



# RAMC 2021

## Elementary II Individual Round

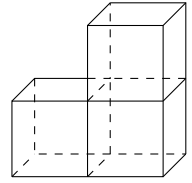
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- **SCORING:** The first 10 questions are worth 1 point each, and the last 5 questions are worth 2 points each.
- This round contains 15 questions to be solved in 45 minutes. Problems towards the end tend to be more difficult than problems toward the beginning.
- No computational aids are permitted other than scratch paper, graph paper, and a pen/pencil. No calculators of any kind are allowed.
- All answers are integers. When submitting answers, do not add additional characters (such as spaces or units) beyond pure numerical digits, with the exception of a minus (-) symbol when needed.
- If you believe there is an error on the test, submit a challenge to [rochestermathclub@gmail.com](mailto:rochestermathclub@gmail.com). Please include your name, level (Elem I/II, MS, HS), and explanation of the problem and your solution.

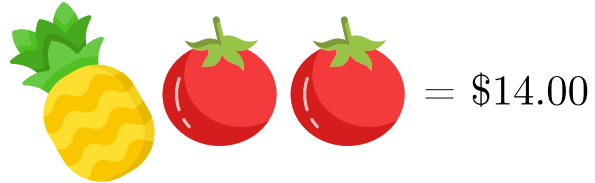
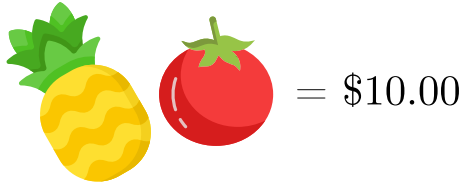
Take a moment to check that your information is entered correctly!

1. Evaluate the expression  $2022 \div ((2 \times 0 + 3) \times 6 + 0 - 6 \times 2 - 0)$ .

2. Yelena is building a small staircase with blocks. It takes three blocks to build two steps. How many blocks will it take her to build nine steps?



3. How much does a pineapple cost in the figure below, in dollars?



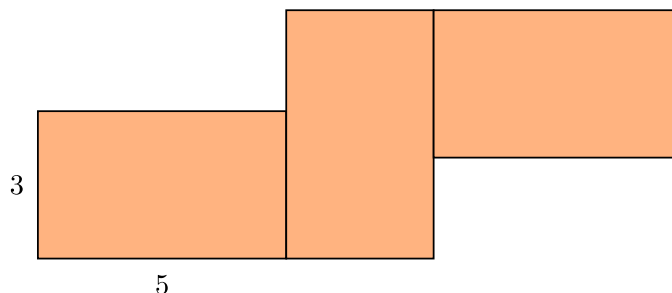
4. Jack has a chocolate bar. He takes half of the whole bar and gives it to Jill, who takes  $\frac{1}{4}$  of the remaining bar. Their friend Julian then takes  $\frac{1}{5}$  of the remaining bar. If the amount of the original chocolate that bar remains after Julian takes his piece is  $\frac{p}{q}$ , find the sum  $p + q$ .

5. Alexander wants to buy candy that costs 66 cents. He only has quarters, nickels, and pennies. What is the least number of coins he can use to pay for the candy?

6. Jenny is trying to tile her kitchen with square tiles that each have an side length of 6 inches. The kitchen is 3 feet by 3 feet, but there is a counter which is 1 foot by 6 inches. If Jenny does not need to tile the area under the counter, how many tiles will she need to tile the entire kitchen?

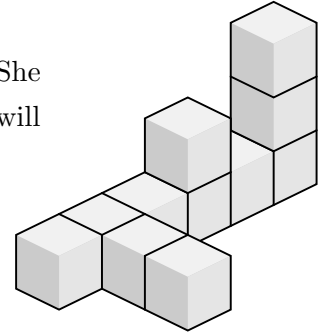
7. Alfredo the bird was out catching worms. He catches a worm on every 13<sup>th</sup> attempt. In addition, for every 15<sup>th</sup> attempt, his friend Benito gives him 3 more worms. How many worms will Alfredo have after exactly 600 attempts?

8. Michael has three rectangles, all of the same size. He makes the figure below with his rectangles. What is the perimeter of the figure?



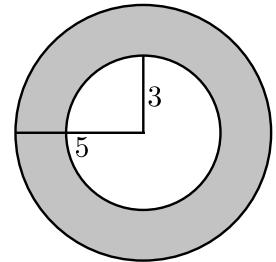
9. There are 18 pieces of candy in Richard's bucket. 12 are chocolates, 3 are lollipops, 2 are caramels, and 1 is a piece of fudge. Richard chooses 3 candies from the bucket, without replacing them after he takes them out. If the probability that Richard chooses a lollipop, a chocolate, and the piece of fudge, in that order is  $\frac{p}{q}$ , where  $p$  and  $q$  are relatively prime positive integers, find  $p + q$ .

10. Natalie builds a structure with 11 cubes, as shown in the figure to the right. She paints the entire structure green, including the bottom. How many cubes will have at least 3 of their faces painted green?



11. Felix has 7 coins, 3 of which are currently heads up and 4 are tails up. In one move, Felix can use three fingers to flip any 3 coins to the other side at the same time. What is the least number of moves it takes for him to get all of the coins heads up?

12. Bob has two concentric circles, one with radius 5 and one with radius 3. The area of the region inside the larger circle but outside the smaller circle can be expressed as  $a\pi$ . Find  $a$ .



13. There are only chickens and pigs in Stephen's barn. If Julia counts 28 heads and 80 feet, how many pigs are in the barn?

14. John draws 8 points on a sheet of paper, such that no 3 points can lie on the same line. How many lines can he draw that go through exactly 2 points?

15. What is the units digit of  $2022^{2021}$ ?