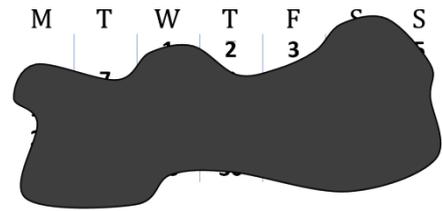


3 point problems

1. The picture shows the calendar of a certain month of the year. Unfortunately some ink fell on the calendar and most of it cannot be seen. Which day of the week was the 27th of that month?

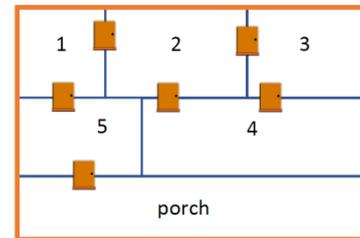


- (A) Monday      (B) Wednesday      (C) Thursday      (D) Saturday      (E) Sunday

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

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

3. 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?

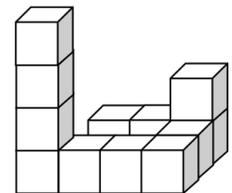


- (A) 1      (B) 2      (C) 3      (D) 4      (E) 5

4. 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

5. The shape shown is made of 10 cubes glued together. The shape is dipped into a bucket of paint covering the surface entirely. How many of the cubes will be painted on exactly four of their faces?

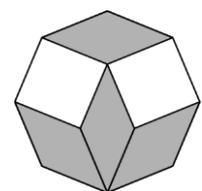


- (A) 6      (B) 7      (C) 8      (D) 9      (E) 10

6. 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.

7. Four identical rhombuses and two squares are put together to make a regular octagon. What is the measure of the larger angle of each rhombus?



- (A)  $135^\circ$       (B)  $140^\circ$       (C)  $144^\circ$       (D)  $145^\circ$       (E)  $150^\circ$

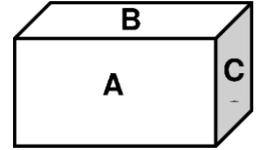
8. There are 65 balls in a box. Eight are white and the rest of the balls are black. In one move, at most five balls can be taken out of the box. It is not allowed to put any balls back in the box. What is the smallest number of moves needed to ensure that at least one white ball is taken out?

# KSF 2018 – Level S



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

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



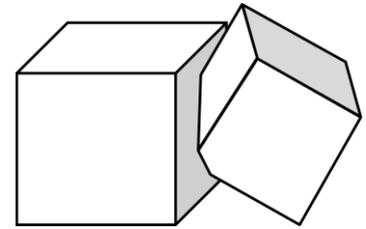
- (A)  $ABC$                       (B)  $\sqrt{ABC}$                       (C)  $\sqrt{AB+AC+BC}$                       (D)  $\sqrt[3]{ABC}$                       (E)  $2(A+B+C)$

10. In how many different ways can the number 1001 be written as the sum of two prime numbers?

- (A) None.                      (B) One.                      (C) Two.                      (D) Three.                      (E) More than three.

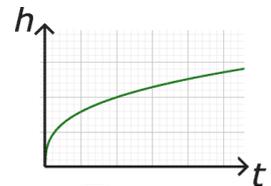
## 4 point problems

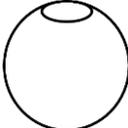
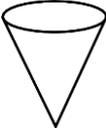
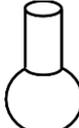
11. Two cubes of volumes  $V$  and  $W$  intersect as shown. The part of the cube of volume  $V$  which is not common to the two cubes is 90% of its volume. The part of the cube of volume  $W$  which is not common to the two cubes is 85 % of its volume. What is the relationship between  $V$  and  $W$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



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

12. 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?

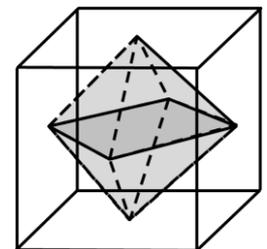


- (A)                       (B)                       (C)                       (D)                       (E) 

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

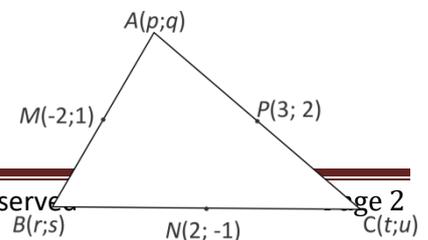
- (A) 10                      (B)  $2\sqrt{17}$                       (C)  $\sqrt{34}-10$                       (D)  $10-\sqrt{34}$                       (E) 0

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



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

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



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$M=(-2;1), N=(2;-1)$  and  $P=(3;2)$ . What is the value of  $p+q+r+st+u$ ?

- (A) 2      (B)  $\frac{5}{2}$       (C) 3      (D) 5      (E) 10

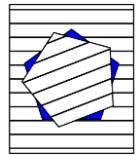
16. Five predictions were made before the football match between Argentina x Brazil.

- (1) The game will not end in a draw.
- (2) Argentina will score.
- (3) Argentina will win.
- (4) Argentina will not lose.
- (5) Three goals will be scored.

What was the final score of the match Argentina x Brazil if exactly three of the predictions came true?

- (A)  $3 \times 0$       (B)  $2 \times 1$       (C)  $0 \times 3$       (D)  $1 \times 2$       (E)  $0 \times 0$

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  $21^\circ$ . 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 the following numbers does not divide  $18^{2017} + 18^{2018}$ ?

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

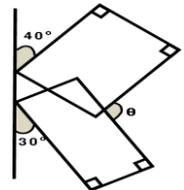
19. Three of the five cards shown are given to Nadia and the rest to Riny. Nadia multiplies the 3 values of her cards and Riny multiplies the 2 values of his cards. It turns out that the sum of the two resulting products is a prime number. What is the sum of the values of Nadia's cards?



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

20. Two rectangles are inclined to the vertical line at angles  $40^\circ$  e  $30^\circ$  as shown. What is the measure of the angle  $\theta$ ?

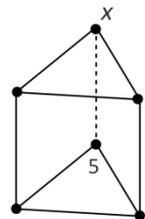
- (A)  $105^\circ$       (B)  $110^\circ$       (C)  $115^\circ$       (D)  $120^\circ$       (E)  $125^\circ$



## 5 point problems

21. The prism in the picture is formed of triangles and squares. The six vertices are numbered from 1 to 6 in such a way that the sum of the numbers of the four vertices of each square is the same for all three squares. One number is already written. What is the value of  $x$ ?

- (A) 2      (B) 3      (C) 4      (D) 6      (E) Not determined.



22. If  $m$  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) 2012

# KSF 2018 – Level S



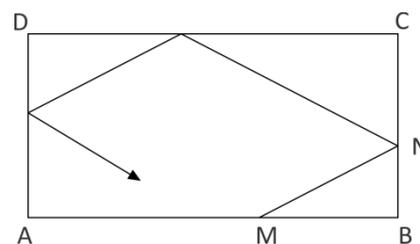
23. Let  $f: Z \rightarrow R$  be a function such that  $f(x+y) = f(x) \cdot f(y)$ . If  $f(1) = \frac{1}{2}$ , what is the value of  $f(0) + f(1) + f(2) + f(3)$ ?

- (A)  $\frac{1}{8}$                       (B)  $\frac{3}{2}$                       (C)  $\frac{5}{2}$                       (D)  $\frac{15}{8}$                       (E) 6

24. The graph of the function  $f(x) = x^2 + px + q$  is such that its graph intersects the coordinated axes in three different points. The circle through these three points intersects the graph of  $f$  in a fourth point. Which is this point?

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

25. 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 and it reflects once on every other side as shown. If  $BM = 1,2m$  and  $BN = 0,8 m$ , at what distance from point A will the ball hit the initial side?

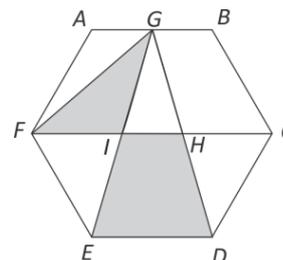


- (A) 1,2 m                      (B) 1,5 m                      (C) 1,8 m                      (D) 2 m                      (E) 2,8 m

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

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

27.  $ABCDEF$  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)  $\frac{\sqrt{3}}{4}$

28. At most, how many common positive divisors can have two two-digit numbers?

- (A) 6                      (B) 8                      (C) 9                      (D) 10                      (E) 12

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

- (A) 20    (B) 24    (C) 36    (D) 38    (E) This situation is not possible.

30. Archimedes calculated  $15!$  and wrote the result on the board. Unfortunately two of the figures, the second and the tenth, are not visible. Which are these two figures?

1 0 7 6 7 4 3 6 0 0 0

- (A) 6                      (B) 8                      (C) 9                      (D) 10                      (E) 12