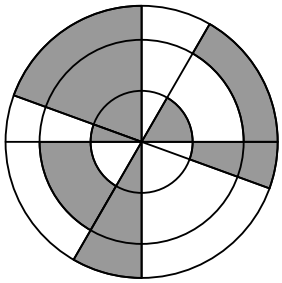
CANADIAN MATH KANGAROO CONTEST PROBLEMS

PART A: EACH CORRECT ANSWER IS WORTH 3 POINTS

1. How many four-digit numbers have the property that their digits, from left to right, are consecutive and in ascending order?

(**A**) 5 (**B**) 6 (**C**) 7 (**D**) 8 (**E**) 9

2. The figure shows three concentric circles with four lines passing through their common centre.



What percentage of the figure is shaded?

(**A**) 30% (**B**) 35% (**C**) 40% (**D**) 45% (**E**) 50%

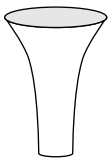
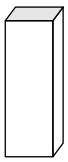
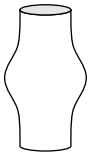
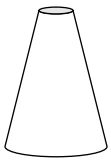
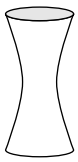
3. When you put the puzzle pieces together correctly, they form a rectangle with a calculation on it.

What is the result of this calculation?

(**A**) -100 (**B**) -8 (**C**) -1 (**D**) 199 (**E**) 208

4. Each of the five vases shown has the same height and each has a volume of 1 litre. Half a litre of water is poured into each vase.

In which vase would the level of the water be the highest?

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

5. A bike lock has four wheels numbered with the digits 0 to 9 in order. Each of the four wheels is rotated by $180°$ from the code shown in the diagram to get the correct code.

What is the correct code for the bike lock?

(A) 

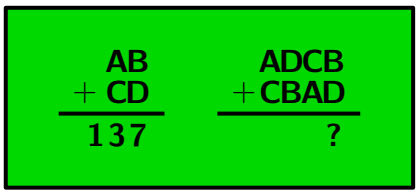
(B) 

(C) 

(D) 

(E) 

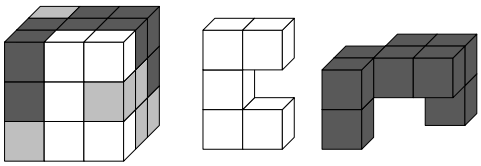
6. In the addition examples, the letters replace digits in a way that same letters replace same digits and different letters replace different digits. The sum of the two-digit numbers is 137.



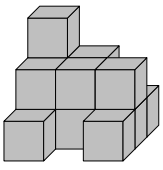
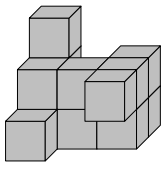
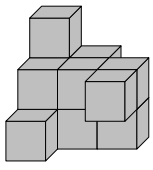
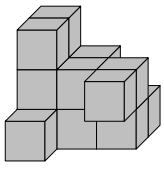
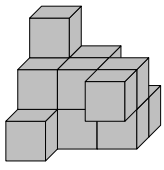
What is the sum of the four-digit numbers in the second example?

(A) 13737 **(B)** 13837 **(C)** 14747 **(D)** 23737 **(E)** 137137

7. A $3 \times 3 \times 3$ cube is made from white, grey and black $1 \times 1 \times 1$ cubes, as shown in the first diagram. The other two diagrams show the white part and the black part of the cube.



Which of the following diagrams shows the grey part?

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

8. A rectangular chocolate bar is made of identical squares. Neil breaks off two complete strips of squares and eats the 12 squares he obtains. Later, Jack breaks off one complete strip of squares from the same bar and eats the 9 squares he obtains.

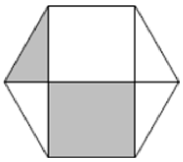
How many squares of chocolate are left in the bar?

(A) 72 **(B)** 63 **(C)** 54 **(D)** 45 **(E)** 36

9. A jar one-fifth ($\frac{1}{5}$) filled with water weighs 560 g.
The same jar four-fifth ($\frac{4}{5}$) filled with water weighs 740 g.
What is the weight of the empty jar?

(**A**) 60 g (**B**) 112 g (**C**) 180 g (**D**) 300 g (**E**) 500 g

10. In a regular hexagon, three diagonals were drawn as shown.



What is the area of the hexagon if the painted area is 20?

(**A**) 40 (**B**) 48 (**C**) 52 (**D**) 54 (**E**) 60

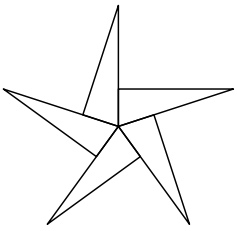
PART B: EACH CORRECT ANSWER IS WORTH 4 POINTS

11. Costa is building a new fence in his garden. He uses 25 planks of wood, each of which are 30 cm long. He arranges these planks so that there is the same slight overlap between any two adjacent planks.

The total length of Costa's new fence is 6.9 metres. What is the length in centimetres of the overlap between any pair of adjacent planks?

(**A**) 2.4 (**B**) 2.5 (**C**) 3 (**D**) 4.8 (**E**) 5

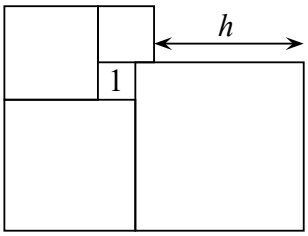
12. Five identical right-angled triangles can be arranged so that their larger acute angles touch to form the star shown in the diagram.



It is also possible to form a different star by arranging more of these triangles so that their smaller acute angles touch. How many triangles are needed to form the second star?

(**A**) 10 (**B**) 12 (**C**) 18 (**D**) 20 (**E**) 24

13. Five squares are positioned as shown. The smallest square has area 1, as indicated.



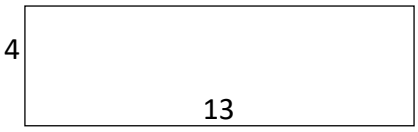
What is the value of h?

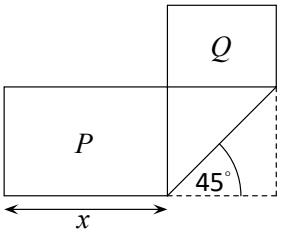
(A) 3 **(B)** 3.5 **(C)** 4 **(D)** 4.2 **(E)** 4.5

14. There are 20 questions in a quiz. Each correct answer scores 7 points, each wrong answer scores -4 points, and each question left blank scores 0 points. Eric took the quiz and scored 100 points. How many questions did he leave blank?

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

15. A rectangular strip of paper of dimensions 4×13 is folded as shown in the diagram. Two rectangles are formed with areas P and Q where $P = 2Q$.

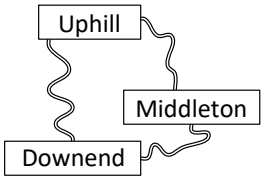




What is the value of x?

(A) 5 **(B)** 5.5 **(C)** 6 **(D)** 6.5 **(E)** $4\sqrt{2}$

16. Three villages are connected by paths as shown.



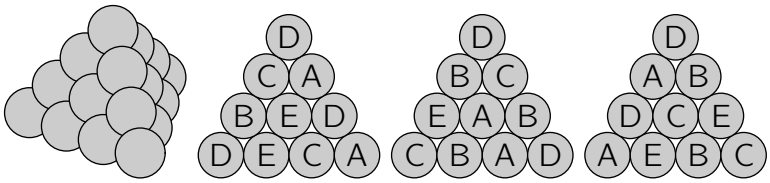
From Downend to Uphill, the detour via Middleton is 1 km longer than the direct path.
From Downend to Middleton, the detour via Uphill is 5 km longer than the direct path.
From Uphill to Middleton, the detour via Downend is 7 km longer than the direct path.
How long is the shortest of the three direct paths between the villages?

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

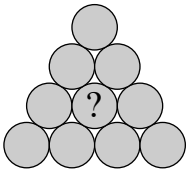
17. In a particular fraction the numerator and denominator are both positive. The numerator of this fraction is increased by 40%. By what percentage should its denominator be decreased so that the new fraction is double the original fraction?

(**A**) 10% (**B**) 20% (**C**) 30% (**D**) 40% (**E**) 50%

18. A triangular pyramid is built with 20 cannon balls, as shown.
Each cannon ball is labelled with one of A, B, C, D or E.
There are four cannon balls with each type of label.
The picture shows the labels on the cannon balls on three of the four faces of the pyramid.



What is the label on the hidden cannon ball in the centre of the fourth face?



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

19. The 6-digit number $\overline{2ABCDE}$ is multiplied by 3 and the result is the 6-digit number $\overline{ABCDE2}$. What is the sum of the digits of this number?

(**A**) 24 (**B**) 27 (**C**) 30 (**D**) 33 (**E**) 36

20. 2021 coloured kangaroos are arranged in a row and are numbered from 1 to 2021. Each kangaroo is either red, grey or blue. Amongst any three consecutive kangaroos, there are always kangaroos of all three colours. Bruce guesses the colours of five kangaroos. These are his guesses:
– Kangaroo 2 is grey;
– Kangaroo 20 is blue;
– Kangaroo 202 is red;
– Kangaroo 1002 is blue;
– Kangaroo 2021 is grey.
Only one of his guesses is wrong.
What is the number of the kangaroo whose colour he guessed incorrectly?

(**A**) 2 (**B**) 20 (**C**) 202 (**D**) 1002 (**E**) 2021

PART C: EACH CORRECT ANSWER IS WORTH 5 POINTS

21. From a study about the price of cherries we get the following data: The price in shop A is 25% higher than in shop B. The price in shop B is 20% lower than in shop C and the price in shop D is 30% higher than in shop C. What is the relation between the prices in shops D and A?

(**A**) The price in shop D is 30% higher than in shop A.

(**B**) The price in shop A is 30% higher than in shop D.

(**C**) Prices in shops A and D are equal.

(**D**) The price in shop D is 35% higher than in shop A.

(**E**) The price in shop A is 35% higher than in shop D.

22. Amelia transforms the numbers from 1 to 100 by the rule: each number is replaced by the difference of the number and its sum of digits.
How many different numbers will she obtain as a result?

(**A**) 99 (**B**) 10 (**C**) 50 (**D**) 100 (**E**) 11

23. A soccer ball is made of white hexagons and black pentagons, as seen in the picture.

There are a total of 12 pentagons. How many hexagons are there?

(**A**) 12 (**B**) 15 (**C**) 18 (**D**) 20 (**E**) 24

24. In a town there are 21 knights who always tell the truth and 2000 knaves who always lie. A wizard divided 2020 of these 2021 people into 1010 pairs. Every person in a pair described the other person as either a knight or a knave. As a result, 2000 people were called knights and 20 people were called knaves. How many pairs of two knaves were there?

(**A**) 980 (**B**) 985 (**C**) 990 (**D**) 995 (**E**) 1000

25. Point D belongs to the side AB of triangle ABC so that triangle ADC is equilateral and its area is half the area of triangle ABC.
What is the measure of $\angle CBA$?

(**A**) $20°$ (**B**) $25°$ (**C**) $27.5°$ (**D**) $30°$ (**E**) $45°$

26. A box contains only green, red, blue and yellow tokens. There is always at least one green tokens amongst any 27 tokens chosen from the box; always at least one red tokens amongst any 25 tokens chosen; always at least one blue amongst any 22 tokens chosen and always at least one yellow amongst any 17 tokens chosen.
What is the largest number of tokens that could be in the box?

(**A**) 27 (**B**) 29 (**C**) 51 (**D**) 87 (**E**) 91

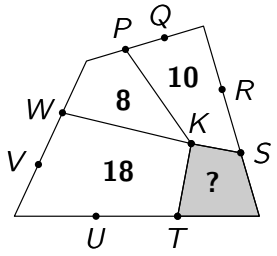
27. In a tournament each of the six teams plays one match against every other team. In each round of matches, three take place simultaneously. A TV station has already decided which match it will broadcast for each round, as shown in the diagram.

1	2	3	4	5
A – B	C – D	A – E	E – F	A – C

In which round will team D play against team F?

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

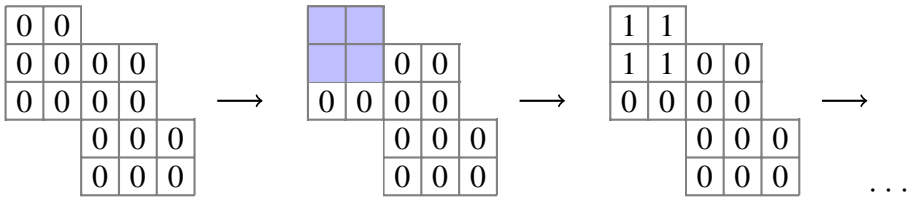
28. The diagram shows a quadrilateral divided into four smaller quadrilaterals with a common vertex K. The points T, U, V, W, P, Q, R and S divide the sides of the large quadrilateral into three equal parts. The numbers indicate the areas of the corresponding small quadrilaterals.

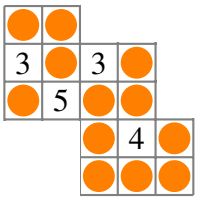


What is the area of the shaded quadrilateral?

(**A**) 4 (**B**) 5 (**C**) 6 (**D**) 6.5 (**E**) 7

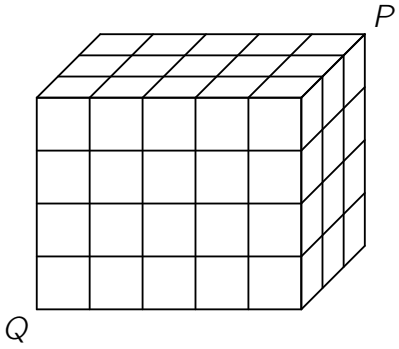
29. Maxim has a shape made up of four squares  .
He places the shape on a grid figure so that it completely covers four of the grid cells.
Every time Maxim does this, the number in the four covered cells increases by 1, as shown below.



Starting with 0 in every cell of the grid, Maxim places his shape several times as described.
In the end, Maxim hid some numbers with circle stickers:  .
What is the sum of all numbers in the grid if all numbers were visible?

(**A**) 44 (**B**) 40 (**C**) 38 (**D**) 36 (**E**) 30

30. A $3 \times 4 \times 5$ cuboid consists of 60 identical small cubes.
A termite eats its way along the diagonal from P to Q.
This diagonal does not intersect the edges of any small cube inside the cuboid.



How many of the small cubes does the termite pass through on its journey?

(**A**) 8 (**B**) 9 (**C**) 10 (**D**) 11 (**E**) 12