weighs 4 kg, then three squares would weigh more than 2 circles (as $3 \times 4 > 2 \times 5$), but that is not what is shown in the first weighing. Therefore, the mass of one square has to be 3 kg (and the mass of a star is 1 kg).