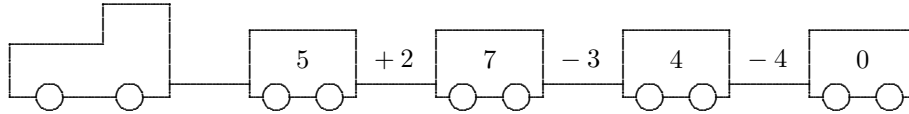


# The 2014 Junior Mathematics Olympiad

## Solutions to Problem Set 1

1. First,  $5 + 2 = 7$ . Then,  $7 - 3 = 4$ . Finally,  $4 - 4 = 0$ . The number behind the question mark is 0.

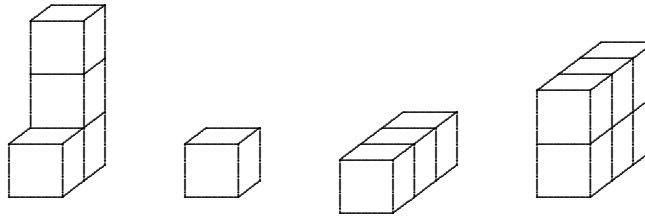


2. There are 4 children and each one starts with 2 apples. So they start with 8 apples. Each child eats one apple. So, they eat 4 apples in all. There are  $8 - 4 = 4$  apples left.

3. Adding or subtracting from left to right,  $5 - 4 + 3 - 2 + 1 = 1 + 3 - 2 + 1 = 4 - 2 + 1 = 2 + 1 = 3$ .

4. Three years ago, Michael was 4. Now he is 7 years old.

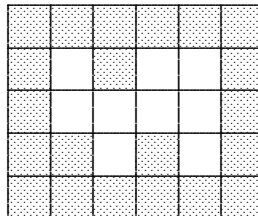
5. The figure may be “exploded” to into four parts as shown below. There are  $4 + 1 + 3 + 6 = 14$  blocks in all.



6. After one lie, his nose will be 6 cm long. After two lies, it will be 12 cm long. After 3, 4, and 5 lies, it will be 24, 48, and 96 cm, respectively. After 6 lies it will be 192 cm long.

7. After 1 day, the hens will lay 2 eggs. After 2 days, they will lay 4 eggs. After 3 days, they will lay 6 eggs. It will take 3 days for two hens to lay 6 eggs.

8. To finish covering the floor, 9 more tiles are needed.



9. Let  $a$  be the number of apples that Anna has. Then Maria has  $a + 2$  apples. Together they have  $a + (a + 2) = 2a + 2$  apples. Then  $2a + 2 = 8$ . Subtracting 2 from both sides gives  $2a = 6$ . Dividing both sides by 2 gives  $a = 3$ . Anna has 3 apples.

10. The only way to make  $4 \square 3 \square 2 \square 1 = 8$  is to write  $4 + 3 + 2 - 1 = 8$

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11. The yellow car is not next to the white one and not next to the red one. So, it is next to the green one (and no other car). Then the yellow car is either first or last. But the first car is white. So the yellow car is last and the green car is third. The red car must be second. The order of the cars from front to back is white, red, green, and yellow.

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12. One year from now, Karl will be 11 and Ala will be 4. Two years from now, Karl will be 12 and Ala will be 5. Three years from now, Karl will be 13 and Ala will be 6. Four years from now, Karl will be 14 and Ala will be 7. So, Karl will be twice as old as Ala in four years.

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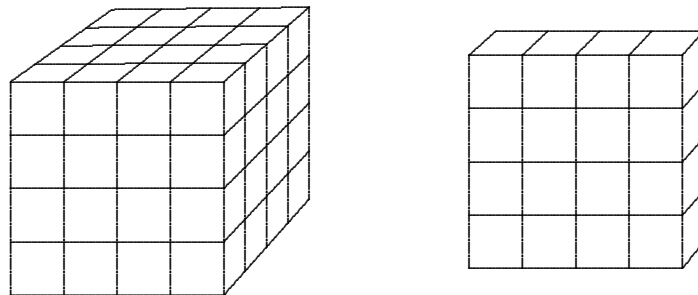
13. Let  $g$  be the number of girls in Mrs. Brown's class. The number of boys is  $4g$ . The total number of students is  $g + 4g = 5g$ . Then  $5g = 30$ . Dividing both sides by 5 gives  $g = 6$ . There are 6 girls in Mrs. Brown's class (and there are 24 boys).

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14. The 7th day after my mother's birthday will be a Sunday. So will be the 14th, 21st, 28th, 35th, 42nd, and 49th days after my mother's birthday. The 50th day will be a Monday, the 51st day will be a Tuesday, and so on. The 55th day will be a Saturday.

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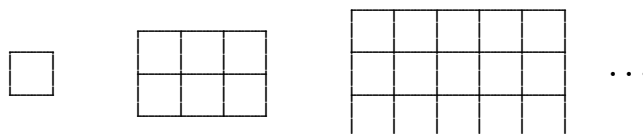
15. When the golden cube is cut, it consists of 4 sections identical to the one shown on the right below. Each section consists of  $4 \times 4 = 16$  small cubes. There are  $4 \times 16 = 64$  cubes in all.



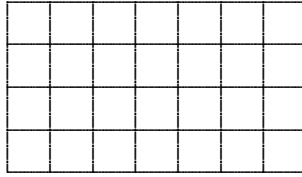
16. Let  $n$  be the page number on the left side. Then the one on the right side is  $n + 1$ . Their sum is  $n + (n + 1) = 2n + 1$ . Then  $2n + 1 = 21$ . Subtracting 1 from both sides gives  $2n = 20$ . Dividing both sides by 2 gives  $n = 10$ . The page number on the left side is 10 and the one on the right side is 11. Their product is  $10 \times 11 = 110$ .

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17. The figures in this sequence are made of 1, 2, 3 ... rows of squares. The next figure will have 4 rows of squares. The figures also have 1, 3, 5, ... squares in each row. The



next figure will have 7 squares in each row. It is the figure shown below.



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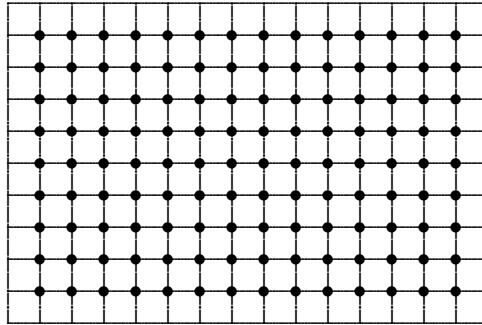
18. Let  $n$  be the number of ducks. Then  $n$  is also the number of pigs and chickens. Each pig has 4 legs, each duck has 2 legs, and each chicken has 2 legs. The total number of legs on these animals is  $4n + 2n + 2n = 8n$ . Then  $8n = 144$ . Dividing by 8 on both sides gives  $n = 18$ . Marsha has 18 ducks on her farm.

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19. Let  $x$  be the number. Then  $x + 24 = 85$ . Subtracting 24 from both sides gives  $x = 61$ . So, the original number was 61. By mistake, John calculated  $61 - 24$  and his answer was 37.

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20. Mama Bear's quilt is 150 cm long and 100 cm wide. To make the quilt, she will need 15 squares in each row and 10 rows of squares. To sew the fancy buttons, she will need 14



buttons in each row and 9 rows of them in all. She will need  $14 \times 9 = 126$  buttons to finish her quilt.