Junior Circle: Welcome Back!
Problems from Russian Olympiads

October 4, 2015

1. 240 students from Moscow and St. Petersburg attended a math camp.
   - Of the total number of students, 125 were boys.
   - 65 boys were from Moscow.
   - There were 53 girls from St. Petersburg.

   How many students came from Moscow? 127

   # female students from Moscow = 240 - 125 - 53 = 62

   # students from Moscow = 62 + 65 = 127

2. Two bike riders are riding on the same bike trail. Biker 1 has a speed of $12 km/hr$ and biker 2 has a speed of $15 km/hr$. At noon, the distance between them is $35 km$. What will the distance between them be at 2:00pm? 4 possible answers: 19, 29, 41, 89

Going the Same Direction:
scenario 1: Biker 1 farther than Biker 2
The distance will decrease by 3*2 = 6 km, for a final space of 35-6 = 29 km.

scenario 2: Biker 2 farther than Biker 1
The distance will increase another 3*2 = 6 km, for a final space of 35+6= 41 km

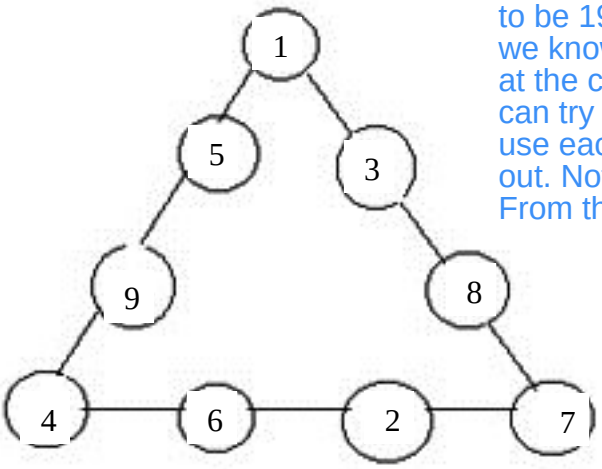
Going the Opposite Direction:
scenario 3: The Bikers are facing each other.
The distance will change by a total of 2*(12+15) = 54 km, so space is |35-54| = 19 km.

scenario 4: The Bikers are facing away from each other.
The distance also changes by 54km, but this time they are getting farther and farther away from one another, so the final difference is 35 + 54 = 89 km.

3. Maria caught the flu from one of her classmates and decided to go to the doctor. The doctor gave her 3 pills and told her to take a medication every half an hour. If she took the first pill at 1:00pm, at what time will she take the last one? 2PM

Pill	1	2	3
time	1:00 pm	1:30 pm	2:00 pm

4. Put numbers 1, 2, 3, ..., 8, 9 into the circles so that the sum of numbers along each side of the triangle is equal to 19.



We know we use all the digits once. If each side adds up to be 19, then the total sides add up to be 3*19 = 57. But we know 1 + 2 + ... + 8 + 9 = 45. Hence the three numbers at the corners sum up to be 57-45 = 12. From there, we can try out a few combinations. However, since we only use each digit once, we want our digits to be evenly spaced out. Notice the only trio that works would be 1, 4, and 7. From there, we can fill out the rest of the triangle.

5. Find the sides of a rectangle with the following conditions:

- the area is $12cm^2$
- the perimeter is $26cm$

1cm X 12cm

Area = base*height = 12
Perimeter = 2(base + height) = 26
so (base + height) = 13

b*h = 12, and b + h = 13

6. Place parentheses into the following expression so that the statement is true.

$$1\ 5 - (3\ 5 + 5) \div 4 = 5$$

7. The city of Moscow was founded in 1147. How old is Moscow today? 868

   When packet was made in 2015: 2015-1147 = 868

   In 2020: 2020 - 1147 = 873

8. The sum of two numbers is 715. The first number ends in a zero. If you erase this 0, you have the second number.

   What are the two numbers?

   650, 65

   Let the second number be x. Then the first number is 10x.

   So, $10x + x = 715$

   $11x = 715$

   $x = 65$

   so x = 65 and 10x = 650

9. The age of Peter's great grandfather is the smallest three digit number written with three different digits. How old is Peter's great grandfather? 102

   You want the first digit to be the smallest, but since a three digit number starting with 0 is only a two digit number, we must first begin with 1 then 0. The next smallest digit is 2. Hence, we have 102.

10. Peter drives from Moscow to St. Petersburg with a speed of $50 km/hr$. Victor drives from St. Petersburg to Moscow with a speed of $70 km/hr$. What is the distance between Peter and Victor two hours before they pass each other? 240km

The rate the are driving towards each other is a combined total of (50 + 70)km/hr = 120 km/hr.

Hence, two hours before the difference is 0 is 2*120 = 240 km.

11. Find all possible solutions for the equation:

$12 \div x = 7 - x$

x = 4, x = 3

12/x = 7-x
12 = 7x - x^2
x^2 - 7x + 12 = 0
(x-3)(x-4) = 0
x = 3, x = 4

12. Katya took a piece of wire and began to bend it into different shapes. When she bent it into a square, the sides were $6 cm$. After, she made a triangle with all sides equal to each other out of the same piece of wire.

What is the length of the sides of the triangle? 8cm

length of wire = 4 * 6 cm = 24 cm

length of triangle = 24 cm / 3 = 8 cm

13. Second graders are planting trees along the side of the school garden. They are told that they need to plant the trees 3 meters apart. The length of this side of the school garden is 30 meters.

If they want to maximize the number of trees in the garden, how many saplings (young trees) should they prepare? 11

They plant 1 tree at length 0. Hence you can plant an additional 30/3 = 10 trees.

Thus, they can plant a total of 1 + 10 = 11 trees.

14. How many hundreds do you get when you multiply two hundred by three hundred? (Hint: Try not to actually multiply the two, think logically) [redacted] 600

you have 200 three hundreds, or 600 one hundreds.

In numbers, 200 x 300 = (2 x 100) x (3 x 100)
= (2 x 3 x 100) x 100
= 600 x 100