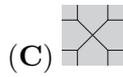**Benjamin**

3 points

1 (Iran). Which of the pieces shown would complete the pattern?

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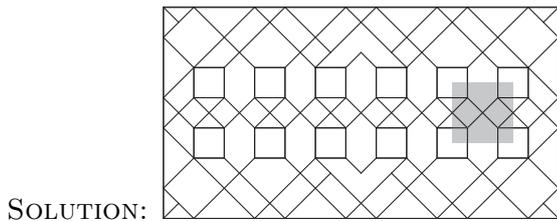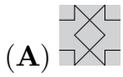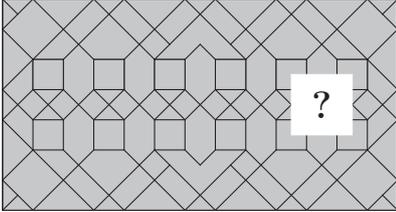
SOLUTION:

2 (Denmark). Anna has built a wall that displays the year 2025. Bella stands on the other side of the wall. What does Bella see?

(**A**)　　　　　　　(**B**)　　　　　　　(**C**)

(**D**)　　　　　　　(**E**)
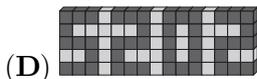
SOLUTION: From the back, 0 remains unchanged, 2 turns into 5, and 5 turns into 2.

3 (Tunisia). Mike has a leaflet with numbers and holes in the flaps on both sides, as shown in the picture.
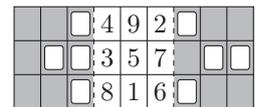He folds the right flap along the dotted line and sees the numbers 2, 3, 5 and 6 through the holes.
Then he folds the left flap along the other dotted line.
What is the sum of the numbers he sees now?
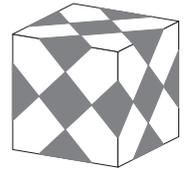

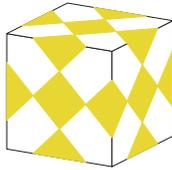(**A**) 10　　　　(**B**) 12　　　　(**C**) 14　　　　(**D**) 9　　　　(**E**) 8

SOLUTION: First a picture when the right flap is folded, and then the last picture where both are folded. The two visible numbers are 5 and 3, their sum is 8.

4 (Slovakia). A cube is decorated by gluing identical grey squares on it. All faces of the cube look the same.
How many grey squares are there in total?

(**A**) 30   (**B**) 18   (**C**) 16   (**D**) 15   (**E**) 14

SOLUTION: The problem can be solved in different ways. On one face, there is 1 full square and 4 half squares, so in total 3 squares. The cube has got 6 faces, so there are $6 \cdot 3 = 18$ squares in total.
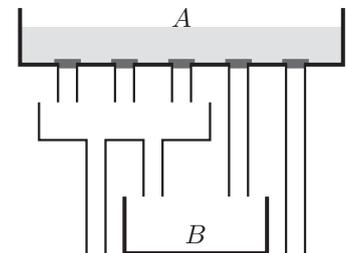
5 (Germany). Emil put slices of tomato, black olives, chillis, mushrooms and onion rings on top of a pizza, but not necessarily in that order. He only put one ingredient at a time. His finished pizza is shown in the picture. Which was the third topping he put on the pizza?
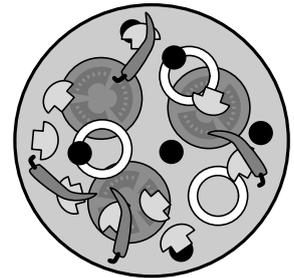
(**A**) tomato slices   (**B**) black olives ●

(**C**) chillis   (**D**) mushrooms   (**E**) onion rings

SOLUTION: First Emil placed tomato slices, then onion rings, black olives, mushrooms and as last he placed hot peppers. So the third ingredient was black olives.

6 (Switzerland). Container A holds 10 litres of water. All five plugs at the bottom of container A are taken out at the same time and the water flows out.
What volume of water flows into container B?

(**A**) 3 litres   (**B**) 4 litres

(**C**) 5 litres   (**D**) 6 litres

(**E**) 8 litres

SOLUTION: $(\frac{1}{2} \cdot \frac{3}{5} + \frac{1}{5}) \cdot 10 \text{ L} = 5 \text{ L}$
Both solutions should be there (the one already written and this one). Alternative solution: the first 5 plugs get 2 L each. The three plugs on the left side have in total 6 L. These 6 L are divided into two new plug, that is 3 L in each. The two plugs on the right have 2 L each. So, in container B it will get $3 \text{ L} + 2 \text{ L} = 5 \text{ L}$.

7 (Germany). Thea rotates a piece of paper divided into six equal parts. When the paper is rotated, it is turned clockwise one part. The original sheet of paper and the result of one rotation are shown in the diagram. What does the sheet of paper look like after a total of eight rotations?

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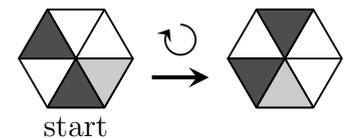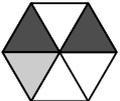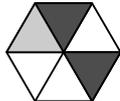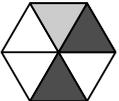
(**A**)   (**B**)   (**C**)   (**D**)   (**E**)

SOLUTION: Since 8 has a remainder of 2 when divided by 6, the hexagonal sheet is rotated 1 full turn and then by two more fields.

8 (Germany). The menu of my favourite burger restaurant is written on a board. However the rain has washed away some of the numbers. The burgers are ordered by price. Which of the following is the price of one of my burgers?

(**A**) 4.10　　　　(**B**) 5.50　　　　(**C**) 5.60　　　　(**D**) 6.30　　　　(**E**) 6.60

SOLUTION:

Starting from the top we see that a classic burger costs at least 4.30, a hot bacon burger at least 4.60, a cheesy burger at least 5.50, and a double burger costs at least 6.10. If any of these burgers was more expensive, a deluxe burger would cost at least 7.10, and that is not the case. Hence, the prices of the four burgers in the middle are 4.30, 4.60, 5.50, and 6.10.

9 (Catalonia). Six children took part in a race.

- Ariadne finished in the third place.

- Biel finished sixth, just behind Ernest.

- Fatima finished between Ariadne and Ernest.

- Diana overtook Charles right before the finish line.

Who won the race?

(**A**) Ariadne　　　　(**B**) Charles　　　　(**C**) Diana　　　　(**D**) Ernest　　　　(**E**) Fatima

SOLUTION: From the information we have A on the third place , E on the fifth and B on the sixth place. Then F must be between A and E, that is on the fourth place. Since D overtakes C, D is the winner, and C is second.
　　Order: D C A F E B

10 (Hong Kong). A bookshelf with three shelves has 17 books on the top shelf, 15 books on the middle shelf, and 7 books on the bottom shelf. Monika wants all shelves to have the same number of books on. She also wants to move as few books as possible. How many books should she move from the middle shelf to the bottom shelf?

(**A**) 1　　　　(**B**) 2　　　　(**C**) 3　　　　(**D**) 4　　　　(**E**) 5
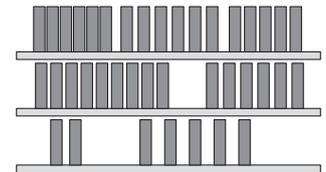
SOLUTION: In total we have 17+15+7=39 books. So, there should be $39/3 = 13$ books on every shelf. So move 4 books from the top shelf and 2 books from the middle shelf to the bottom shelf. Now there are 13 books on each shelf. We have moved 2 books from the middle to the bottom shelf.

4 points

11 (Russia). Three turtles participate in a 10-kilometre race. Each of them moves at a constant speed. When the first turtle finishes, the second turtle has covered $\frac{1}{4}$ of the distance, and the third turtle has covered $\frac{1}{5}$ of the distance.
How far from the finish line will the third turtle be when the second turtle finishes?

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

SOLUTION: When the second turtle covers $\frac{1}{4}$ of the distance, the third turtle covered $\frac{1}{5}$ of the distance. The second turtle has three times more of the distance left to cover. Thus the third turtle will cover

three more such parts of the distance. This leaves $\frac{1}{5}$ of the distance remaining for the third turtle. $10km : 5 = 2$ km.

or:

When the first turtle reaches the finishing line at 10 km, the second turtle has covered a quarter, this ist 2.5 km, the third turtle has covered 2 km. The second turtle needs four times as long as the first turtle to cover the 10 km. When the second turtle reaches the finish line, the third turtle will have covered 4 * 2 km = 8 km, so it is 2 km from the finishing line.

12 (Germany). Vera has built a tower of blocks. She wants to replace the two blocks with the question marks on with two blocks with numbers on. She wants the number on each block in her tower to be at least 2 more than the number on the block below it. In how many ways can Vera do this?


(**A**) 3
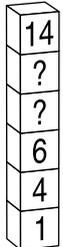
(**B**) 4

(**C**) 5

(**D**) 6

(**E**) 7

SOLUTION: The possibilites are 8 and 10, 8 and 11, 8 and 12, 9 and 11, 9 and 12, 10 and 12. So there are 6 possibilities.

13 (Norway). The picture shows five wheels of fortune. Each wheel is divided into a different number of identical parts. You will win a prize when the wheel is spun and then stops with the triangle above the wheel pointing to a part that is shaded.
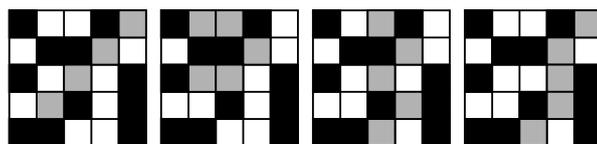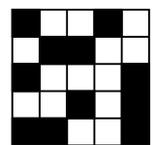Which wheel gives you the best chance of winning?
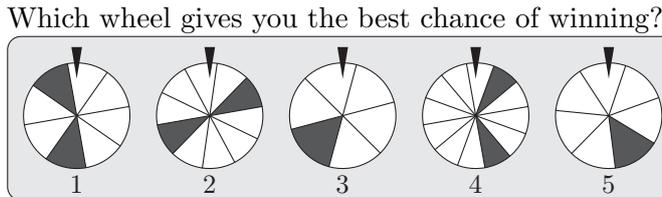
(**A**) 1   (**B**) 2   (**C**) 3   (**D**) 4   (**E**) 5
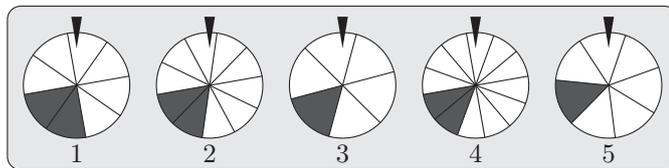
SOLUTION: $\frac{2}{8} > \frac{2}{10} > \frac{1}{6} = \frac{2}{12} > \frac{1}{7}$

14 (Germany). Which shape, or any rotation of the shape, <u>cannot</u> be placed onto the white parts of the large square?

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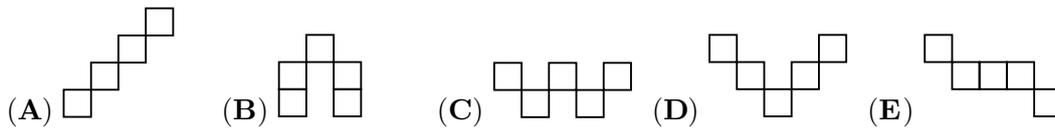
SOLUTION:

15 (Germany). My school's swimming team is practising for a relay competition. Five swimmers swam the same distance, one after the other. The pictures below show the times on their coach's stopwatch when each swimmer had finished their leg. The first swimmer needed 2 minutes and 8

seconds.
Which one of the swimmers needed the least time?


(**A**) the first   (**B**) the second   (**C**) the third   (**D**) the fourth   (**E**) the fifth

SOLUTION: The first swimmer needs 8 s more than 2 min, the second swimmer needs 1 s less than 2 min, the third swimmer needs 3 s more than 2 min, the fourth swimmer needs 5 s less than 2 min, the fifth swimmer needs 2 s less than 2 min. This means that the fourth swimmer (D) needed the least time (because he/she is the fastest swimmer).

16 (Brazil). Janaína cuts four identical squares from the corners of a square sheet of paper, as shown. The total area she cut off is 16 cm^2 and the area of the cross that remains is 9 cm^2. What is the perimeter of the cross in cm?
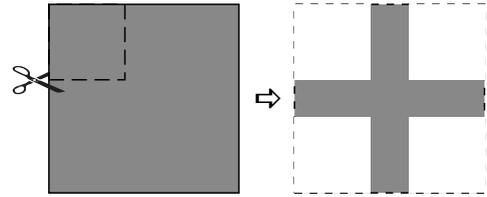
(**A**) 9   (**B**) 16   (**C**) 20   (**D**) 25   (**E**) 32

SOLUTION: The area of the sheet is 16 cm^2 + 9 cm^2 = 25 cm^2, so the side-lenght of the square is 5 cm and its perimeter is $4 \cdot 5$ cm = 20 cm. The perimeter of the cross is the same.

17 (Greece). Each of the cards shown below have two 3-digit numbers written on them, but some of the digits cannot be seen as they are covered in ink. On one of the cards, the sum of the digits of both numbers is the same. On which card are those two numbers?

(**A**) 543 and 11▮   (**B**) 58▮ and 11▮   (**C**) 982 and 1▮▮

(**D**) 211 and 6▮▮   (**E**) 777 and 2▮▮

SOLUTION: For A we have 5+4+3=12 so the second number needs another 12-1-1=10, which is not a digit, so this card is rejected. Similarly we can reject B,D,E. But for C we can have the numbers 982 and 199 (the choice is unique).

18 (Turkey). The shape in the diagram is made of identical squares. Point B is halfway between points A and C. Also, point D is halfway between points C and E. Maria wants to divide the shape into two parts of equal area. Which of the points A, B, C, D or E should she connect with a straight line to point S to do this?

(**A**) A   (**B**) B   (**C**) C

(**D**) D   (**E**) E

SOLUTION:

5
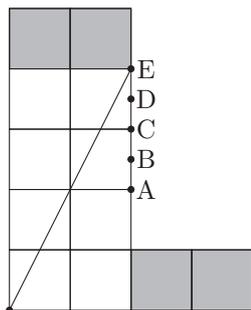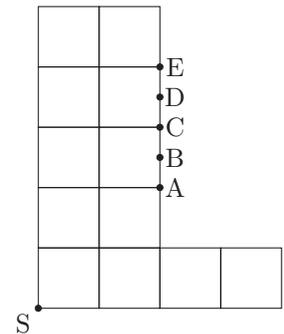
19 (Poland). Hasan wants to write a 0 or a 1 in each cell of the diagram so that the sum of the numbers in each row, column and diagonal is 3. He has already written a 0 in one of the cells.

When he finishes, what will the sum of the numbers in the cells shown with a question mark be?

	?		
		0	
?			?
	?		

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

(**E**) It cannot be calculated.

SOLUTION: Because there is already placed 0, all the other cells in the second row, the third column and the diagonal through the cell with a 0 must be filled in with number 1.

	?	1	1
1	1	0	1
?	1	1	?
1	?	1	

If we now place a 0 or a 1 in one of the cells with a questionmark and fill in the rest of the cells, the sum of all the cells with question marks will be 2.

0	1	1	1
1	1	0	1
1	1	1	0
1	0	1	1

1	0	1	1
1	1	0	1
0	1	1	1
1	1	1	0

20 (Greece). Mary and Paul each wrote down three 3-digit numbers using the digits 1 to 9 exactly once. Then they ordered their numbers as smallest, middle and largest. Mary wrote down the largest possible value the middle number could have. Paul wrote down the smallest possible value the middle number

392	487	516
smallest	middle	largest

could have. Paul wrote down the smallest possible value the middle number could have. What is the difference between their two middle numbers?

(**A**) 642   (**B**) 684   (**C**) 864   (**D**) 888

(**E**) none of the previous

SOLUTION: The hundred-digit of the largest middle number cannot be 9 because this would not leave a suitable digit for the larger 3 digit number. So the largest middle number must start with an 8, leaving the 9 for the larger one. It is now clear the largest middle number is 876. Similarly the smallest middle number is 234. Their difference is 876-234=642.

5 points

21 (Greece). A witch had 10 apples, 9 bananas and 6 pears. One day she performed some magic and turned each of her pieces of fruit into one of the other two types. For example, she changed each apple into either a banana or a pear. She now has 15 apples, 7 bananas and 3 pears. How many of the apples did she change into a banana?
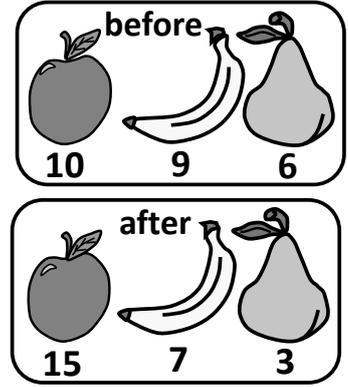

(**A**) 3   (**B**) 4   (**C**) 5   (**D**) 6   (**E**) 7

SOLUTION:

Notice the bananas and the pears before the change are a total of 9+6 = 15 fruits, which is exactly the same as the apples the next day. It means (this is the crucial observation) that ALL the bananas and the pears turned into apples. For example, no banana turned into a pear because then the 9 bananas and 6 pears would result in less than 9+6=15 apples, which is not the case. Similarly, no pear turned into a banana. Now (this is the second crucial observation) since no banana was formerly a pear and no pear was former a banana hence all the bananas and all the pears were formerly apples. In particular 7 bananas were changed from apples this is the answer.
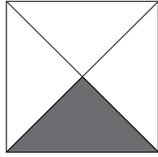
22 (Spain). The side-length of the square shown in the diagram is 10 cm. The line down in the middle of the square divides it into two equal rectangles. What is the area of the shaded region?
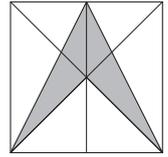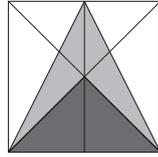

(**A**) 12.5 cm^2 (**B**) 25 cm^2 (**C**) 30 cm^2 (**D**) 40 cm^2 (**E**) 50 cm^2
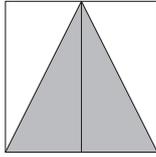
SOLUTION:

$100 \, \text{cm}^2 : 2$
$= 50 \, \text{cm}^2$

$100 \, \text{cm}^2 : 4 =$
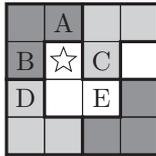$= 25 \, \text{cm}^2$

$50 \, \text{cm}^2 - 25 \, \text{cm}^2$
$= 25 \, \text{cm}^2$

23 (Hong Kong). Joanna divides the figure shown into five equally shaped parts, each constisting of three squares. The square containing which letter is in the same part as the square marked with a star?
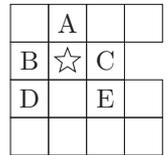
(**A**) A   (**B**) B   (**C**) C   (**D**) D   (**E**) E

SOLUTION:

24 (Argentina). Facu never tells the truth on Tuesdays, Thursdays and Saturdays. He always tells the truth on the other four days.
One day Mateo had the following conversation with Facu:
Mateo: "What day is today?"
Facu: "Saturday"
Mateo: "What day will be tomorrow?"
Facu: "Wednesday"
On which day did this conversation take place?

(**A**) Monday   (**B**) Tuesday   (**C**) Wednesday   (**D**) Thursday   (**E**) Friday

SOLUTION: The answers are both contradictory, so it's one of the days on which Facu lies (Tuesday, Thursday or Saturday). Consequently, both statements are wrong. It can't be Saturday nor the day before Wednesday, that is Tuesday, because Facu lies. Therefore, the only possible day remaining is Thursday. Both Facus statements are incorrect, so Thursday is the solution.
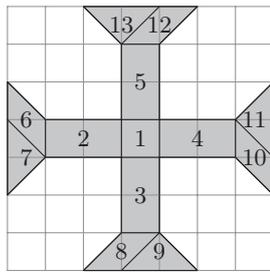
25 (Puerto Rico). Julio wants to construct this cross shape shown in the picture using pieces shaped like the ones below the cross. He has many copies of each piece and knows he can rotate them if needed. The pieces must not overlap.
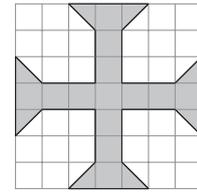
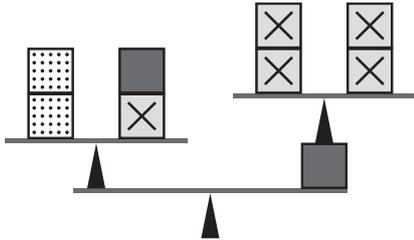What is the smallest number of pieces he could use to construct the shape?
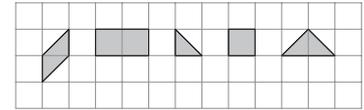
(**A**) 11   (**B**) 12   (<u>**C**</u>) 13

(**D**) 15   (**E**) 17

SOLUTION:

26 (Finland). Some blocks are balanced on top of each other, as shown. Blocks that are shaded in the same way have the same weight.


Ville wants to order the three different types of square block from heaviest to lightest. What order should Ville obtain?

(<u>**A**</u>)   (**B**)   (**C**)

(**D**)   (**E**)

SOLUTION: Comparing the left and right sides of the construction we see that two dotted blocks weigh the same three crossed blocks, so dotted blocks are heavier.

On the left we see that a gray box and a crossed box weigh the same as two dotted boxes. Since the crossed box is lighter, the gray box must be heavier than the dotted box. Thus gray is heaviest, then dotted, then crossed, and the answer is A.

27 (Poland). Patricia wants to write the numbers from 1 to 9 into the squares in the diagram, with one number in each square. She wants the sum of the numbers in any two adjacent squares to be equal to the number shown on the line joining these squares.
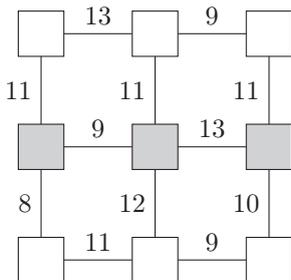

What is the sum of the numbers she writes in the shaded row?

(**A**) 16   (**B**) 17   (<u>**C**</u>) 18   (**D**) 20   (**E**) 21

SOLUTION: If a square contains 1 then the sum in any pair of squares containing that square is ≤ 10. The only square with that property is bottom right corner. So position of 1 is uniquely determined. Then we can fill in the rest because of all the sums. Picture with everything filled in.

6. 7. 2 5. 4. 9 3. 8. 1 The sum is 5+4+9=18.
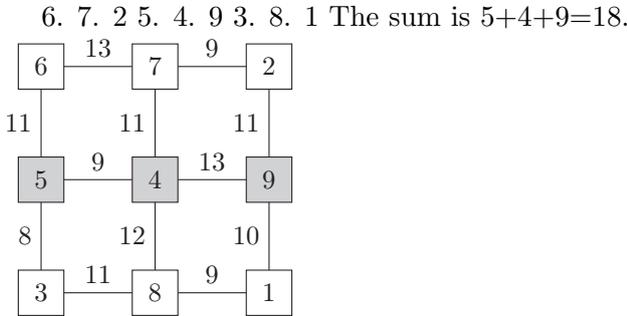
28 (Germany). Tino combines the three building blocks shown on the right. Which of the following constructions could he make?

(A)   (B)   (C)   (D)   (E)
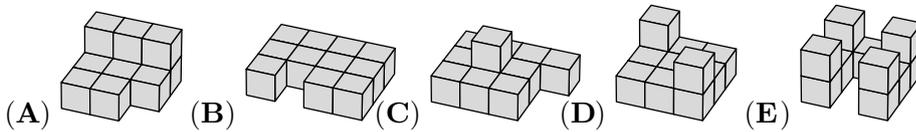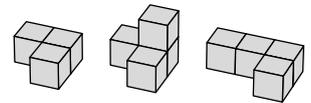
SOLUTION: (A) is not possible, because at least one of the blocks on the upper floor has to come from the second building block. But then there isn't room for the other two building blocks left.

(B) is not possible, because there has to be at least 1 block on the upper floor from the second building block.

(C) is not possible, because the building block on the upper floor has to come from the second building block and then there is not room for the other two building blocks left.

(D) is possible, one block from the second building block and one block from the third building block are on the upper floor.

(E) is not possible, because there can be at most 3 groups of blocks on the upper floor.

29 (Iran). Sara had three times as many chocolates as Sanaz. Sara then gave a quarter of her chocolates to Sanaz. Sara now has six more chocolates than Sanaz. How many more chocolates than Sanaz did Sara have originally?
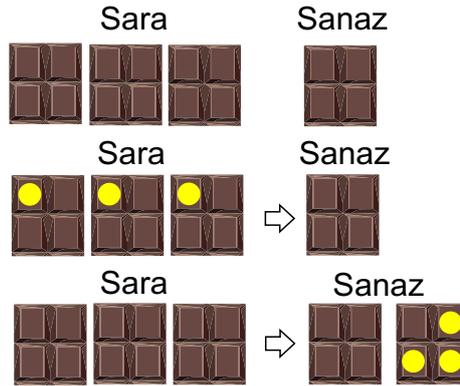
(**A**) 36   (**B**) 30   (**C**) 27   (**D**) 24   (**E**) 20

SOLUTION: We draw some shapes. As Sara gave a quarter of her chocolates to Sanaz, we divided each unit of chocolates into four parts.
Sara chose a quarter of her chocolates.
Sara gave a quarter of her chocolates to Sanaz.

Sara still has 6 more chocolates than Sanaz.
The difference (which is $9 - 7 = 2$ parts) has the value of 6 chocolates. Thus, each part has a value of 3 chocolates.
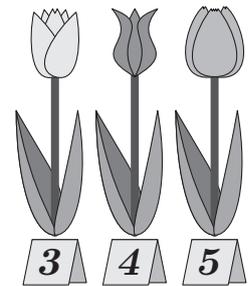
Therefore Sara and Sanaz originally had $12 \times 3 = 36$ and $4 \times 3 = 12$ respectively which gives the difference $36 - 12 = 24$.

30 (Denmark). Zeta wants to buy some flowers. The prices of the three flowers she can buy are shown in the picture.
How many different bouquets with a total cost of exactly 23 can she buy?

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

SOLUTION: There are 7 solutions:
$2 \cdot 3 + 3 \cdot 4 + 1 \cdot 5 = 23$
$1 \cdot 3 + 5 \cdot 4 = 23$
$1 \cdot 3 + 4 \cdot 5 = 23$
$6 \cdot 3 + 1 \cdot 5 = 23$
$3 \cdot 3 + 1 \cdot 4 + 2 \cdot 5 = 23$
$2 \cdot 4 + 3 \cdot 5 = 23$
$5 \cdot 3 + 2 \cdot 4 = 23$