The University of the West Indies, Mona Campus

2015 Junior Mathematics Olympiad

Solutions for Grades 4, 5, and 6

1. After Al ate one sweetie and gave one to his teacher, he had 8 sweeties left. After Barb and Carl ate one sweetie and gave one to their teacher, they each had 8 sweeties left. The number of sweeties Al, Barb, and Carl had left between them was 24.

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2. Shanique has three medium-sized boxes, and each one has three small boxes in it. She has 9 small boxes in all. So, Shanique has 1 large box, three medium-sized boxes, and 9 small boxes. She has 13 boxes in all.

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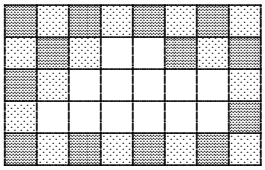
3. The floor is 8 tiles wide and 5 tiles high. When it is finished, it will have 4 grey and 4 black tiles in each row. So, there will be 20 grey tiles and 20 black tiles on the floor. Mr. Brown has put down 14 grey tiles so far. He will need 6 more to finish the floor.



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4. After the first whistle, there were 4 rows with 4 monkeys in each row. There were 16 monkeys in all. After the second whistle, the monkeys were in 8 equal rows. There were 2 monkeys in each row.

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5. Since Matt had more stamps than Paul, Matt did not have the least number of stamps. Since Tom had fewer than Adam, Adam did not have the least number of stamps. But Tom did not have the least number of stamps, either. So, Paul had the least number of stamps.

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6. From the equation $\triangle + \triangle = 4$, we see that $\triangle = 2$. From the equation $\bigcirc + \triangle = 3$ we see that $\bigcirc + 2 = 3$. Then $\bigcirc = 1$. From the equation $\triangle + \square = 5$ we see that $2 + \square = 5$. Then $\square = 3$. Finally, $\bigcirc + \square = 1 + 3 = 4$. The number covered by the grey card is 4.

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7. Eva, her mother, her father, and her brother have 2 legs each. They have 8 legs among them. Their dog and two cats have four legs each. They have 12 legs among them. The two parakeets have a total of 4 legs, and the goldfish have no legs. In Eva's house, there are $8 + 12 + 4 = 24$ legs in all.

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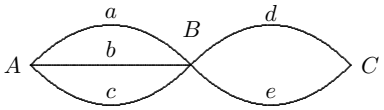
8. Let a, b, and c be the three paths from City A to City B (see the figure below). Let d and e the two paths from City B to City C. A traveler could go from City A to City C along the paths a and d, a and e, b and d, b and e, c and d, or c and e. There are 6 such paths in all.



9. When 1 piece of paper is cut into 3 pieces, the total number of pieces increases by 2. So, after one piece was cut there were 11 pieces in all. After two pieces were cut, there were 13 pieces in all. After 3 pieces were cut, there were 15 pieces in all. A total of 3 pieces of paper were cut.

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10. Without any breaks, the movie would have lasted 90 minutes. This is 1 hour and 30 minutes. The movie would have finished at 6:40 pm. However, there were breaks totaling 13 minutes during the movie. The movie actually finished at 6:53 pm.

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11. Let b be the number of boys (not including Nicholas) in his class. There are twice as many girls in his class, so there are $2b$ girls in his class. The total number of students (except for Nicholas) is $2b + b = 3b$. This is obviously a multiple of 3. When Nicholas is included, the number of students is $3b + 1$ in all. This means that when the number of students in Nicholas's class is divided by 3, the remainder is 1. Among the numbers 20, 24, 30, 29, and 25, the number 25 is the only one that has a remainder of 1 when divided by 3. So, 25 is the only number on the list that could be the number of students in Nicholas's class.

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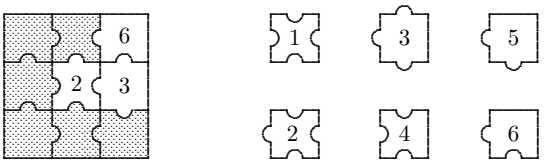
12. The pieces that complete the puzzle are the ones labeled 2, 3, and 6.



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13. Operating from left to right,

$$2014 - 1014 + 114 - 14 = 1000 + 114 - 14 = 1114 - 14 = 1100.$$

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14. The value of 3 pesos is 12 centavos more than the value of 1 peso. However, the value of 3 pesos is also 2 pesos more than the value of 1 peso. So, 12 centavos has the same value as 2 pesos. Then 1 pesos worth 6 centavos.

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15. Starting in the upper-left corner, the sum of the numbers down the diagonal is $16 + 10 + 4 = 30$. Then, along the top row, $16 + 3 + A$ is also equal to 30. Solving for A gives $A = 11$. Starting in the

16	3	A
C	10	
B		4

16	3	11
5	10	
9		4

upper-right corner and moving down the diagonal, $11+10+B = 30$. Solving for B gives $B = 9$. Moving down the first column, $16+C+9 = 30$. Solving for C gives $C = 5$. Then $A+B+C = 11+9+5 = 25$.

16. In order to taker out 50 gold coins, at least 5 boxes must be unlocked. In order to unlock 5 boxes, at least 2 chests must be unlocked. In order to unlock the 2 chests, the trunk must be unlocked. You must open at least $1 + 2 + 5 = 8$ locks in order to take out 50 gold coins.

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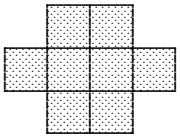
17. The shaded figure consists of 8 equal squares. Its perimeter consists of the lengths of 14 equal sides of a square. Their total length is 42 cm. So, each side of a square is 3 cm. The area of one square is $9\,\text{cm}^2$. The area of the shaded figure is $8 \times 9\,\text{cm}^2 = 72\,\text{cm}^2$.



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18. Since Barb has \$660 and Ala has \$240, Barb has \$420 more than Ala. Also, one-half of \$420 is \$210. So, Sophie has \$210 more than Ala. This means that she also has \$210 less than Barb. Sophie has \$240 + \$210 = \$450.

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19. For the largest possible sum, Gregorio should use the two largest digits, 6 and 5, for the hundreds digits of his numbers. He should use the next largest digits, 4 and 3, for the tens digits. He should use the last two digits, 2 and 1, for the ones digits. The largest possible sum is

$$(6 + 5) \times 100 + (4 + 3) \times 10 + (2 + 1) = 1,100 + 70 + 3 = 1,173.$$

For example, Gregorio could have written the numbers 632 and 541. Their sum is 1,173.

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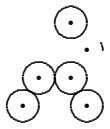
20. If just three coins are removed, it will still be possible to form an equilateral triangle from centres of the remaining coins. This is true no matter which three coins they are (try it). However, if four coins



are removed in the way shown above, it is not possible to form a triangle from the centres of the remaining coins. So, four is the smallest number of coins that need to be removed.

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21. The walking stick in the picture measures 2 cm long. Actually, it is 1 m long. In other words, the stick is actually 100 cm long. So, lengths of objects in the picture are 1/50 of their true length. Their true length is 50 times their length in the picture. In the picture, the height of the fence is 4.5 cm. Multiplying this by 50, the true height of the fence is 225 cm.

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22. The puzzle Miss James made is shown in Figure 22(a) below. After her students simplified the expressions in it, they obtained the puzzle shown in Figure 22(b). When they completed it, they obtained the one shown in Figure 22(c). The number 3 goes in the shaded square.

1×1		1×3	
2×2	$6 - 3$		$6 - 5$
$4 - 1$	$1 + 3$	$8 - 7$	
$9 - 7$	$2 - 1$		

Figure 22(a)

1		3	
4	3		1
3	4	1	
2	1		

Figure 22(b)

1	2	3	4
4	3	2	1
3	4	1	2
2	1	4	3

Figure 22(c)

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23. At the last step, Michael multiplied the number he had by 4 and obtainer 2012. So, just before the last step he had 503. The step before that, he added 3 in order to obtain 503. So, his number was 500 before doing so. The step before that, he multiplied his number by 10 to obtain 500. So, Michael's number was 50 before doing so. The step before that, he added 1 to his number to obtain 50. So, he had 49 before doing so. Finally, he multiplied his first number by itself to obtain 49. So, the number he started with was 7.

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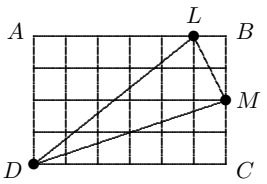
24. The area of triangle DLM is the same as area of rectangle $ABCD$ minus the sum of the areas of



triangles ALD, LBM, and MCD. The area of rectangle $ABCD$ is 24 square units. The area of triangle ALD is equal to

$$\frac{1}{2}(AL)(AD) = \frac{1}{2}(5)(4) = \frac{1}{2}(20) = 10.$$

Similarly, the area of triangle LBM is $\frac{1}{2}(LB)(BM) = \frac{1}{2}(1)(2) = 1$. The area of triangle MCD is $\frac{1}{2}(MC)(CD) = \frac{1}{2}(2)(6) = 6$. Then the area of triangle LMD is $24 - (10 + 1 + 6) = 24 - 17 = 7$.

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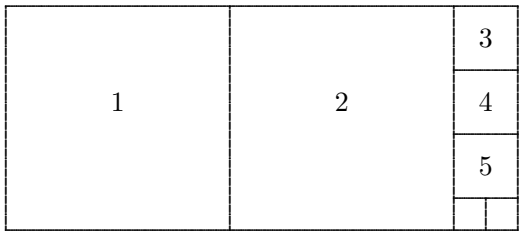
25. On the first step, a square of size 84 mm × 84 mm is cut off. A rectangle of size 108 mm × 84 mm remains. On the second step, another square of size 84 mm × 84 mm is cut off. A rectangle of size 24 mm × 84 mm remains. On the third step, a square of size 24 mm × 24 mm is cut off. A rectangle of



size 24 mm × 60 mm remains. On the fourth step, another square of size 24 mm × 24 mm is cut off. A rectangle of size 24 mm × 36 mm remains. At the fifth step, another square of size 24 mm × 24 mm is cut off. A rectangle of size 24 mm × 12 mm remains. At the sixth step, a square of size 12 mm × 12 mm is cut off. Another square of size 12 mm × 12 mm remains. Since all the pieces are now squares, this process stops. The length of a side of the smallest square produced in this way is 12 mm.