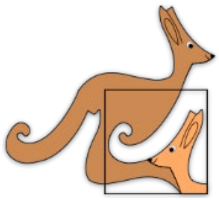


INTERNATIONAL CONTEST-GAME
MATH KANGAROO
CANADA

INSTRUCTIONS
GRADE 9-10

1. You have 75 minutes to solve 30 multiple choice problems. For each problem, decide which answer is correct and fill in (blacken) the oval that has the same letter as the appropriate answer. If you fill in (blacken) more than one oval for a question, your response will be marked as wrong.

1. Record your answers in the response form. Remember that this is the only sheet that is marked, so make sure you have all your answers transferred to that form before giving it back to the contest supervisor.
2. The problems are arranged in three groups. A correct answer of the first 10 problems is worth 3 points. A correct answer of problems 11-20 is worth 4 points. A correct answer of problems 21-30 is worth 5 points. For each incorrect answer, one point is deducted from your score. Each unanswered question is worth 0 points. To avoid negative scores, you start from 30 points. The maximum score possible is 150.
3. The use of external material or aid of any kind is **not permitted**.
4. The figures *are not* drawn to scale. They should be used only for illustration purposes.
5. Remember, you have about 2 to 3 minutes for each problem; hence, if a problem appears to be too difficult, save it for later and move on to another problem.
6. At the end of the allotted time, please **give the response form to the contest supervisor**.
7. Your score and electronic Certificate of Participation will be available in your account after June 1.

Good luck and enjoy!

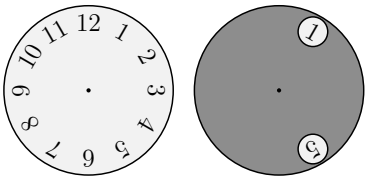
Canadian Math Kangaroo Contest team

CANADIAN MATH KANGAROO CONTEST PROBLEMS

PART A: EACH CORRECT ANSWER IS WORTH 3 POINTS

1. The dark circle with two holes is placed on the clock face and is rotated around its center so that an 10 appears in a hole.

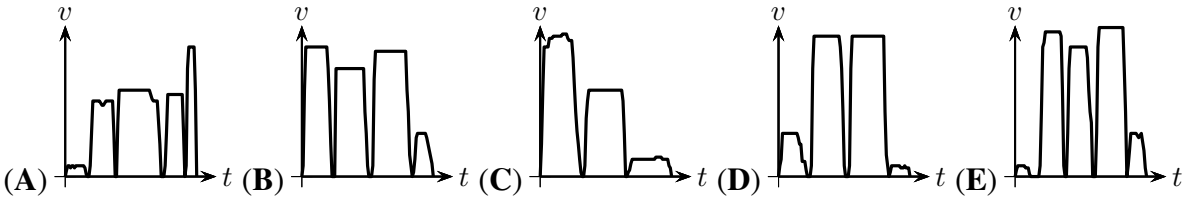
What two numbers is it possible to see in the other hole?



(**A**) 2 or 6 (**B**) 3 or 7 (**C**) 3 or 6 (**D**) 1 or 9 (**E**) 2 or 7

2. Maria had to run to catch the subway. She got off two stops later and then walked to school.

Which of the following speed-time graphs would best represent her journey?



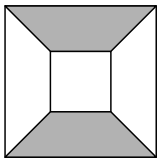
3. The positive integers m and n are both odd. Which of the following integers is also odd?

(**A**) $m(n+1)$ (**B**) $m+n$ (**C**) $m+n+2$ (**D**) $m \cdot n+2$ (**E**) $(m+1) \cdot (n+1)$

4. A large square of side-length 10 cm contains a smaller square of side-length 4 cm, as shown in the figure.

The corresponding sides of the two squares are parallel.

What percentage of the large square is shaded?



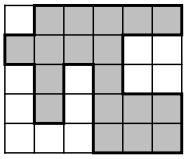
(**A**) 25% (**B**) 30% (**C**) 40% (**D**) 42% (**E**) 45%

5. Today is Thursday. What day will it be in 2023 days' time?

(**A**) Tuesday (**B**) Wednesday (**C**) Thursday (**D**) Friday (**E**) Saturday

6. The large rectangle in the figure is divided into 30 equal squares, as shown. The perimeter of the shaded region is 240 cm.

What is the area of the rectangle?



(**A**) 480 cm^2 (**B**) 750 cm^2 (**C**) 1080 cm^2 (**D**) 1920 cm^2 (**E**) 2430 cm^2

7. The ages of a family of five add to 80. The two youngest are 6 and 8. What was the sum of the ages of the family seven years ago?

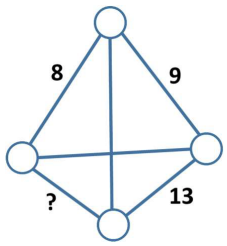
(**A**) 35 (**B**) 36 (**C**) 45 (**D**) 46 (**E**) 66

8. A researcher has two alloys. One alloy contains 90% of gold and the other alloy contains 54% of gold. The researcher mixed 320 grams of the first alloy and 160 grams of the second alloy and obtained the new alloy. What percentage of the gold is contained in the new alloy?

(**A**) 33% (**B**) 48% (**C**) 65% (**D**) 72% (**E**) 78%

9. A number is written at each vertex of a triangular pyramid, but these numbers are now invisible. On each edge of the pyramid we write the sum of the two numbers at its endpoints. Three of these numbers are shown.

What is the number on the edge with the question mark?



(**A**) 11 (**B**) 12 (**C**) 13 (**D**) 14

(**E**) we cannot be sure

10. After having played 200 games of chess, my winning rate is exactly 49%. What is the smallest number of extra games I need to play to increase my winning rate to exactly 50%?

(**A**) 0 (**B**) 1 (**C**) 2 (**D**) 3 (**E**) 4

PART B: EACH CORRECT ANSWER IS WORTH 4 POINTS

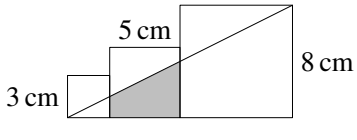
11. Jenni is trying to save water. She reduced the time she spent in her shower by a quarter. She also lowered the water pressure of her shower to reduce the rate the water comes out of the shower head by a quarter.

By what fraction did Jenni reduce the total amount of water she uses for a shower?

(**A**) by $\frac{1}{4}$ (**B**) by $\frac{3}{8}$ (**C**) by $\frac{5}{8}$ (**D**) by $\frac{5}{12}$ (**E**) by $\frac{7}{16}$

12. The figure shows three squares of side-length 3 cm, 5 cm and 8 cm.

What is the area, in cm^2, of the shaded trapezoid?



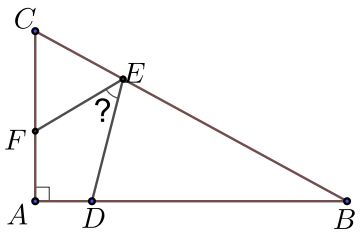
(**A**) 13 (**B**) $\frac{55}{4}$ (**C**) $\frac{61}{4}$ (**D**) $\frac{65}{4}$ (**E**) $\frac{69}{4}$

13. A wire of length 95 m is cut into three pieces such that the length of each piece is 50% more than the previous piece. What is the length of the largest piece?

(**A**) 36 m (**B**) 42 m (**C**) 45 m (**D**) 46 m (**E**) 48 m

14. Triangle ABC is right angled. Points D, E and F are located so that $BD = BE$ and $CE = CF$.

What is the measure of the angle $\angle DEF$?

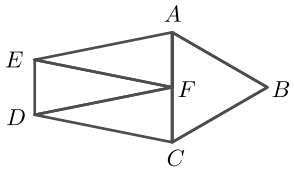


(**A**) 30° (**B**) 37°30′

(**C**) 45° (**D**) 52°30′

(**E**) It can vary according to the size of angle $\angle B$ of the triangle.

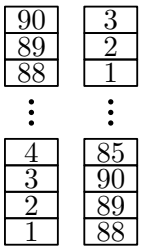
15. Pentagon $ABCDE$ is divided into four triangles with equal perimeter. Triangle ABC is equilateral and AEF, DFE and CDF are three identical isosceles triangles. What is the ratio of the perimeter of the pentagon $ABCDE$ to the perimeter of triangle ABC?



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

16. On the table there is a tower made of blocks numbered from 1 to 90. Bob takes blocks from the top of the tower, three at a time, to build a new tower, as shown.

When he has finished building the new tower, how many blocks will be between the blocks numbered 39 and 40?



(**A**) 0 (**B**) 1 (**C**) 2 (**D**) 3 (**E**) 4

17. Ms Mary has three sons. They were born biannually (one every two years). Mary celebrated her 48th birthday this year. Her oldest son Carl remarked that in three years, they should throw her an extra special birthday party, since Mary's age will be the sum of the ages of her three sons.

How old is Carl this year?

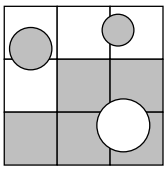
(**A**) 15 (**B**) 16 (**C**) 17 (**D**) 18 (**E**) 19

18. We call a two-digit number **power-less** if none of its digits can be written as an integer to a power greater than 1. For example, 53 is power-less, but 54 is **NOT** power-less since $4 = 2^2$.

Which of the following is a common divisor of the smallest and the largest power-less numbers?

(**A**) 3 (**B**) 5 (**C**) 7 (**D**) 11 (**E**) 13

19. A square of side 30 cm is divided into nine identical smaller squares. The large square contains three circles with radii 5 cm (bottom right), 4 cm (top left) and 3 cm (top right), as shown.
What is the area of the shaded part?



(**A**) 400 cm^2 (**B**) 500 cm^2 (**C**) $(400 + 50\pi)$ cm^2

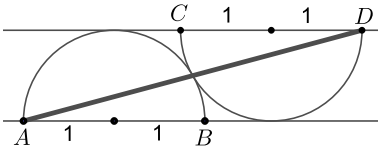
(**D**) $(500 - 25\pi)$ cm^2 (**E**) $(500 + 25\pi)$ cm^2

20. Tim calculates the mean of five different prime numbers. His answer is an integer. What is the smallest possible integer he could have obtained?

(**A**) 2 (**B**) 5 (**C**) 6 (**D**) 12 (**E**) 30

PART C: EACH CORRECT ANSWER IS WORTH 5 POINTS

21. The figure shows two touching semicircles of radius 1 and parallel diameters AB and CD.
What is the square of the distance AD?



(**A**) 16 (**B**) $8 + 4\sqrt{3}$ (**C**) 12 (**D**) 9 (**E**) $5 + 2\sqrt{3}$

22. When it is given a list of four numbers, the Kangaroo Machine continues the list by typing the smallest non-negative integer that is different to each of the four preceding numbers. The machine repeats this process indefinitely. Jacob types in the numbers 2, 0, 2, 3, into the machine. What number will be the 2023rd number in the list?

(**A**) 0 (**B**) 1 (**C**) 2 (**D**) 3 (**E**) 4

23. A rectangle with vertices $(0, 0), (100, 0), (100, 50)$ and $(0, 50)$ has a circle with centre $(75, 30)$ and radius 10 cut out of it. What is the slope of the line through $(75, 30)$ that divides the remaining area of the rectangle into two equal parts?

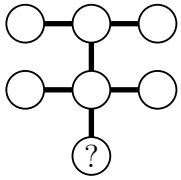
(**A**) $\frac{1}{5}$ (**B**) $\frac{1}{3}$ (**C**) $\frac{1}{2}$ (**D**) $\frac{2}{5}$ (**E**) $\frac{2}{3}$

24. When Metin's phone is fully charged, it runs out in 32 hours if he only uses it for phone-calls, in 20 hours if he only uses it for the Internet, and in 80 hours if he does not use it at all. Metin gets on a train with his phone half-charged. While on the train, the time he is on the Internet, the time he is making phone-calls and the time he is not using it are all the same. His phone runs out of charge just as the train reaches his destination. How many hours did the train journey take?

(**A**) 10 (**B**) 12 (**C**) 15 (**D**) 16 (**E**) 18

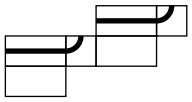
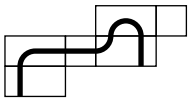
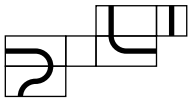
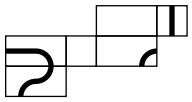
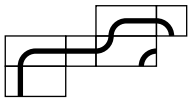
25. Seven different single-digit numbers are written in the circles of the figure shown with one number in each circle. The product of the three numbers in each of the three lines of three numbers is the same.

Which number is written in the circle containing the question mark?



(**A**) 2 (**B**) 3 (**C**) 4 (**D**) 6 (**E**) 8

26. Leon has drawn a closed path on a rectangular prism and then unfolded it to give a net. Which of the nets shown could **not** be the net of Leon's rectangular prism?

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

27. How many three-digit positive integers x are there, such that subtracting the sum of digits of x from x gives a three-digit number whose digits are all the same?

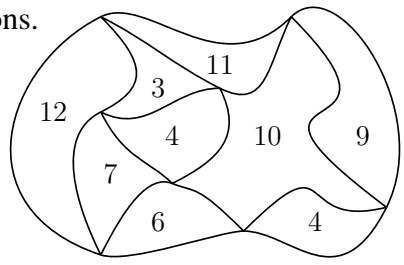
(**A**) 1 (**B**) 2 (**C**) 3 (**D**) 20 (**E**) 30

28. A stationery shop ordered pens that write red or green, 15 each. Three boxes were delivered, and the labels on them say: "10 red", "10 green", "5 red, 5 green". There is a note saying that unfortunately all the labels are switched, none of them is on the correct box. How many pens must be tried at least to find out the content of all the three boxes?

(**A**) 1 (**B**) 5 (**C**) 7 (**D**) 8 (**E**) 12

29. The figure shows a map of a park. The park is divided into regions. The number inside each region gives its perimeter, in km.

What is the outer perimeter of the park?

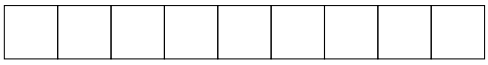


(**A**) 22 km (**B**) 26 km

(**C**) 28 km (**D**) 32 km

(**E**) none of the previous

30. Pia wants to write the integers 1 to 9 in the nine boxes shown so that the integers in any three adjacent boxes add to a multiple of 3. In how many ways can she do this?



(**A**) 6^4 (**B**) 6^3 (**C**) 2^9

(**D**) $6 \times 5 \times 4 \times 3 \times 2 \times 1$ (**E**) $9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

CMKC 2023 Grade 9-10 Answers

PART A					
1	**A**	B	C	D	E
2	A	B	C	**D**	E
3	A	B	C	**D**	E
4	A	B	C	**D**	E
5	A	B	**C**	D	E
6	A	B	C	**D**	E
7	A	B	C	**D**	E
8	A	B	C	D	**E**
9	A	**B**	C	D	E
10	A	B	C	D	**E**

PART B					
11	A	B	C	D	**E**
12	A	**B**	C	D	E
13	A	B	**C**	D	E
14	A	B	**C**	D	E
15	A	B	C	**D**	E
16	A	B	C	D	**E**
17	A	**B**	C	D	E
18	A	B	C	**D**	E
19	A	**B**	C	D	E
20	A	B	**C**	D	E

PART C					
21	A	**B**	C	D	E
22	A	B	**C**	D	E
23	**A**	B	C	D	E
24	A	B	C	**D**	E
25	**A**	B	C	D	E
26	A	B	**C**	D	E
27	A	B	C	**D**	E
28	**A**	B	C	D	E
29	A	**B**	C	D	E
30	**A**	B	C	D	E