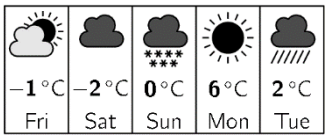
KSF 2021 – Junior (J)

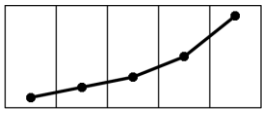
3 points problems

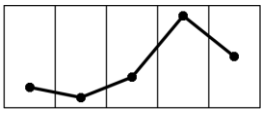
1. Each year, the third Thursday in March is named Kangaroo Day. The dates of Kangaroo Day for the next few years are shown below, with one error. Which date is wrong?

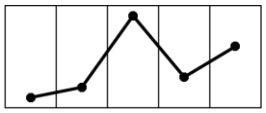
(A)17/3/2022 (B) 16/3/2023 (C) 14/3/2024 (D) 20/3/2025 (E) 19/3/2026

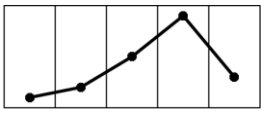
2. Jenny looks at her weather app that shows the predicted weather and maximum temperatures for the next five days. Which of the following represents the corresponding graph of maximum temperatures?

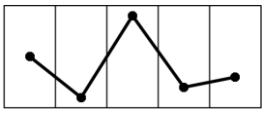


(A) 

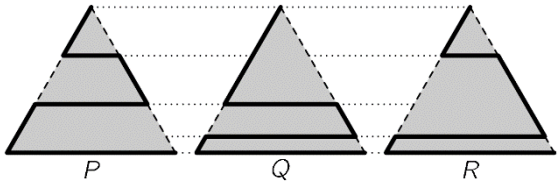
(B) 

(C) 

(D) 

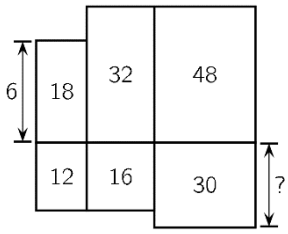
(E) 

3. A park is shaped like an equilateral triangle. A cat wants to walk along one of the three indicated paths (thicker lines) from the upper corner to the lower right corner. The lengths of the paths are P, Q and R, as shown. Which of the following statements about the lengths of the paths is true?



(A) $P<Q<R$ (B) $P<R<Q$ (C) $P<Q=R$ (D) $P=R<Q$ (E) $P=Q=R$

4. Six rectangles are arranged as shown. The top left-hand rectangle has height 6 cm. The numbers within the rectangles indicate their areas in cm^2. What is the height of the bottom right-hand rectangle?



(A) 4 cm (B) 5 cm (C) 6 cm (D) 7.5 cm (E) 10 cm

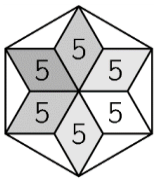
5. The halftime score of a handball match was **9:14**, thus the visiting team was leading by five goals. As a consequence of coach instructions received at halftime, the home team dominated in the second half and scored twice as many goals as their opponents. The home team won the match by one goal. What was the final score of the match?

(A) **20:19** (B) **21:20** (C) **22:21** (D) **23:22** (E) **24:23**

6. In a jazz band, Giuseppe plays the saxophone, Sergio plays the trumpet and Eliana sings. They are all the same age. There are 3 more members of the jazz band, who are 19, 20 and 21 years old, respectively. The average age of the jazz band is 21. How old is Eliana?

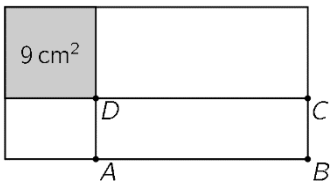
(A) 20 (B) 21 (C) 22 (D) 23 (E) 24

7. Six congruent rhombuses, each of area 5 cm^2, form a star. The tips of the star are joined to draw a regular hexagon, as shown. What is the area of the hexagon?



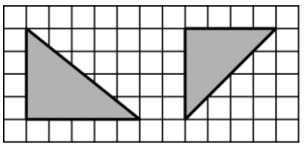
(A) 36 cm^2 (B) 40 cm^2 (C) 45 cm^2 (D) 48 cm^2 (E) 60 cm^2

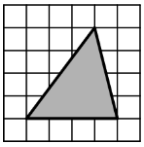
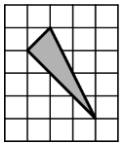
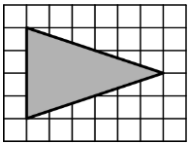
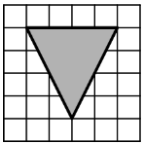
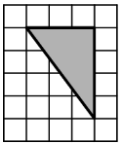
8. A rectangle with perimeter 30 cm is divided into four parts by a vertical line and a horizontal line. One of the parts is a square of area 9 cm^2, as shown in the figure. What is the perimeter of rectangle *ABCD*?



(A) 14 cm (B) 16 cm (C) 18 cm (D) 21 cm (E) 24 cm

9. Ally drew 3 triangles on a grid. Exactly 2 of them have the same area, exactly 2 of them are isosceles, and exactly 2 are right-angled triangles. 2 of the triangles are shown. Which could be the third one?



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

10. The little kangaroo has chosen a special number. She gets the same result when she subtracts $\frac{1}{10}$ from her number as she does when she multiplies it by $\frac{1}{10}$. What is her number?

(A) $\frac{1}{100}$ (B) $\frac{1}{11}$ (C) $\frac{1}{10}$ (D) $\frac{11}{100}$ (E) $\frac{1}{9}$

4 points problems

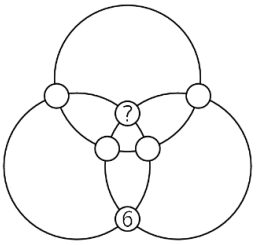
11. Tom had ten sparklers of the same size. He lit one first. When only a tenth of it remained, he lit the second one. When only a tenth of that remained, he lit the third one, and so on. Sparklers burn at the same speed along their entire length. One sparkler will burn in 2 minutes. How long did it take for all 10 sparklers to burn down?

(A) 18 min 20 sec (B) 18 min 12 sec (C) 18 min (D) 17 min (E) 16 min 40 sec

12. Ahmad walks up 8 steps going up either 1 or 2 steps at a time. There is a hole on the 6th step, so he cannot use this step. In how many different ways can Ahmad reach the top step?

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

13. The numbers from 1 to 6 are placed in the circles at the intersections of 3 rings. The position of number 6 is shown. The sums of the numbers on each ring are the same. What number is placed in the circle with the question mark?

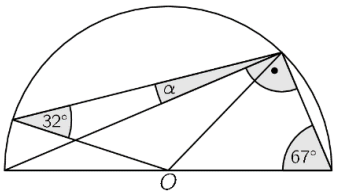


(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

14. 2021 has a remainder of 5 when divided by 6, by 7, by 8, and by 9. How many positive integers, less than 2021, have this property?

(A) 4 (B) 3 (C) 2 (D) 1 (E) none

15. The figure shows a semicircle with center *O.* Two of the angles are given. What is the size, in degrees, of the angle α ?



(A) 9^{O} (B) 11^{O} (C) 16^{O} (D) $17{,}5^{O}$ (E) 18^{O}

16. In a team competition, there are 5 teams waiting to start. Each team consists of either only boys or only girls. The number of team members are 9, 15, 17, 19 and 21. After all members of the first team have started, the number of girls not started yet is 3 times the number of boys not started yet. How many members are on the team that has already started?

(A) 9 (B) 15 (C) 17 (D) 19 (E) 21

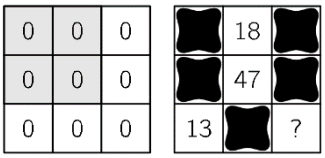
17. Five cars participated in a race, starting in the order shown.

. Whenever a car overtook another car, a point was awarded. The cars reached the finish line in the following order:

. What is the smallest number of points in total that could have been awarded?

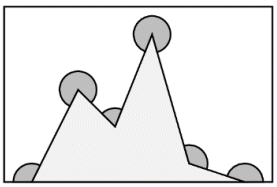
(A) 10 (B) 9 (C) 8 (D) 7 (E) 6

18. A 3×3 square initially has the number 0 in each of its cells. In one step all four numbers in one 2×2 sub-square such as the shaded one, for example, are then increased by 1. This operation is repeated several times to obtain the arrangement on the right. Unfortunately, some numbers in this arrangement are hidden. What number is in the square with the question mark?



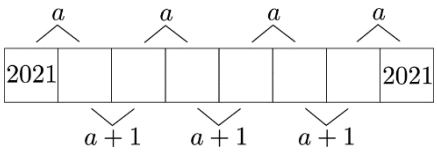
(A) 14 (B) 15 (C) 16 (D) 17 (E) 19

19. What is the sum of the six marked angles in the picture?



(A) 360^{O} (B) 900^{O} (C) 1080^{O} (D) 1120^{O} (E) 1440^{O}

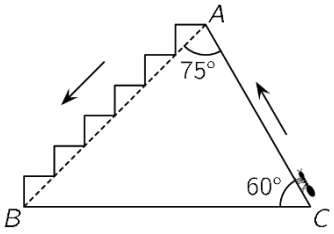
20. There are eight boxes in the strip shown. Numbers in adjacent boxes have sum a or $a+1$ as shown. The numbers in the first box and the eighth box are both 2021. What is the value of a?



(A) 4041 (B) 4042 (C) 4043 (D) 4044 (E) 4045

5 points problems

21. An ant climbs from *C* to *A* on path *CA* and descends from *A* to *B* on the stairs, as shown in the diagram. What is the ratio of the lengths of the ascending and descending paths?



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

22. The numbers a, b and c satisfy $a+b+c=0$ and $abc=78$. What is the value of $(a+b)(b+c)(c+a)$?

(A) -156 (B) -78 (C) -39 (D) 78 (E) 156

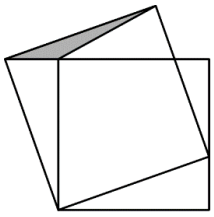
23. Let N be the smallest positive integer whose sum of its digits is 2021. What is the sum of the digits of $N+2021$?

(A) 10 (B) 12 (C) 19 (D) 28 (E) 2021

24. Three boys played a "Word" game in which they each wrote down 10 words. Each boy scored three points if neither of the other boys had the same word. Each boy scored one point if only one of the other boys had the same word. No points were awarded for words which all three boys had. When they added up their scores, they found that they each had different score. Sam had 19 points, which was the smallest score, and James had the highest score. How many points did James score?

(A) 20 (B) 21 (C) 23 (D) 24 (E) 25

25. The smaller square in the picture has area 16 and the grey triangle has area 1. What is the area of the larger square, in cm^2?

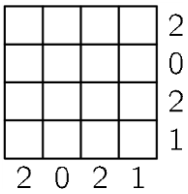


A) 17 (B) 18 (C) 19 (D) 20 (E) 21

26. Each of the numbers *a* and *b* is a square of an integer. The difference $a-b$ is a prime number. Which of the following could be number *b*?

(A) 100 (B) 144 (C) 256 (D) 900 (E) 10 000

27. In the 4×4 table some cells must be painted black. The numbers next to and below the table show how many cells in that row or column must be black. In how many ways can this table be painted?



(A) 1 (B) 2 (C) 3 (D) 5 (E) more than 5

28. How many five-digit positive numbers have the product of their digits equal to 1000?

(A) 10 (B) 20 (C) 30 (D) 40 (E) 60

29. Christina has eight coins whose weights in grams are different positive integers. When Christina puts any two coins on one side of a balance scales and any two on the other side of the balance scales, the side containing the heaviest of the four coins is always the heavier side. What is the smallest possible weight of the heaviest coin?

(A) 8 g (B) 12 g (C) 34 g (D) 128 g (E) 256 g

30. 2021 balls are arranged in a row and are numbered from 1 to 2021. Each ball is coloured in one of four colours: green, red, yellow or blue. Among any five consecutive balls there is exactly one red, one yellow and one blue ball. After any red ball the next ball is yellow. The balls numbered 2, 20 and 202 are green. What colour is the ball numbered 2021?

(A) green (B) red (C) yellow (D) blue (E) not determined