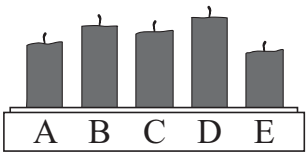
Ecolier

3 points

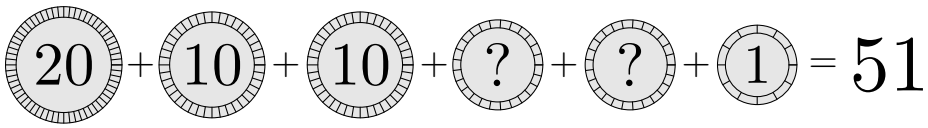
1 (France). Akira lits 5 identical candles all at the same time.
They stopped burning at different times and now look as shown in the picture.
Which candle stopped burning first?



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

SOLUTION: Since they are initially identical candles, the one that went out first is the one whose size has decreased the least.

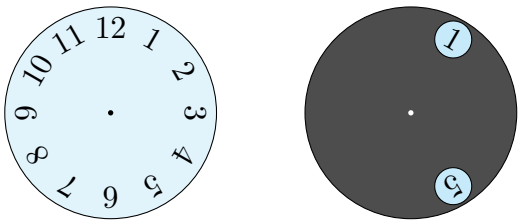
2 (Denmark). The 2 kangaroo coins with the question mark on have the same value.
What is this value?



(**A**) 1 (**B**) 2 (**C**) 5 (**D**) 10 (**E**) 20

SOLUTION: The value of the 2 coins together is $51 - 20 - 10 - 10 - 1 = 10$. Hence their value is 5.

3 (Denmark). A gray circle with 2 large holes in it is put on top of a clock-face, as shown.

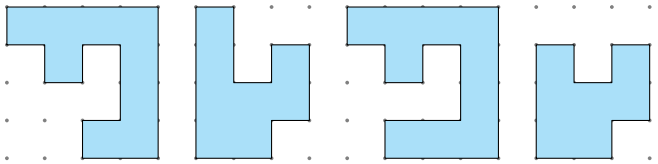


The gray circle is turned around its center.
Which 2 numbers is it possible to see at the same time?

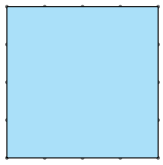
(**A**) 4 and 9 (**B**) 5 and 9 (**C**) 5 and 10 (**D**) 6 and 9 (**E**) 7 and 12

SOLUTION: The picture shows that one hole will show a time 4 hours after the other. This is only true for B.

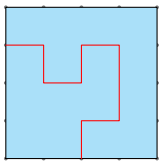
4 (Denmark). Alice has these puzzle pieces:



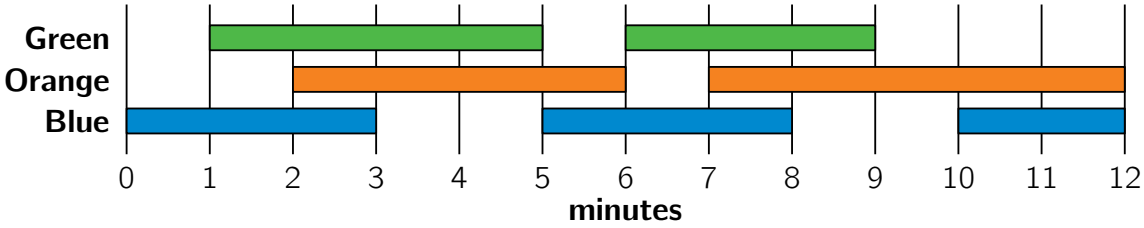
Which 2 pieces can she put together to form this square?



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

SOLUTION: 

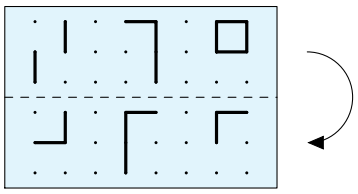
5 (Slovakia). A light engineer in the theatre turns the lights on and off.
She uses the plan shown.
How long in total are exactly 2 of the lights on at the same time?



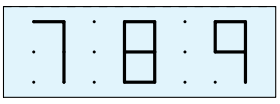
(**A**) 2 minutes (**B**) 6 minutes (**C**) 8 minutes (**D**) 9 minutes (**E**) 10 minutes

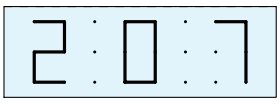
SOLUTION: The diagram shows twelve instants (minutes), numbered from 1 to 12, at which the lights are turned on or turned off. There are exactly 2 lights on during the following instants (minutes): 2 (green and blue lights), 4 (green and orange lights), 5 (green and orange lights), 6 (orange and blue lights), 7 (green and blue lights), 9 (green and orange lights), 11 (orange and blue lights), and 12 (orange and blue lights). Thus, there are 2 lights on for 8 minutes.

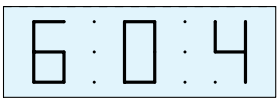
6 (Denmark). Kristoffer folds the transparent paper along the dashed line.

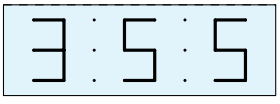


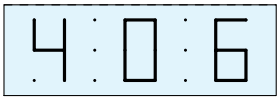
What can he then see?

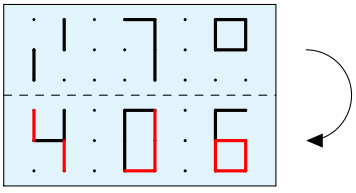
(**A**) 

(**B**) 

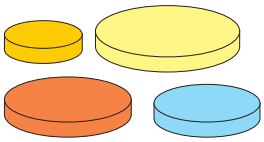
(**C**) 

(**D**) 

(**E**) 

SOLUTION: 

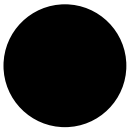
7 (Slovenia). Anna has 4 discs of different sizes.
She wants to build a tower of 3 discs so that every disc is smaller than the disc below it.
How many different towers can Anna make?



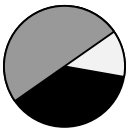
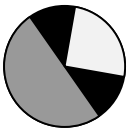
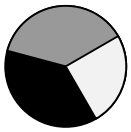
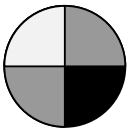
(**A**) 1 (**B**) 2 (**C**) 4 (**D**) 5 (**E**) 6

SOLUTION: We can use A, B, C and D to describe the 4 discs orderd by size. Without the disc A there is exactly 1 way to costruct such a tower: BCD. Without the disc B there is exactly 1 way to costruct such a tower: ACD. Without the disc C there is exactly 1 way to costruct such a tower: ABD. Without the disc D there is exactly 1 way to costruct such a tower: ABC. Therefore, Anna can make 4 different towers.

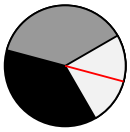
8 (Germany). Danny glued the 2 pieces of paper  on top of the black circle on the right.



What can he not obtain?

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

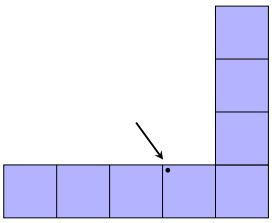
SOLUTION: Answer: D. Danny can obtain the composition (A) by gluing the grey piece over the black piece, and the white piece over the grey piece. He also can obtain the composition (B) by gluing the white piece over the black piece, and the grey piece over the black and the white pieces, as shown beside: 

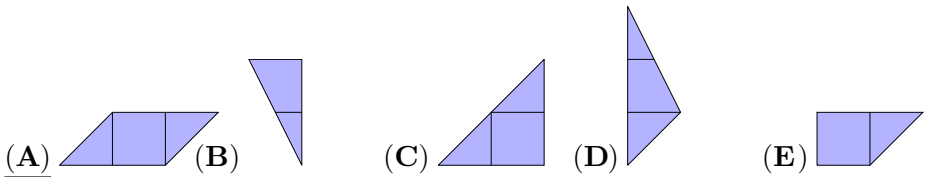
It is possible to obtain the composition (C) by gluing the white and grey pieces over the black piece. Finally, it is possible to obtain the composition (D) by gluing the white piece over the black piece, and the grey piece over the black and the white pieces, as shown beside: 

However, it is impossible to obtain the composition (E), because the grey piece is shaped like two white pieces together, while this option shows two grey pieces separated.

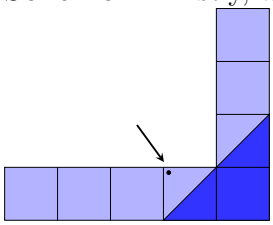
4 points

9 (Greece). The shape on the right is covered with the 5 pieces below.
Which piece will cover the dot?

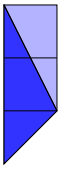
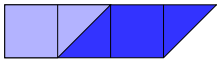


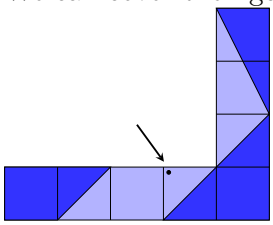


SOLUTION: Firstly, we have to choose the piece for the corner. C is the only option to place.



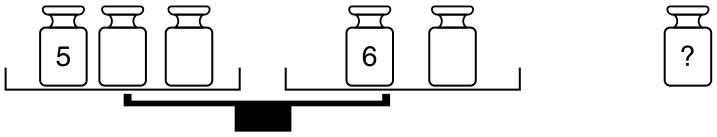
Now there are 3 and half squares on the horizontal position and 2 and half on the vertical position are still needed to fill.

Combination of Piece B and Piece D can make the figure:  and combination of Piece A and Piece C can make the figure 
So, the piece that covers the dot is A.
(Or)
We can cover the figure with the five pieces as below.



So, the piece that covers the dot is A.

10 (Russia). There are six weights of 1, 2, 3, 4, 5 and 6 kg.
Rossitza puts five of them on the scales and puts one weight aside.
The scales balance.
Which weight did she put aside?

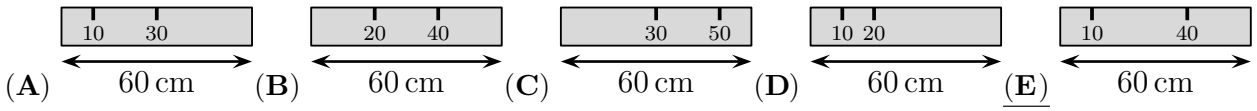


(**A**) 1 kg (**B**) 2 kg (**C**) 3 kg (**D**) 4 kg (**E**) can't be sure

SOLUTION: Weights 5 and 6 kg are already used. If we do not use weights 2 or 4 kg the total weight of the remaining weights will be expressed as an odd number (19 and 17 kg accordingly). In this case it is impossible to divide the weights so that the scales come in balance. So the answer is 1 or 3 kg. Let's check them. Without the weight 1 kg the total weight will be $2 + 3 + 4 + 5 + 6 = 20$ kg. So on each bowl of the scales should be 10 kg. It is possible if we put $5 + 3 + 2$ on one bowl and $4 + 6$

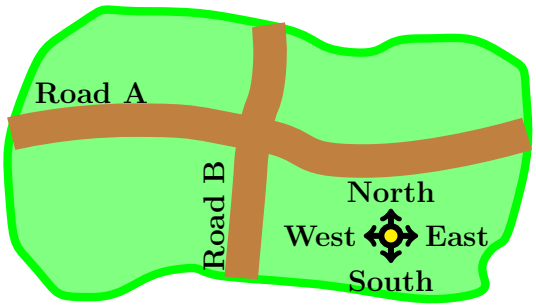
on the other bowl. It matches with the picture. Without the weight 3 kg the total weight will be $1+2+4+5+6=18$ kg. So on each bowl should be 9 kg. It is possible if we put $5+4$ on one bowl and $6+2+1$ on the other bowl. But that does not match with the picture.

11 (Greece). Ali has a 60 cm ruler.
Unfortunately, some of the markings have faded away.
He is able to measure any of the lengths 10, 20 , 30 , 40 , 50 and 60 cm using his ruler only once.
Which is Ali's ruler?



SOLUTION: With E) he has ready the length 10 cm. He can measure 20 cm by using the portion from 40 to the end, which is of length 60-40 = 20 cm. He can get 30 from the marks by using 40-10 = 30 cm. The length 40 cm is already marked, 50 cm is from 60-10 = 50 cm. and the length 60 cm is the whole ruler

12 (Greece). There are 7 houses north of Road A, 8 houses east of Road B and 5 houses south of Road A.
How many houses are west of Road B?



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

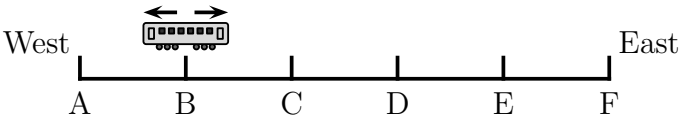
SOLUTION: The houses north and south of Road A are all the houses. So all the houses are 7+5 = 12. The houses east and west of road B are also all the houses (so 12). As there are 8 houses east of it, the remaining 12-8 = 4 houses are west of road B. (Note we cannot find an exact number of houses per quarter. Going clockwise from the first quadrant they are N, 8-N, N-3 and 7-N houses respectively as the parameter N can vary on an appropriate range.)

13 (Norway). There are 8 cars waiting in a queue for the ferry.
Every car contains either 2 or 3 people.
There are 19 people in total waiting for the ferry.
How many cars contain exactly 2 people?

(**A**) 2 (**B**) 3 (**C**) 4 (**D**) 5 (**E**) 6

SOLUTION: Answer: D. Since 19 is divisible neither by 3 nor 2, there are at least 1 car with 2 people and at least 1 car with three people. If there were exactly 1 car with three people, there would be 7 cars with two people each. However, 19 - 3 = 16, and 2 x 7 = 14. If there were exactly 2 cars with three people each, there would be 6 cars with two people each. However, 19 - 6 = 13, and 2 x 6 = 12. Considering there are exactly 3 cars with three people each, there must be 5 cars with two people each. Also, 19 - 9 = 10, and 2 x 5 = 10. Thus, there are 5 cars with two people each.

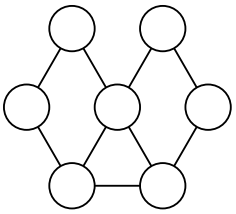
14 (Greece). The Metro line has 6 stations, A, B, C, D, E, and F.
The train stops at every station.
When it reaches one of the two end stations, it changes its direction.
The train driver started driving at station B and her first stop was station C.
Which station will be her 96th stop?



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

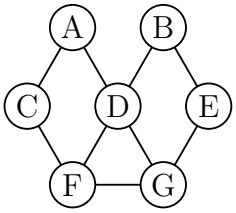
SOLUTION: Solution 1: After 10 stops she is at exactly the same position and is traveling to East. So we only need to calculate her location after 96-90 = 6 stops. That brings her to D and she is traveling towards the West. Solution 2: A B C D E F 1 2 3 4 9 8 7 6 5 10 11 12 13 14 19 18 17 16 15 And continue this until the number 96 is reached. Or notice some regularity in here, for example for F: 4, 14, 24, 34, 44, 54, 64, 74, 84, 94, and then two more to the left from F so that will be D. Or notice that for D in every second row there is 6, 16, 26, 36, and so on, until 96 so the answer is D. Note that this question allows for solutions at many different levels.

15 (Hungary). Hatice wants to paint the circles in the picture.
She wants to paint any 2 circles connected with a line different colours.
What is the smallest number of colours she needs?

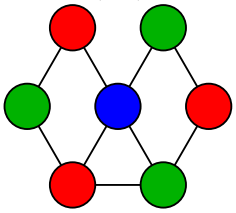


(**A**) 2 (**B**) 3 (**C**) 4
(**D**) 5 (**E**) 6

SOLUTION: Name the circles as shown in figure.

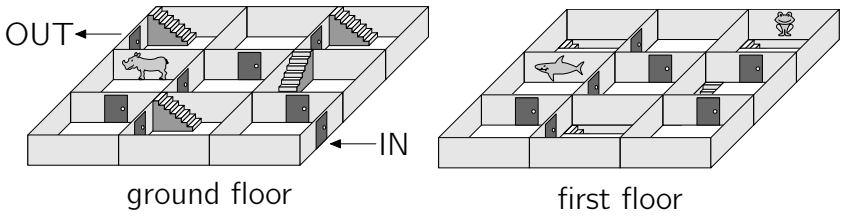


Among the circles, Circle D has the highest number of connections with the other circles. So, we have to start with this circle to get the correct answer. The question is the get the smallest number of colors to be used. If we paint Circle D with blue, we can use red in Circle F and green in Circle G. We can choose red or green for Circle A. If we choose red for Circle A, we can use green for Circle C because red is also used for Circle F and it is connected to Circle C. We can choose red or green for Circle B. We have to choose green for Circle B, red for Circle E because green is also used for Circle G and it is connected to Circle E. Therefore, the smallest number of colors we need is 3; red, blue and green. (Or) We can paint the circles as shown in the following figure.



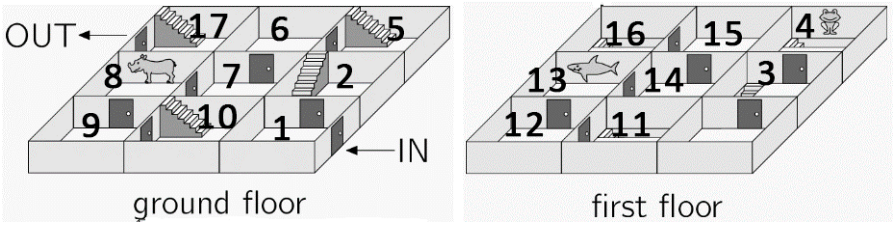
The smallest number of colors we need is 3; red, blue and green.

16 (Belgium). Sam walks through the two-storey maze from the entrance to the exit, passing 3 wall stickers.
In what order will she see them?



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

SOLUTION: Sam has to walk along the numbers from the entrance to exit.



Firstly, he will see the frog in number 4, then rhino in number 8 and finally shark on number 13. So, the answer is (A) frog, rhino and shark.

5 points

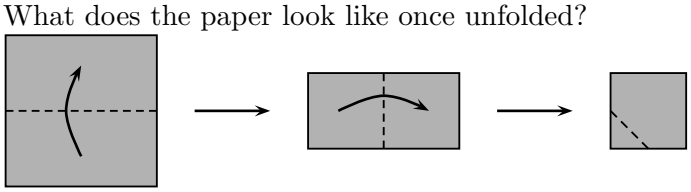
17 (Greece). 6 beavers and 2 kangaroos are standing in a line. Amongst any 3 consecutively numbered animals, exactly 1 is a kangaroo.
Which numbered animal is a kangaroo?

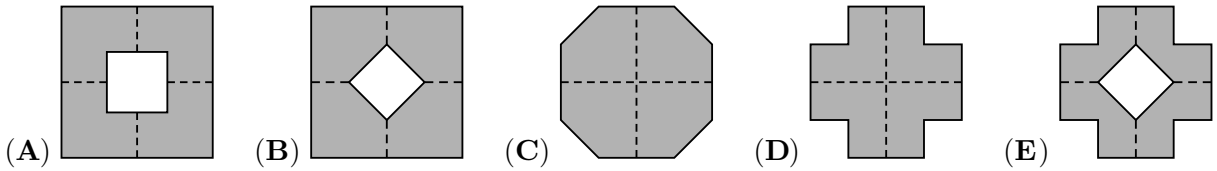
(**A**) 1 (**B**) 2 (**C**) 3 (**D**) 4 (**E**) 5

SOLUTION: If number 1 is a kangaroo then 2 and 3 are beavers. But if 2 and 3 are beavers, then 4 is a kangaroo. Similarly 5 and 6 are beavers and 7 is a kangaroo. This is impossible because we only have two kangaroos and we found at 1, 4 and 7. Similarly 2 cannot be a kangaroo because by a variant of the previous argument it would follow that the 2, 5 and 8 are (three, not two) kangaroos. Number 3 is a possibility: It follows 3 and 6 are kangaroos and the rest are beavers. We can reject the case where number 4 is a kangaroo as it forces 1 and 7 to be kangaroos. Also 5 is rejected with a similar argument.
We conclude that numbers 3 and 6, and only them, are kangaroos. 

Solution 2: Starting with a kangaroo at the position 1 would mean there are kangaroos at positions 4 and 7, and there are only two kangaroos; similarly, if the first kangaroo is at the position 2, we must have one at position 5 and position 8 which is not possible. Therefore, kangaroos are at positions 3 and 6, so the answer is 3.

18 (Slovakia). Rebecca folds a square piece of paper twice.
Then she cuts off one corner.
Next, she unfolds the paper.
What does the paper look like once unfolded?





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

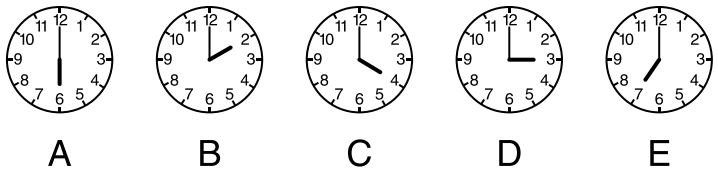
SOLUTION: The upper right quarter of the square retains its position after folding, and it has a triangle cut out at its bottom left, which after unfolding gives shape (B).

19 (Hungary). Hermione, Harry and Ron always walk into the common room one at a time.
Hermione is never first, Harry is never second and Ron is never third.
In how many different orders could they walk in?

(**A**) 1 (**B**) 2 (**C**) 3 (**D**) 4 (**E**) 6

SOLUTION: If Hermione is second, Ron must be third and Harry first. If Hermione is third, Harry must be first and Ron second. Therefore, there are two possible orders.

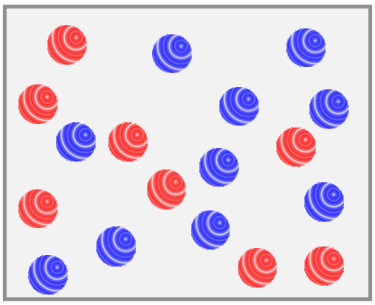
20 (Russia). There are five clocks on the wall.
It is known that one clock is an hour fast, one clock is an hour slow,
one clock shows the correct time and two clocks have stopped.
Which clock shows the correct time?



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

SOLUTION: Solution 1: If one clock shows the correct time, one clock is in a hurry for an hour and one clock is an hour behind then three clocks should show the time with a difference of 1 hour. The clock in the workshop shows 6, 2, 4, 3 and 7 o'clock. The only set that fits the condition is 2, 3 and 4 hours. So the correct time - 3 o'clock - is shown by clock D. Solution 2: Having two clocks that are off by 1 hour means that together with the clock that shows correct time these clocks show three consecutive numbers. The clocks in the workshop show 6, 2, 4, 3, and 7 o'clock, hence the correct time is 3 o'clock.

21 (Brazil). Adam and Brenda have 9 marbles each.
Together, they have 8 red and 10 blue marbles.
Brenda has twice as many blue marbles as red marbles.
How many blue marbles does Adam have?

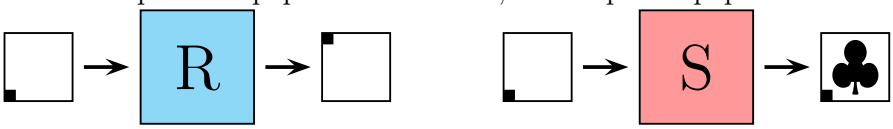


(**A**) 3 (**B**) 4
(**C**) 5 (**D**) 6
(**E**) 0

SOLUTION: Note: the picture is not necessary but can be used. Brenda has 6 blue and 3 red marbles which means Adam has the remaining 10-6=4 blue marbles.

22 (Denmark). Else has two machines.
When she puts a square sheet of paper in machine R, it turns the paper 90° clockwise, as shown in the picture.

When she puts the paper in machine S, it stamps the paper with a ♣.

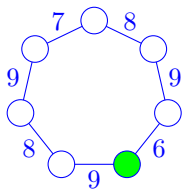


In which order are the machines used to produce the result shown?

(**A**) SRR (**B**) RSR (**C**) RSS (**D**) RRS (**E**) SRS

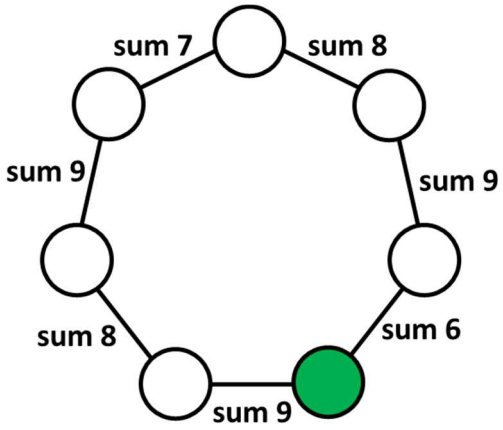
SOLUTION: The paper has been turned 90 degrees clockwise twice, but only one time after it was stamped. Hence RSR.

23 (Greece). Teacher Olena wants to write the numbers 1 to 7 in the circles.
Inside each circle she writes 1 number.
She wants the sum of the numbers in 2 circles that are next to each other to be as shown.
What number must she write inside the green/shaded circle?

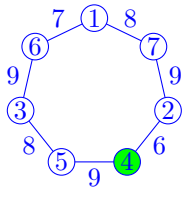


(**A**) 1 (**B**) 2 (**C**) 3 (**D**) 4 (**E**) 5

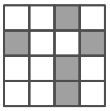
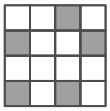
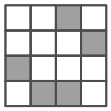
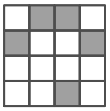
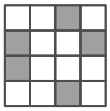
SOLUTION: Note: there is a b/w version with the word sum in it available



Note. Alternative text (LB) for the second line of text: Along each line is the addition of the numbers in the 2 circles on that line. Solution 1: The problem can be solved by figuring out where the number 1 goes. Notice that number 1 cannot give sum 9 together with a circle next to it as the available numbers are from 1 to 7. Therefore number 1 must go in the top circle, and from there it's quick to figure that the green circle is filled with number 4.
The solution can also be obtained by checking all the possible solutions for the green circle one by one. Solution 2: We work by checking systematically the cases. For example a) suppose for the moment that the green circle contain the number 1. Then going anti clock wise ALL other numbers can be filled using the given sums. For instance the next circle (on the right of the green one) must 5 so that the sum is 6. The next after that must be 6-5=1, then 9-1=8. This cannot be because the numbers are up to 7, so we start again supposing for the moment that b) the green circle contain the number 2. This will be followed by 6-2=4, then by 9-4=5, then by 8-8=3 then by 7-3 = 4. This cannot be because the number 4 has already been used. So new start with c) with 3 at the green circle. The next number is again 3, which we reject. We start again with 4. This time it works as shown, and we are done. If we tried 5 it will fail as in the cases we already saw. Note that we can save time by doing some ad hoc little arguments to reject cases. For example at a) above we started with the number 1. This can immediately be rejected because the number on its left would have to be 9-1= 8, which is not permitted. And so on.



24 (Catalonia). Maria has shaded exactly 5 cells in a 4×4 grid.
She challenges 5 of her friends to guess which cells she has shaded.
The grids they have drawn are shown below.
Maria looks at them and says: "One of you is right and each of the rest of you has four cells correct."
Which is the correct answer?

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

SOLUTION: There are three shaded cells which are common for all grids. Looking at the differences, the only grid which differs from each of the other grids by exactly one cell is grid (E).