



## CANADIAN MATH KANGAROO CONTEST PROBLEMS

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

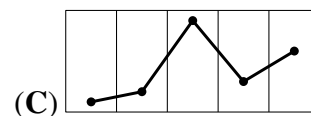
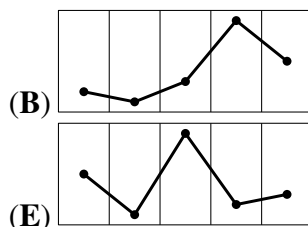
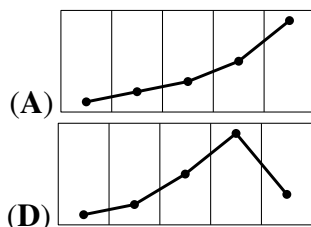
1. By pouring the same amount of water into two bottles of the same diameter but different height, one of them is filled to half its height and the other is filled to a third of its height. How much taller is one bottle relative to the other?

(A) 10%      (B) 25%      (C) 50%      (D) 75%      (E) 100%

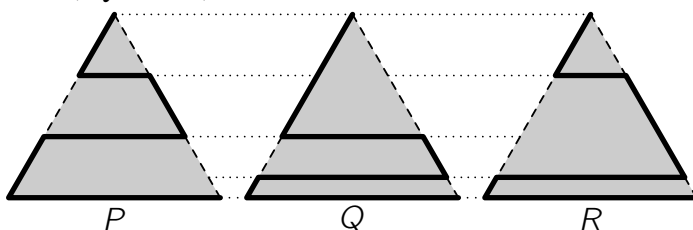
2. Jenny's weather app shows the predicted weather and maximum temperatures for the next five days.

$-1^{\circ}\text{C}$	$-2^{\circ}\text{C}$	$0^{\circ}\text{C}$	$6^{\circ}\text{C}$	$2^{\circ}\text{C}$
Fri	Sat	Sun	Mon	Tue

Which of the following represents the corresponding graph of maximum temperatures?



3. A park is shaped like an equilateral triangle. A cat walks along one of the three paths (indicated with the 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)  $P = Q = R$

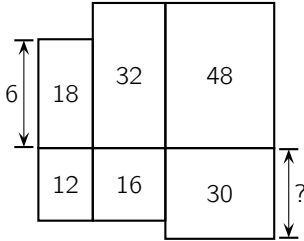
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4. Six rectangles are arranged as shown. The top left-hand rectangle has height 6 cm. The numbers within the rectangles indicate their areas in  $\text{cm}^2$ .

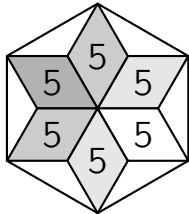


What is the height of the bottom right-hand rectangle?

- (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 result 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. Six congruent rhombuses, each of area  $5 \text{ cm}^2$ , 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)  $36 \text{ cm}^2$       (B)  $40 \text{ cm}^2$       (C)  $45 \text{ cm}^2$       (D)  $48 \text{ cm}^2$       (E)  $60 \text{ cm}^2$
7. In a jazz band, Gim plays the saxophone, Sergio plays the trumpet, and Eliana sings. They are all the same age. There are three more members in 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

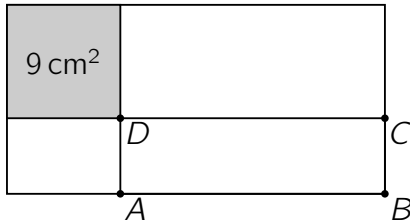
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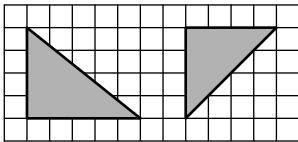
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8. A rectangle with perimeter 30 cm is divided into four parts by a vertical line and a horizontal line. One of the parts is a square of area  $9 \text{ cm}^2$ , as shown in the figure.

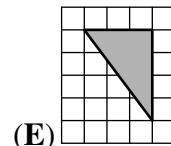
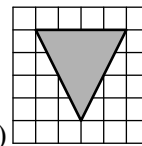
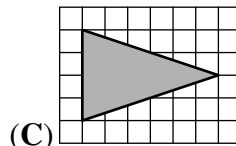
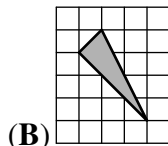
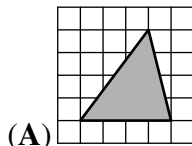


What is the perimeter of rectangle ABCD?

- (A) 14 cm      (B) 16 cm      (C) 18 cm      (D) 21 cm      (E) 24 cm
9. Ally drew three triangles on a grid. Exactly two of them have the same area, exactly two of them are isosceles, and exactly two are right-angled triangles. Two of the triangles are shown.



Which triangle could be the third one?



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)  $\frac{1}{9}$

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

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

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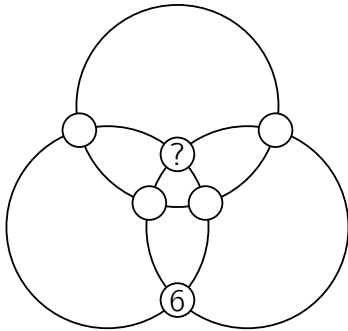
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12. James chose three distinct digits from the set  $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ . With these three digits he made the largest and the smallest possible three-digit numbers, and then added the two numbers. If the sum was 545, what is the sum of the three digits he chose?

(A) 7                      (B) 9                      (C) 11                      (D) 13                      (E) 15

13. The numbers from 1 to 6 are placed in the circles at the intersections of three rings. The position of number 6 is shown. The sums of the numbers on each ring are the same.



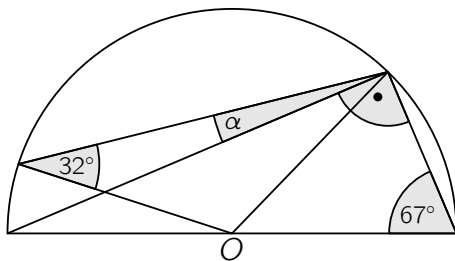
What number is placed in the circle with the question mark?

(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, respectively. 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  $\alpha$ ?

(A)  $9^\circ$                       (B)  $11^\circ$                       (C)  $16^\circ$                       (D)  $17.5^\circ$                       (E)  $18^\circ$

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16. In a team competition, there are five 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, not necessarily in that order. After all members of the first team have started, the number of girls not started yet is three 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

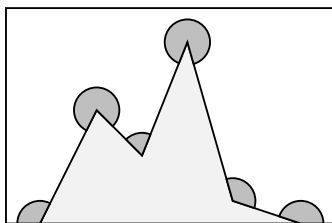
18. A  $3 \times 3$  square initially has the number 0 in each of its cells. In one step all four numbers in one  $2 \times 2$  subsquare such as the shaded one, for example, are then increased by 1. This operation is repeated several times to obtain the arrangement on the right. Unfortunately some numbers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

0	0	0
0	0	0
0	0	0

	18	
	47	
13		?

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

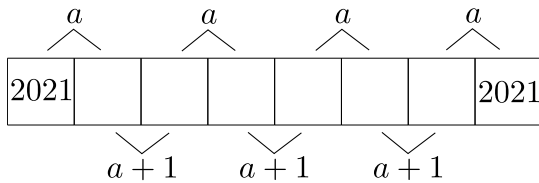
19. What is the sum of the six marked angles in the picture?



(A)  $360^\circ$                       (B)  $900^\circ$                       (C)  $1080^\circ$                       (D)  $1120^\circ$                       (E)  $1440^\circ$



20. There are eight boxes in the strip shown. Numbers in adjacent boxes have sum  $a$  or  $a + 1$  as shown.



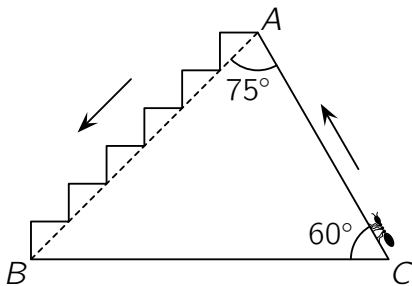
The numbers in the first box and the eighth box are both 2021.

What is the value of  $a$ ?

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

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

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)  $1/2$       (C)  $1/3$       (D)  $\sqrt{2}/2$       (E)  $\sqrt{3}/3$
22. One digit was erased in a two-digit number. As a result, the number is  $n$  times smaller. Which of the following cannot be  $n$ ?
- (A) 3      (B) 4      (C) 5      (D) 6      (E) 7
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

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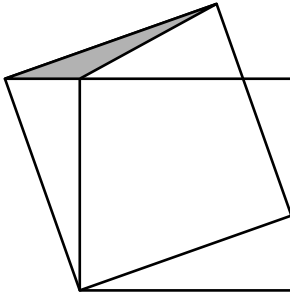
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24. Three boys played a “Word” game in which they each wrote down 10 words. Each boy scored three points if neither of the other boys had the same word. Each boy scored one point if only one of the other boys had the same word. No points were awarded 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?

(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  $b$ ?

(A) 100                      (B) 144                      (C) 256                      (D) 900                      (E) 10000

27. 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) Impossible to determine.

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

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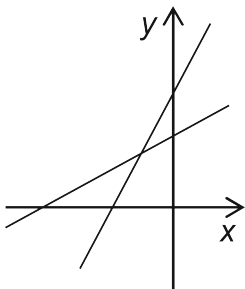
Grade 9–10

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                      (B) 12                      (C) 34                      (D) 128                      (E) 256

30. One of two lines on the coordinate plane has an equation  $y = ax + b$  for some real  $a$  and  $b$ .



Which of the following equations can the other line have?

- (A)  $y = ax - b$     (B)  $y = bx + a$     (C)  $y = \frac{b}{a}x + b$     (D)  $y = -bx + a$     (E)  $y = \frac{a}{b}x + a$



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## International Contest-Game Math Kangaroo Canada, 2021

### Answer Key Grade 9-10

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