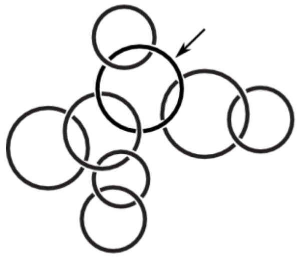
3 point problems

1. In my family each child has at least two brothers and at least one sister. What is the smallest possible number of children in my family?

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

2. Some of the rings in the picture form a chain that includes the ring indicated by the arrow. How many rings are there in the longest possible chain?

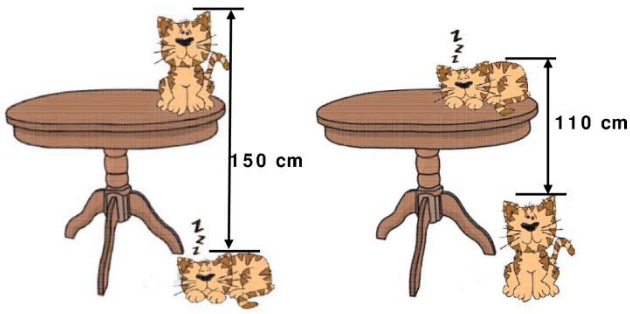


(A) 3 (B) 4 (C) 5 (D) 6 (E) 7

3. The lengths of the sides of a triangle are 2, 5, and an odd integer number. What is this number?

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

4. The distance from the top of the sleeping cat on the floor to the top of the cat sitting on the table is 150 cm. The distance from the top the cat sitting on the floor to the top on the cat sleeping on the table is 110 cm. What is the height of the table, in cm?

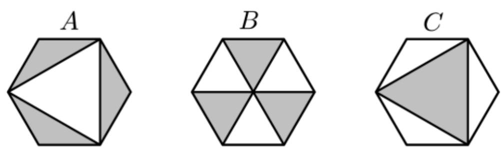


(A) 110 (B) 120 (C) 130 (D) 140 (E) 150

5. The sum of five consecutive integers is 10^{2018}. What is the middle number?

(A) 10^{2013} (B) 5^{2017} (C) 10^{2017} (D) 2^{2018} (E) $2\cdot 10^{2017}$

6. Let *X*, *Y*, and *Z* be the gray areas in each of the congruent regular hexagons *A*, *B*, and *C*, respectively. Which of the following statements is true?



(A) $X = Y = Z$ (B) $X = Z \neq Y$ (C) $X = Y \neq Z$ (D) $Y = Z \neq X$ (E) The three areas are different.

7. Mary has collected 42 apples, 60 apricots and 90 cherries. She wants to divide all the fruits into identical piles, with the same number of each of the three types of fruit. What is the largest number of piles she can make?

(A) 3 (B) 6 (C) 10 (D) 14 (E) 42

8. Some of the digits in the correct addition at right have been replaced by the letters *P*, *Q*, *R* and *S*, as shown. How much is $P+Q+R+S$?

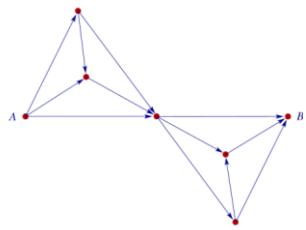
$$\begin{array}{cccc} & P & 4 & 5 \\ + & Q & R & S \\ \hline & 6 & 5 & 4 \end{array}$$

(A) 14 (B) 15 (C) 16 (D) 17 (E) 24

9. What is the value of the sum 25% of 2018 + 2018% of 25?

(A) 1009 (B) 2016 (C) 2018 (D) 3027 (E) 5045

10. In the picture shown, how many different routes are there from A to B along the lines following the directions of the arrows?



(A) 6 (B) 9 (C) 12 (D) 16 (E) 20

4 point problems

11. Two buildings are located on the same street, at a distance of 250 meters from each other. There are 100 students living in the first building and there are 150 students living in the second building.
Where should a bus stop be built so that the sum of the distances that all these students must walk to get from their buildings to the bus stop is the least possible?

(A) In front of the first building.
(B) 100 meters from the first building.
(C) 100 meters from the second building.
(D) In front of the second building.
(E) Anywhere between the buildings.

12. Peter wanted to buy a book, but he didn't have any money. He bought it with the help of his father and his two brothers. His father gave him half of the amount given by his brothers. His elder brother gave him one third of what the others gave. The younger brother gave him 10 reais. What was the price of the book?

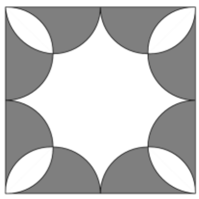
(A) 24 (B) 26 (C) 28 (D) 30 (E) 32

13. In true equality below, how many times the term 2018^2 appears inside the radical sign?

$$\sqrt{2018^2+2018^2+\ldots+2018^2}=2018^{10}$$

(A) 5 (B) 8 (C) 18 (D) 2018^8 (E) 2018^{18}

14. Eight congruent semicircles are drawn inside a square of length 4. What is the area of the non-shaded part of the square?



(A) $\dfrac{2}{\pi}$ (B) 8 (C) $6+\pi$ (D) $\dfrac{3}{\pi}-2$ (E) $\dfrac{3}{\pi}$

15. On one day, 40 buses traveled each one between exactly two cities *M*, *N*, *O*, *P* and *Q*, so that 10 buses traveled from or to *M*, 10 buses traveled from or to *N*, 10 buses traveled from or to *O* and 10 buses traveled from or to *P*. How many buses traveled from or to city *Q*?

(A) 0 (B) 10 (C) 20 (D) 30 (E) 40

16. At the University of Humanities you may study Languages, History and Philosophy. In this year, 35% of the students enrolled in Languages are taking English and 13% of all University students are taking some language other than English. No student takes more than one language. What percentage of the University students are taking Languages?

(A) 13% (B) 20% (C) 22% (D) 48% (E) 65%

17. Calculating the value of $\frac{1}{9}\times10^{2018}\times\left(10^{2018}-1\right)$, how many digits has the resulting number?

(A) 2017 (B) 2018 (C) 4035 (D) 4036 (E) 4037

18. How many 3-digit numbers are there with the property that the 2-digit number obtained by deleting the middle digit is equal to one ninth of the original 3-digit number?

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

19. There are 105 numbers written to form the sequence: 1, 2, 2, 3, 3, 3, 4, 4, 4 ,4, 5, 5, 5, 5, 5, ... (each number *n* is written exactly *n* times). How many of these numbers are divisible by 3?

(A) 4 (B) 12 (C) 21 (D) 30 (E) 45

20. A regular 2018-gon has its vertices numbered from 1 to 2018. Two diagonals are drawn, one diagonal connects the vertices with the numbers 18 and 1018 and the other connects the vertices with the numbers 1018 and 2000. How many vertices do the resulting three polygons have?

(A) 38, 983, 1001 (B) 37, 983, 1001 (C) 38, 982, 1001 (D) 37, 982, 1000 (E) 37, 983, 1002

5 point problems

21. Several integers are written on a blackboard, including the number 2018. The sum of all these integers is 2018 and the product of these integers is also 2018. Which of the following could be the number of integers written on the blackboard?

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

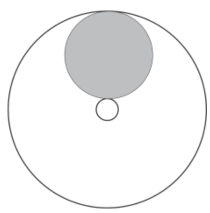
22. Four positive numbers are given. You choose three of them, calculate their arithmetic mean and then add the fourth number. Doing that in the four possible ways, the results are 17, 21, 23 and 29. What is the largest of the given four numbers?

(A) 12 (B) 15 (C) 21 (D) 24 (E) 29

23. The points $A_0, A_1, A_2, \ldots$ lie on a straight line such that $A_0A_1 = 1$ and the point A_n is the midpoint of the segment $\overline{A_{n+1}A_{n+2}}$ for every non-negative integer *n*. What is the length of the segment $\overline{A_0A_{11}}$?

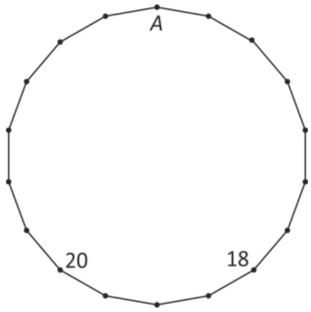
(A) 171 (B) 341 (C) 512 (D) 587 (E) 683

24. Two concentric circles of radii 1 and 9 form a ring. In the interior of this ring *n* circles are drawn without overlapping, each one being tangent to both of the circles of the ring. In the example given, we have *n* = 1. What is the largest possible value for *n*?



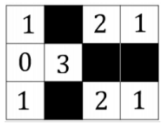
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

25. Julia wants to write a number at each vertex of a regular 18-sided polygon so that each one is the sum of the numbers written at the adjacent vertices. She already wrote two numbers, as shown in the picture. What number will she write at the vertex *A*?



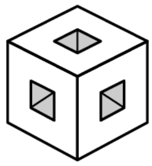
(A) –38 (B) –20 (C) 18 (D) 38 (E) 2018

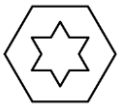
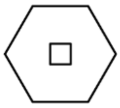
26. Paul drew a rectangular grid 3×4 and painted black some of the 12 squares. Then he wrote in the blank squares the number of neighboring black squares, as in the figure. Paul wants to do the same with a board 2×1009 of 2018 squares in order to get the largest possible sum of the numbers that are written in the blank squares. What is this sum?



(A) 1262 (B) 2016 (C) 2018 (D) 3025 (E) 3027

27. Seven unit cubes were removed from a cube edge 3, as shown. Then the cube was cut by a plane passing through the center of the cube and perpendicular to one of its four inner diagonals. What does this section look like?



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

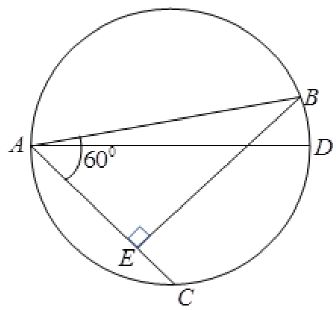
28. The squares on a 2×3 board can be numbered from 1 to 6 so that the sum of the numbers in each row and each column is a number divisible by 3. In how many different ways can this be done?

(A) 18 (B) 36 (C) 42 (D) 45 (E) 48

29. Ed made a cube by gluing together a number of small identical cubes and then he painted some of the faces of the large cube. His sister dropped the cube and it broke into the original small cubes. Exactly 45 of these small cubes didn't have any painted faces. How many faces of the large cube did Ed paint?

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

30. Two chords *AB* and *AC* are drawn in a circle of diameter *AD*. Given that $B\hat{A}C = 60°$, $\overline{BE} \perp \overline{AC}$, *AB* = 24 cm e *EC* = 3 cm, what is the length of the chord *BD*?



(A) $\sqrt{3}$ (B) 2 (C) 3 (D) $2\sqrt{3}$ (E) $3\sqrt{2}$