

Rochester Area Math Competition (Elementary School)

Hosted by Rochester Math Club (RMC)

March 14th, 2018

1 Introduction

Welcome to the first annual Rochester Area Math Competition (RAMC)! RAMC is a unique opportunity for K-12 students to demonstrate their mathematical knowledge. This is the Elementary School test; if you feel you are taking the wrong test level, please raise your hand and we will provide a different test for you.

Read through the following guidelines. Do **NOT** flip the page until you are told to do so.

1.1 Contest Format

RAMC consists of a 45-minute individual test containing 15 problems that range in difficulty. Problems at the end of the test are guaranteed to be more difficult than the first couple problems and are meant to challenge you. Partial credit is not given. Calculators **MAY NOT** be used on this test. All answer must be filled out on the given answer sheet.

1.2 Challenges

After the contest is over, solutions will be posted on-site and on the website. If you have any challenges to test questions, please make the challenge within half an hour of when the solutions are posted. On a blank sheet of paper, please include your name, grade, problem number, your proof and explanation of why you believe your answer is (also) correct. Give your proof to one of the test mods.

1.3 Ties

Ties will be broken through a tiebreaker round. We will announce the finalist shortly after the competition. The tiebreaker round will be explained to those who make it. Awards will be determined on the day of the competition.

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2 RAMC

Information: RAMC is broken into two sections: Problems 1-10, 11-15. Problems in the first range are each worth one point; problems in the second range are each worth two points. Partial credit is not given.

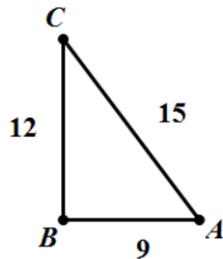
Note: The word "exact" in the questions call for an answer in simplest form. For example, instead of answering 1.73205, the right answer is $\sqrt{3}$. Please try to reasonably simplify your arithmetic. Good luck!

1. What is the area of a square with side length 9?
2. In the magic square below, the numbers in each row and each column add up to the same sum. Find x .

10.5	7	
3.5		13.5
9		x

3. A cake that costs \$16.50 is cut into 15 equal pieces. Tracy eats 3 pieces. How much are the pieces that Tracy ate worth?
4. If 7 apples cost the same as 4 oranges, and 5 oranges cost the same as 2 grapefruits, how many apples cost the same as 16 grapefruits?
5. A year on RMC Planet has exactly 420 days. Each week on this planet has 9 days. If year 1 starts on the first day of the week, what will be the next year that the first day of the year is the first day of the week?
6. Calculate the sum: $1 + 2 + 3 + \cdots + 48 + 49 + 50$.

7. A bag has 7 red, 10 blue, and 8 white marbles. How many extra white marbles do you need to add so that the number of white marbles is half of the total number of marbles?
8. The special operation @ works as follows: $a@b = a^2 + b$. If $5@(3@x) = 49$, what is x ?
9. Chris has 4 quarters (25 cents each), 7 dimes (10 cents each), 5 nickels (5 cents each), and 15 pennies (1 cent each). What is the greatest number of coins he can use to make \$1.83?
10. The RMC orchard has trees arranged into a square with X columns and X rows. To enlarge the square by 2 rows and 2 columns, the RMC team planted 24 more trees. How many trees were there before the enlargement?
11. In the figure below, triangle ABC has side lengths $AB = 9$, $BC = 12$, and $CA = 15$. Find the length of the height of this triangle that passes through point B .

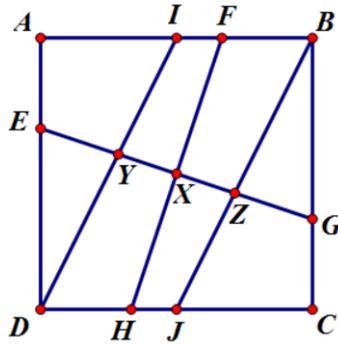


12. Tracy, Richard, and Helen are each cutting a string. All three strings have the same integer length. Tracy makes 15 cuts, Richard makes 27 cuts, and Helen makes 9 cuts. Each initial string is cut into pieces of equal integer length. What is the smallest possible length of one of the original strings?
13. At a movie theater, a bag of popcorn costs twice as much as a bottle of soda. John bought 2 bags of popcorn and 4 bottles of soda, while Jane bought 4 bags of popcorn and 2 bottles of soda. John paid \$2.50 less than Jane did. How much does a bag of popcorn cost?

14. Find the exact value of:

$$\frac{1}{1 \cdot 3} + \frac{1}{3 \cdot 5} + \frac{1}{5 \cdot 7} + \frac{1}{7 \cdot 9} + \frac{1}{9 \cdot 11} + \frac{1}{11 \cdot 13} + \frac{1}{13 \cdot 15} + \dots$$

15. In square $ABCD$ with side length 6, point E is on AD such that $AE : ED = 1 : 2$, point F is on AB such that $BF : FA = 1 : 2$, point G is on BC such that $CG : GB = 1 : 2$, point H is on CD such that $DH : HC = 1 : 2$. Lines EG and HF intersect at a point X . If I and J are the midpoints of AB and CD , respectively, and DI and BJ intersect line EG at Y and Z , respectively, find exactly $YX + XZ$.



This is the end of the test. Please go back and check your answers until your time is up.