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10th International Mathematics and Science Olympiad (IMSO) for Primary School 2013

Instructions:

- * Write down your name and country on the answer sheet.
- * Write your answer on the answer sheet.
- * You have 60 minutes to work on this test.
- * Use pen or pencil to write your answer.



“Smart, Skilled, and Creative In a Joyful Competition for Excellence”

Alfonso, Cavite, Philippines

25 – 29 Nov 2013

Country: _____ Name: _____ No.: _____ Score: _____

SHORT ANSWER PROBLEMS

- (1) Square pieces of sides 0.5 cm are cut from a sheet which is 11 cm long and 2 cm wide. What is the total number of squares that can be cut?

- (2) Study the following pattern.

$$\frac{1}{1 \times 2} = \frac{1}{2}, \quad \frac{1}{1 \times 2} + \frac{1}{2 \times 3} = \frac{2}{3}, \quad \frac{1}{1 \times 2} + \frac{1}{2 \times 3} + \frac{1}{3 \times 4} = \frac{3}{4}.$$

Given that $\frac{1}{1 \times 2} + \frac{1}{2 \times 3} + \frac{1}{3 \times 4} + \dots + \frac{1}{2013 \times 2014} = \frac{a+2}{a+3}$, where a is a positive integer. Find the value of a .

- (3) Thirty girls joined a mathematics contest. The first girl scored 70 and the second girl scored 80. The teacher then announced that the score of every girl after the first two was equal to the average of the scores of all the girls before her. What was the score of the last girl?

- (4) Five boys, A, B, C, D, and E, attended a meeting. In this meeting :

- a. A shook hands with one boy.
- b. B shook hands with two boys.
- c. C shook hands with three boys.
- d. D shook hands with four boys.

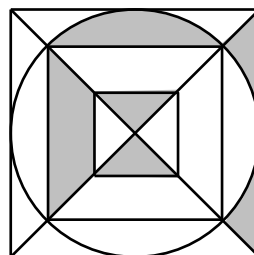
How many boys did E shake hands with?

- (5) What is the simplified value of

$$2 \times 1\frac{1}{2} + 3 \times 1\frac{1}{3} + 4 \times 1\frac{1}{4} + 5 \times 1\frac{1}{5} + 6 \times 1\frac{1}{6} + 7 \times 1\frac{1}{7} + 8 \times 1\frac{1}{8} + 9 \times 1\frac{1}{9}?$$

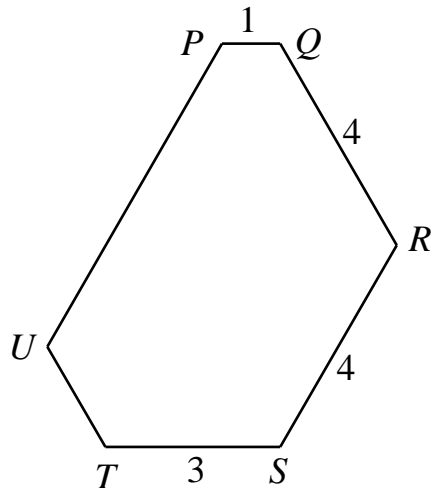
- (6) The sum of the digits of a two-digit number \overline{ab} is 6. By reversing the digits, one obtained another two-digit number \overline{ba} . If $\overline{ab} - \overline{ba} = 18$, find the original two-digit number.

- (7) The side length of the biggest square in the given diagram is 10 cm long. As shown in the diagram, the total shaded regions formed by two diagonals inside the circle and two squares is 26 cm^2 . What is the length side of the smallest square in cm?

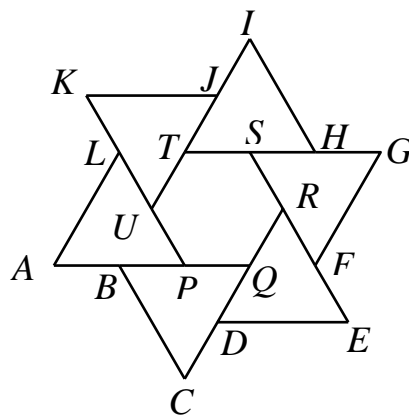


- (8) The product of 1110, 1111, 1112 and 1113 is the thirteen digit number $\underline{152628x755760}$, with one digit replaced by x . What is the value of x ?

- (9) Each of A, B, C and D either always tells the truth or always tells lies. A says C always tells lies. B says A always tells lies. C says D always tells the truth. D says either A or C always tells lies. Who always tells lies?
- (10) In the Figure below each of the interior angles of hexagon $PQRSTU$ is 120° . Given that $PQ = 1$ cm, $QR = RS = 4$ cm and $ST = 3$ cm. Find the perimeter of the hexagon $PQRSTU$.



- (11) $PQRSTU$ is a regular hexagon with side 2 cm. The polygon $ABCDEFGHIJKL$ is obtained by drawing the equilateral triangles of side 4 cm, producing the sides of the hexagon. Find $\frac{\text{area of } ABCDEFGHIJKL}{\text{area of } PQRSTU}$.

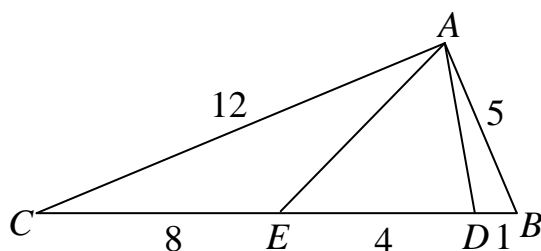


- (12) Nine lines, parallel to the base of a triangle, divide each of the other sides into 10 equal segments and the area into 10 distinct parts. Find the area of the original triangle, if the area of the largest of these parts is 76 cm^2 .
- (13) The dates of three Sundays in a month are even numbers. What day is the 28th day of the month?
- (14) The company Coco has a number of operational cars. The tax for the first car is \$2,000, the tax for second car is 5 % more than the tax for the first car, the tax for third car is 10 % more than the tax for the first car, the tax for the other cars are 15 % more than the tax for the first car. The company pays \$15,500 tax for all cars. How many cars does the company have?

- (15) There are 1500 red dots and 513 white dots on a circle. We write 1 between two red dots, -1 between two white dots, and 0 between two dots that have different colours. What is the sum of the 2013 numbers we have written on this circle?
- (16) A paper cutter will cut a stack of up to 500 sheets of paper in one operation. If no piece of paper is ever folded, what is the minimum number of operations to get 2013 sheet of paper, starting with one sheet?
- (17) On Monday, Austin kept half of his cows and divided the other half equally between Dustin and Justin. On Tuesday, Dustin kept half of his cows and divided the other half equally between Justin and Austin. On Wednesday, Justin kept half of his cows and divided the other half equally between Austin and Dustin. Each now had 8 cows. How many cows did Dustin have originally?
- (18) In a 4×4 table, there is a symbol in each square, a white circle, a black circle, a triangle right side up or a triangle upside down. There is exactly one symbol of each kind in each row, each column and each of the two long diagonals. The symbols in four of the squares are shown in the diagram below. What is the symbol in the square marked with a question mark?

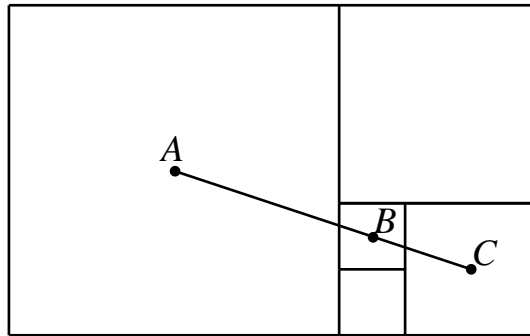
			△
○	△		
		●	
	?		

- (19) In the figure below, $AB= 5$ cm, $AC= 12$ cm, $DB= 1$ cm, $ED= 4$ cm, $CE= 8$ cm. What is the size of $\angle EAD$, in degrees?



- (20) Find the smallest multiple of 9 which is not divisible by the sum of its digits.
- (21) Cut a cube by two planes parallel to the base of the cube into three rectangular blocks. The ratio of surface areas of these three blocks is $3:4:5$. Find the ratio of their volumes in simplified form.

- (22) The diagram below shows five squares of respective side lengths 1, 1, 2, 3 and 5. The centres A , B and C of three of the squares lie on a straight line. What is the ratio of the length BC to the length AB ?



- (23) Let \square and \triangle be two distinct positive integers such that $\square - \triangle = 2013$, $\frac{\square}{\triangle} = \frac{\square - \triangle - 669}{\square - \triangle - 2011}$. What is the value of \square ?
- (24) Robert bought two different candles. The ratio of the length of the short candle to the longer candle is $5 : 7$. It is known that the longer candle, when lighted can melt in 3.5 hours while the shorter candle, when lighted, can melt in 5 hours. Now the two candles are lighted at the same time, after how many hours will the length of two candles be exactly equal?
- (25) In a game, Alvin and Benny take turns painting a rectangle in the diagram below. When a rectangle is painted, then all rectangles adjacent to it can no longer be painted. The player who cannot make a move loses the game. For example, if Alvin paints the rectangle a first and Benny paints the rectangle e , then Alvin cannot paint any other rectangle. Thus Alvin loses. If Alvin wants to win the game, then what rectangle must he paint first?

