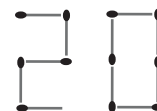




## CANADIAN MATH KANGAROO CONTEST PROBLEMS

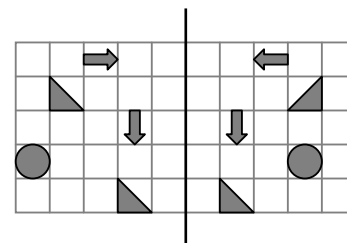
## PART A: EACH CORRECT ANSWER IS WORTH 3 POINTS

1. Carola is forming the four-digit number 2022 using some matches from a box. The box originally contained 30 matches. She has already started and formed the first two digits, as shown in the diagram. How many matches will remain in the box when she has finished forming 2022?



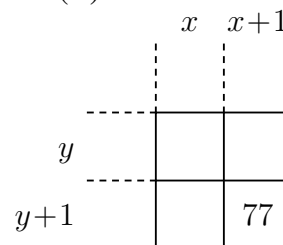
(A) 20                      (B) 19                      (C) 10                      (D) 9                      (E) 5

2. Some shapes are drawn on a piece of paper. The teacher folded the left-hand side of the paper over the thick line. How many of the shapes on the left-hand side will fit exactly on top of a shape on the right-hand side?



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

3. The shown  $2 \times 2$  square is part of a multiplication table. Only the product of  $x + 1$  and  $y + 1$  is visible. The integers  $x$  and  $y$  are both positive and  $x$  is greater than  $y$ . What is the value of  $x$ ?

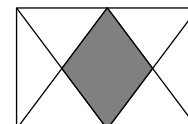


(A) 6                      (B) 7                      (C) 8                      (D) 10                      (E) 11

4. I am a number less than my half and greater than my double. The sum of me and my square is zero. Who am I?

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

5. In the rectangle shown, each midpoint of the two longest sides is joined to the two vertices on the opposite sides.

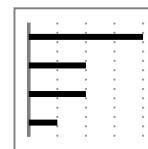


What fraction of the rectangle is shaded?

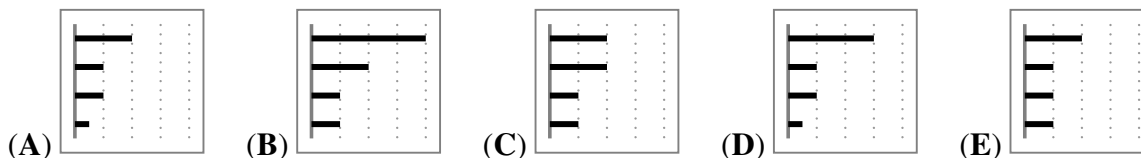
(A)  $\frac{1}{5}$                       (B)  $\frac{1}{4}$                       (C)  $\frac{2}{7}$                       (D)  $\frac{1}{3}$                       (E)  $\frac{2}{5}$



6. On Nadya’s smartphone, this diagram shows how much time she spent last week on each of her apps. This week she halved the time spent on two of these apps, but spent the same amount of time on the other two apps.



Which of the following could be the diagram for this week?



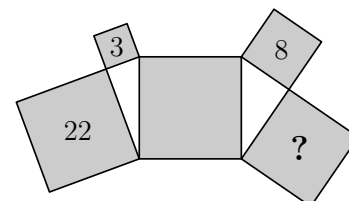
7. There are five candidates in the school election. After 90% of the votes had been counted, the preliminary results were as follows:

Alex	Bella	Calvin	Diane	Eddy
14	11	10	8	2

How many students still have a chance of winning the election?

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

8. Five squares and two right-angled triangles are arranged as shown. The numbers 3, 8 and 22 inside three of the squares indicate their areas in square meters.



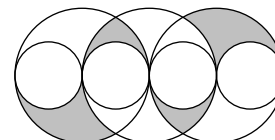
What is the area of the square containing the question mark?

- (A)  $14 \text{ m}^2$                       (B)  $15 \text{ m}^2$                       (C)  $16 \text{ m}^2$                       (D)  $17 \text{ m}^2$                       (E)  $18 \text{ m}^2$

9. Eva puts 2022 tiles in a long line. Then Adam removes every sixth tile. Next Beata removes every fifth tile from those that remain. Then Calle removes every fourth tile from those that remain. Finally, Doris removes all the remaining tiles. How many tiles does Doris remove?

- (A) 0                      (B) 337                      (C) 674                      (D) 1011                      (E) 1348

10. The diagram shows three large circles of equal radius and four small circles of equal radius where the centers of all circles and all points of contact lie on one straight line. The radius of each small circle is 1. What is the shaded area?

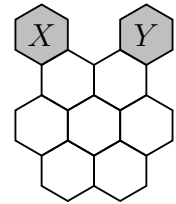


- (A)  $\pi$                       (B)  $2\pi$                       (C)  $3\pi$                       (D)  $4\pi$                       (E)  $6\pi$



**PART B: EACH CORRECT ANSWER IS WORTH 4 POINTS**

11. Apini moves from hexagon  $X$  to hexagon  $Y$ . She can only move from one hexagon to another if they have an edge in common. How many different routes are there from  $X$  to  $Y$  that pass through each of the seven white hexagons exactly once?

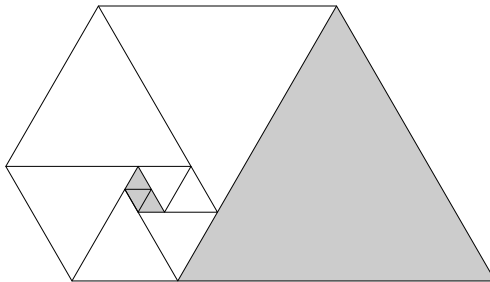


- (A) 2                      (B) 3                      (C) 4                      (D) 5                      (E) 6

12. The sum of two positive numbers is three times the difference between them. The product of the same two numbers is four times their sum. What is the sum of the two numbers?

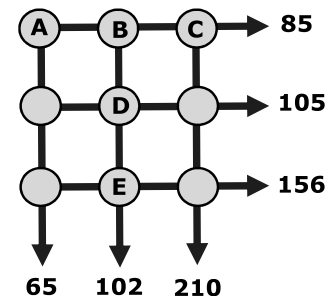
- (A) 9                      (B) 10                      (C) 12                      (D) 15                      (E) 18

13. Padovan makes a drawing that consists of equilateral triangles. The three smallest triangles together have area 1. What is the area of the largest triangle?



- (A) 27                      (B) 42                      (C) 45                      (D) 48                      (E) 49

14. In the circles, some positive integers are placed, one number per circle. Right now, some circles are empty or contain a letter. To the right of each row, the product of the numbers in the circles in that row is given. To the bottom of each column, the product of the numbers in the circles of that column is given.

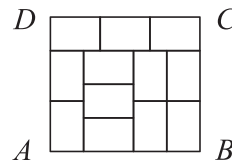


Which circle contains the number 17?

- (A) A                      (B) B                      (C) C  
(D) D                      (E) none of the previous

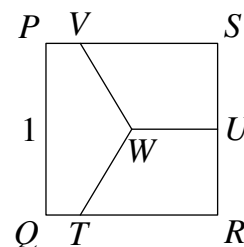


15. The diagram shows a large rectangle  $ABCD$  divided into 12 identical small rectangles. What is the ratio  $AD/DC$ ?



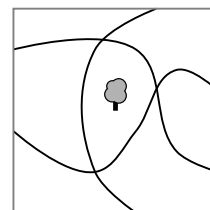
- (A)  $8/9$       (B)  $5/6$       (C)  $7/8$       (D)  $2/3$       (E)  $9/8$
16. A rabbit and a hedgehog had a race around a 550 m long circular track. Both ran at constant speeds. The rabbit's speed was 10 m/s, and the hedgehog's speed was 1 m/s. They started at the same time and at the same place. However, the hedgehog ran in the opposite direction to the rabbit. When they met, the hedgehog immediately turned around and ran after the rabbit. How long after the rabbit did the hedgehog reach the place they started running?
- (A) 45 seconds      (B) 50 seconds      (C) 55 seconds      (D) 100 seconds      (E) 505 seconds

17. The diagram shows square  $PQRS$  of side-length 1. The midpoint of  $RS$  is marked  $U$  and the centre of the square is marked  $W$ . Line segments  $TW$ ,  $UW$  and  $VW$  split the square into three regions of equal area.

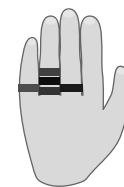


What is the length of  $SV$ ?

- (A)  $\frac{1}{2}$       (B)  $\frac{2}{3}$       (C)  $\frac{3}{4}$       (D)  $\frac{4}{5}$       (E)  $\frac{5}{6}$
18. There are three paths through our rectangular city park. They connect opposite sides of the park, as shown. A tree is planted in the middle of the park, as shown. What is the smallest number of trees that need to be planted so that there are the same number of trees on both sides of each of the paths?
- (A) 1      (B) 2      (C) 3      (D) 4      (E) 5



19. Veronica has five rings on her fingers, as shown. She takes them off one at a time. In how many different ways can she do this?



- (A) 16      (B) 20      (C) 24      (D) 30      (E) 45
20. In a rectangle  $ABCD$ , the acute angle formed by the diagonals is  $60^\circ$ . We denote by  $O$  the intersection of diagonals and by  $E$  the foot of the perpendicular from  $A$  to the diagonal  $BD$ . If  $EO = 1$  cm, what is the area of the rectangle?

- (A)  $4\sqrt{3}$  cm<sup>2</sup>      (B)  $6\sqrt{3}$  cm<sup>2</sup>      (C)  $4\sqrt{2}$  cm<sup>2</sup>      (D)  $3\sqrt{3}$  cm<sup>2</sup>      (E) 6 cm<sup>2</sup>

**PART C: EACH CORRECT ANSWER IS WORTH 5 POINTS**

21. Alicia and Benito each choose 3 different numbers from the list: 2, 3, 4, 5, 6, 7, in such a way that Alicia and Benito have at most two numbers in common. It is known that the product of the numbers that Alicia chose is equal to the product of the numbers that Benito chose.

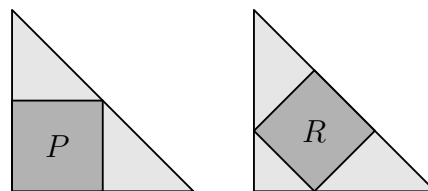
Which of the following cannot be the sum of Alicia's numbers?

- (A) 12                      (B) 13                      (C) 14                      (D) 15                      (E) 16

22. Two congruent isosceles right-angled triangles each have a square inscribed, as shown.

The square marked  $P$  has an area of 45.

What is the area of the square marked  $R$ ?



- (A) 35                      (B) 40                      (C) 45                      (D) 50                      (E) 60

23. The positive integer  $N$  is such that the product of its digits is 20.

Which of the following could not be the product of the digits of  $N + 1$ ?

- (A) 40                      (B) 30                      (C) 25                      (D) 35                      (E) 24

24. Eight teams participate in a football tournament. Each team plays against each other team exactly once. In each match, the winner gets 3 points and the loser does not get any points. If a match is drawn, each team gets 1 point. At the end of the tournament the total number of points obtained by all the teams is 61.

What is the largest number of points that the champion team could have obtained?

- (A) 21                      (B) 19                      (C) 18                      (D) 17                      (E) 16

25. The inhabitants of a city always speak by means of questions. There are two types of inhabitants: the "positives", who always ask questions for which the answer is "yes" and the "negatives" who always ask questions for which the answer is "no". I met Albert and Berta and Berta asked me "Are Albert and I both negative?". What type of inhabitants are Albert and Berta?

- (A) Both are positives.                      (B) Both are negatives.  
(C) Albert positive, Berta negative.                      (D) Albert negative, Berta positive.  
(E) There are not enough information to decide.

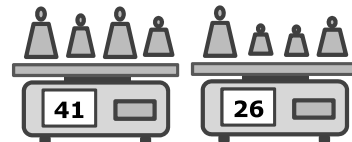


26. A group of pirates divided 200 gold coins and 600 silver coins between them.  
Each officer received 5 gold and 10 silver coins.  
Each sailor received 3 gold and 8 silver coins.  
Each cabin boy received 1 gold and 6 silver coins.

How many pirates are there in the group?

- (A) 50                      (B) 60                      (C) 72                      (D) 80                      (E) 90

27. A grocer has twelve scale weights whose masses are different integer numbers from 1 kg to 12 kg. She splits them into three groups of four weights each. The total weight of the first group is 41 kg and of the second is 26 kg.



Which of the following weights is in the same group as the weight of 9 kg?

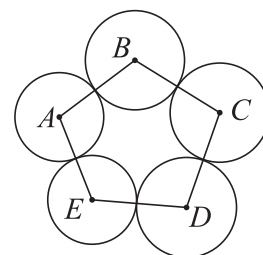
- (A) 3 kg                      (B) 5 kg                      (C) 7 kg                      (D) 8 kg                      (E) 10 kg

28. From an ordinary book (page numbering starting from 1), a sheet is torn out. We add the numbers of the remaining pages of the book. The result is 414.

Which of the following can be the smaller page number of the sheet torn out?

- (A) 19                      (B) 21                      (C) 23                      (D) 25                      (E) 27

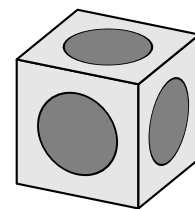
29. Five circles with centres  $A$ ,  $B$ ,  $C$ ,  $D$  and  $E$  are arranged as shown. Line segments are drawn to join the centres of adjacent circles. It is known that  $AB = 16$  cm,  $BC = 14$  cm,  $CD = 17$  cm,  $DE = 13$  cm,  $AE = 14$  cm.



Which point is the centre of the circle with the largest radius?

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

30. A hole in the shape of a hemisphere is carved into each face of a cube. The holes are identical and centered at the centre of each face. The holes touch their neighbours at only one point. The cube has side 2.



What is the diameter of each hole?

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



## CMKC 2022 Grade 9-10 Answers

PART A						PART B						PART C					
1	A	B	C	<u>D</u>	E	11	A	B	C	<u>D</u>	E	21	A	B	C	D	<u>E</u>
2	A	B	<u>C</u>	D	E	12	A	B	C	D	<u>E</u>	22	A	<u>B</u>	C	D	E
3	A	B	C	<u>D</u>	E	13	A	B	C	<u>D</u>	E	23	A	B	C	<u>D</u>	E
4	A	<u>B</u>	C	D	E	14	A	<u>B</u>	C	D	E	24	A	B	C	<u>D</u>	E
5	A	<u>B</u>	C	D	E	15	<u>A</u>	B	C	D	E	25	A	B	<u>C</u>	D	E
6	A	B	<u>C</u>	D	E	16	<u>A</u>	B	C	D	E	26	A	B	C	<u>D</u>	E
7	A	B	<u>C</u>	D	E	17	A	B	C	D	<u>E</u>	27	A	B	<u>C</u>	D	E
8	A	B	C	<u>D</u>	E	18	A	B	<u>C</u>	D	E	28	A	B	C	<u>D</u>	E
9	A	B	C	<u>D</u>	E	19	A	<u>B</u>	C	D	E	29	<u>A</u>	B	C	D	E
10	A	<u>B</u>	C	D	E	20	<u>A</u>	B	C	D	E	30	A	B	<u>C</u>	D	E