Kangourou Sans Frontières

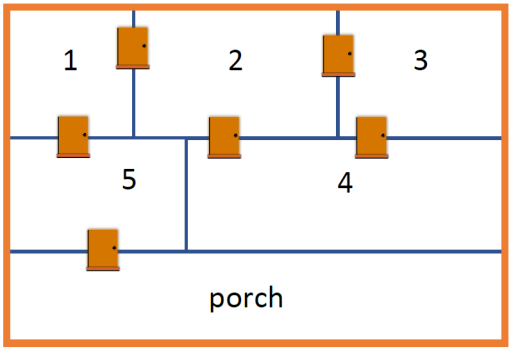
Student Test

Name:_____

Costa Rica 2018

3 points

1. The figure shows the floor plan of Renate's house. Renate enters her house from the porch and walks through each door exactly once. In which room does she end up?



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

2. Which of the following numerical expressions has the highest value?

(**A**) $2-0\cdot 1+8$ (**B**) $2+0\cdot 1\cdot 8$ (**C**) $2\cdot 0+1\cdot 8$ (**D**) $2\cdot(0+1+8)$ (**E**) $2\cdot 0+1+8$

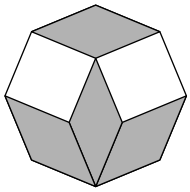
3. Thor has seven stones and a hammer. Every time he hits a stone with the hammer it breaks into exactly five smaller stones. He does this several times. Which of the following numbers could be the number of stones he may end with?

(**A**) 17 (**B**) 20 (**C**) 21 (**D**) 23 (**E**) 25

4. The following two statements are true: Some aliens are green, the others are purple. Green aliens live only on Mars. Therefore, it logically follows that

(**A**) all aliens live on Mars (**B**) only green aliens live on Mars (**C**) some purple aliens live on Venus.
(**D**) all purple aliens live on Venus (**E**) no green aliens live on Venus.

5. Four identical rhombusses and two squares are put together to make a regular octogon. What is the measure of the larger angle of each rhombus?

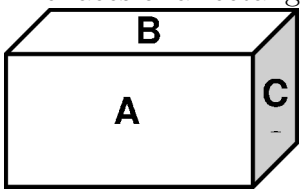


(**A**) 135° (**B**) 140° (**C**) 144° (**D**) 145° (**E**) 150°

6. There are 65 balls in a box. 8 are white and the rest of the balls are black. In one move, at most 5 balls can be taken out of the box. It is not allowed to put any balls back in the box. What is the smallest number of moves needed to ensure that at least one white ball is taken out?

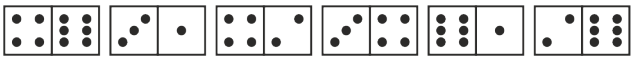
(**A**) 11 (**B**) 12 (**C**) 13 (**D**) 14 (**E**) 15

7. The faces of a rectangular brick have areas A, B and C as shown. What is the volume of the brick?



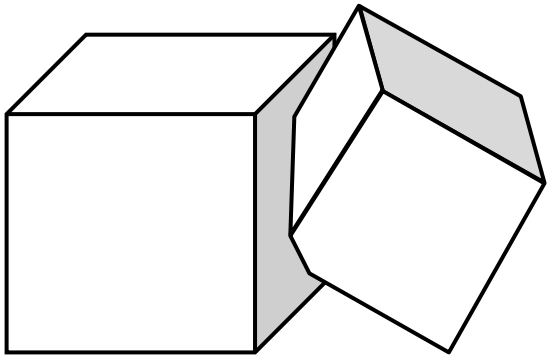
(**A**) ABC (**B**) $\sqrt{ABC}$ (**C**) $\sqrt{AB+BC+CA}$
(**D**) $\sqrt[3]{ABC}$ (**E**) $2(A+B+C)$

8. Domino tiles are said to be arranged correctly if the number of spots at the ends that touch for any two adjacent dominoes are the same. Paulius laid six dominoes in a line as shown in the diagram. He can make a move by either swapping the position of any two dominoes or by rotating one dominoe. What is the smallest number of moves he needs to make to arrange all the tiles correctly?



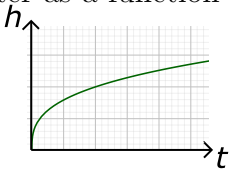
(**A**) 1 (**B**) 2 (**C**) 3 (**D**) 4
(**E**) it is impossible to do

9. Two cubes of volumes V and W intersect. The part of the cube of volume V which is not common to the two cubes is 90% of its volume. The part of the cube of volume W which is not common to the two cubes is 85 % of its volume. What is the relationship between V and W?

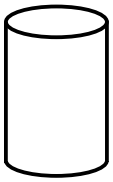


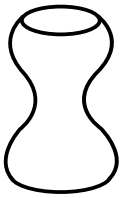
(**A**) $V = \frac{2}{3}W$ (**B**) $V = \frac{3}{2}W$ (**C**) $V = \frac{85}{90}W$
(**D**) $V = \frac{90}{85}W$ (**E**) $V = W$

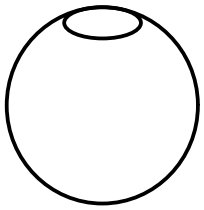
10. A vase is filled up to the top with water, at a constant rate. The graph shows the height h of the water as a function of time t.

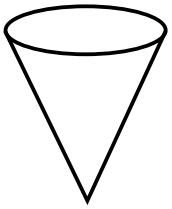


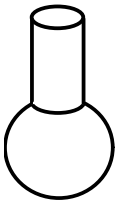
Which of the following could be the shape of the vase?

(**A**) 

(**B**) 

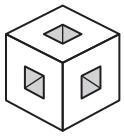
(**C**) 

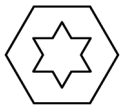
(**D**) 

(**E**) 

4 points

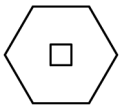
11. Seven small cubes have been deleted from a $3 \times 3 \times 3$ cube (see the picture). We cut this cube by the plane passing through the centre of the cube and perpendicular to one of its four big diagonals. What will the cross-section look like?



(**A**) 

(**B**) 

(**C**) 

(**D**) 

(**E**) 

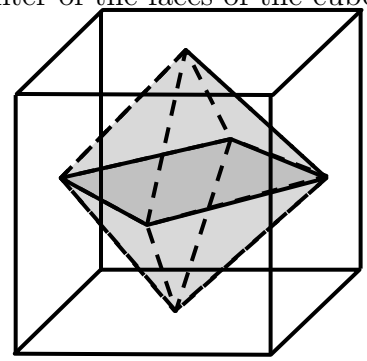
12. Each number of the set $\{1, 2, 3, 4, 5, 6\}$ is written exactly into one cell of a 2×3 table. In how many ways can this be done such that in each row and in each column the sum of the numbers is divisible by 3?

(**A**) 36 (**B**) 42 (**C**) 45 (**D**) 48 (**E**) another number

13. $|\sqrt{17} - 5| + |\sqrt{17} + 5| =$

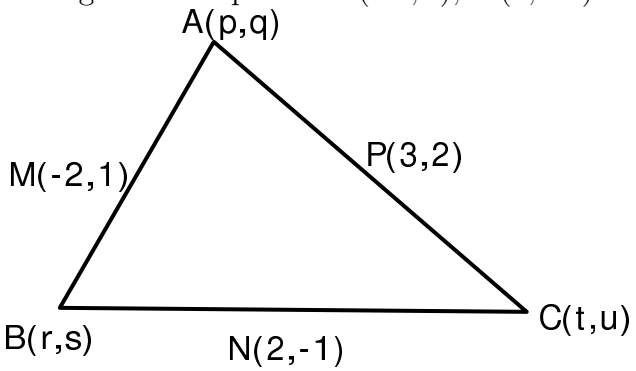
(**A**) 10 (**B**) $2\sqrt{17}$ (**C**) $\sqrt{34} - 10$ (**D**) $10 - \sqrt{34}$ (**E**) 0

14. An octahedron is inscribed in a cube of side length 1. The vertices of the octahedron are at the center of the faces of the cube. What is the volume of the octahedron?



(**A**) $\frac{1}{3}$ (**B**) $\frac{1}{4}$ (**C**) $\frac{1}{5}$ (**D**) $\frac{1}{6}$ (**E**) $\frac{1}{8}$

15. The vertices of a triangle are $A(p, q)$, $B(r, s)$ and $C(t, u)$ as shown. The midpoints of the sides of the triangle are the points $M(-2, 1)$, $N(2, -1)$ and $P(3, 2)$. What is the value of $p + q + r + s + t + u$?



(**A**) 2 (**B**) $\frac{5}{2}$ (**C**) 3 (**D**) 5 (**E**) none of these

16. Five predictions were made before the football match between Real Madrid and Manchester United:

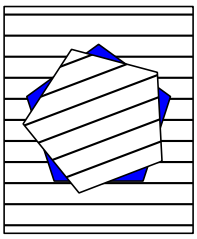
1. The game will not end in a draw;
2. Real Madrid will score;
3. Real Madrid will win;
4. Real Madrid will not lose;
5. Three goals will be scored.

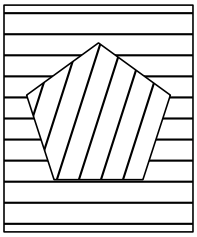
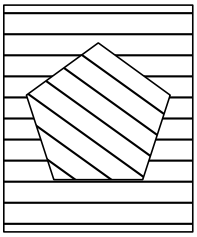
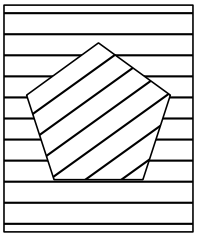
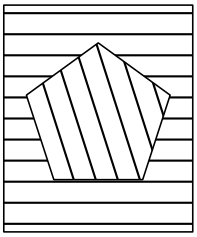
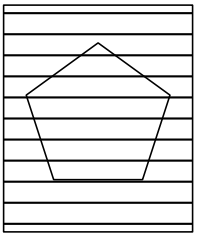
What was the final score of the match Real Madrid - Manchester United if exactly three of the predictions came true?

(**A**) 3-0 (**B**) 2-1 (**C**) 0-3 (**D**) 1-2

(**E**) this situation is not possible

17. We cut out a regular pentagon from a lined piece of paper. In each step we rotate the pentagon counterclockwise around its centre by 21°. The situation after the first step is shown. What will we see when the pentagon first fits back in the hole?



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

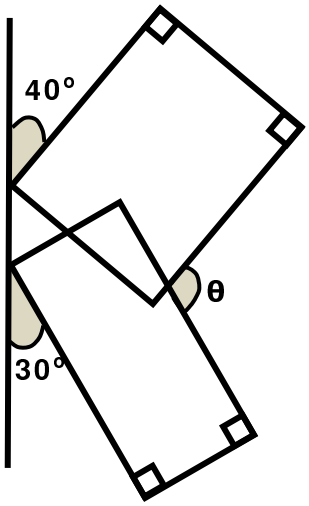
18. Which of these five numbers does not divide $18^{2017} + 18^{2018}$?

(**A**) 8 (**B**) 18 (**C**) 28 (**D**) 38 (**E**) 48

19. Three of the five cards shown are given to Nadia and the rest to Riny. Nadia multiplies the 3 values of her cards and Riny multiplies the 2 values of his cards. It turns out that the sum of the two resulting products is prime. What is the sum of the values of Nadia's cards?

(**A**) 12 (**B**) 13 (**C**) 15 (**D**) 17 (**E**) 18

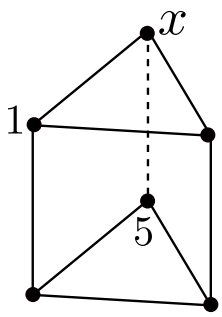
20. Two rectangles are inclined to the vertical line at angles 40° and 30° as shown. What is the measure of the angle θ?



(**A**) 105° (**B**) 120° (**C**) 130° (**D**) 135° (**E**) None of these

5 points

21. The prism in the picture is formed of two triangles and three squares. The six vertices are numbered from 1 to 6 in such a way that the sum of the four vertices of each square is the same for all three squares. Numbers 1 and 5 are already shown. What number is at the vertex labeled x?



(**A**) 2 (**B**) 3 (**C**) 4 (**D**) 6 (**E**) the situation is impossible

22. m and n are the roots of the equation $x^2 - x - 2018 = 0$. What is the value of $n^2 + m$?

(**A**) 2016 (**B**) 2017 (**C**) 2018 (**D**) 2019 (**E**) 2020

23. Four brothers named A, B, C and D have different heights. They state the following:

- A: I am neither the tallest nor the shortest. - B: I am not the shortest. - C: I am the tallest. - D: I am the shortest.

Exactly one of them is lying. Who is the tallest?

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

(**E**) We do not have enough information

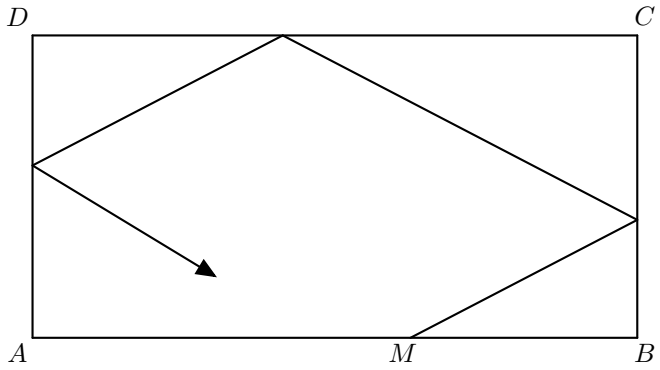
24. Let f be a function such that $f(x+y) = f(x)f(y)$ for all integers x and y. If $f(1) = 1/2$, find the value of $f(0) + f(1) + f(2) + f(3)$.

(**A**) $1/8$ (**B**) $3/2$ (**C**) $5/2$ (**D**) $15/8$ (**E**) 6

25. A quadratic function $f(x) = x^2 + px + q$ is such that its graph intersects the x-axis and the y-axis in three different points. The circle through these three points intersects the graph of f in a fourth point. What are the coordinates of this fourth point?

(**A**) $(0, -q)$ (**B**) (p, q) (**C**) $(-p, q)$ (**D**) $\left(-\frac{q}{p}, \frac{q^2}{p^2}\right)$ (**E**) $(1, p+q+1)$

26. We are given a rectangular billiard table with sides of length $3m$ and $2m$. A ball is shot from the point M on one of the longer sides. It reflects once on every other side as shown. At what distance from point A will it hit the initial side if $BM = 1,2m$ and $BN = 0,8m$?

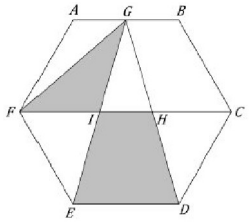


(**A**) $1,2m$ (**B**) $1,5m$ (**C**) $2m$ (**D**) $2,8m$ (**E**) $1,8m$

27. How many real solutions does the equation $\big||4^x - 3| - 2\big| = 1$ have?

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

28. $ABCDEF$ is a regular hexagon. G is the midpoint of AB. H and I are the points of intersection of the segments GD and GE with FC respectively. What is the ratio between the area of the triangle GIF and the area of the trapezoid $IHDE$?



(**A**) $\frac{1}{2}$ (**B**) $\frac{1}{3}$ (**C**) $\frac{1}{4}$ (**D**) $\frac{\sqrt{3}}{3}$ (**E**) $\frac{\sqrt{3}}{4}$

29. There are 40 % more girls than boys in a class. How many pupils are in this class if the probability that a two-person delegation selected at random consists of a girl and a boy equals $\frac{1}{2}$?

(**A**) 20 (**B**) 24 (**C**) 36 (**D**) 38

(**E**) This situation is not possible.

30. Archimedes calculated 15!. The result is written on the board. Unfortunatelly two of the figures, the second and the tenth, are not visible. Which are these two figures?

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(**A**) 2 and 0 (**B**) 4 and 8 (**C**) 7 and 4 (**D**) 9 and 2 (**E**) 3 and 8

Hoja de Respuestas

Nombre:_____

Institución:_____ Nivel: _____

01.	A	B	C	D	E
02.	A	B	C	D	E
03.	A	B	C	D	E
04.	A	B	C	D	E
05.	A	B	C	D	E
06.	A	B	C	D	E
07.	A	B	C	D	E
08.	A	B	C	D	E
09.	A	B	C	D	E
10.	A	B	C	D	E
11.	A	B	C	D	E
12.	A	B	C	D	E
13.	A	B	C	D	E
14.	A	B	C	D	E
15.	A	B	C	D	E

16.	A	B	C	D	E
17.	A	B	C	D	E
18.	A	B	C	D	E
19.	A	B	C	D	E
20.	A	B	C	D	E
21.	A	B	C	D	E
22.	A	B	C	D	E
23.	A	B	C	D	E
24.	A	B	C	D	E
25.	A	B	C	D	E
26.	A	B	C	D	E
27.	A	B	C	D	E
28.	A	B	C	D	E
29.	A	B	C	D	E
30.	A	B	C	D	E