Chapel Hill Math Circle – 1.26.19

Math Auction 1

Rules of the game

1. We will divide into teams of 4-5 students each and work on the problems below for the first 40 minutes. *Note: We want students to work together in coming up with the answers, so parents please don't give away answers.*
2. Each time is given starting money of $1000. (we will keep track of $ on the board)
3. The best solution to a problem is worth $200.
4. The way the auction works is this:
    a. The problem is put up for auction, where each team will bid $ to present their answer(in increments of $10). Each team will have a leader who is responsible for bidding for their team.
    b. The team with the highest bid is allowed to present their solution to the class. One person from their team goes up to the board to share their answer. *Note: Each team member is only allowed to present 1 answer to a problem, then they must let each of their team members present an answer before going up again.*
    c. The problem is put up for auction again, however this time the solution must be better than the previous solution (we will describe what 'better' means below)
    d. If a team presents a better solution, they would get $200 *instead* of the first team.
    e. We keep auctioning & presenting solutions until there are no better solutions. The team with the best solution gets $200 added to their balance.
5. We're going to start with problem 1, go through the steps mentioned above, then move onto problem 2.

Problems

1. Using the digit '2' five times, represent as many consecutive natural numbers as possible, starting from 1. You can use the arithmetic operations $+, -, \times, \div$, and parentheses. The same operation can be used several times. You are not required to use all four operations. Examples: 1 = (2 – 2 / 2)x(2/2), 2 = 22 – 22 + 2

A team has a stronger solution for this problem if it is able to continue the list starting from where the previous team had stopped.

2. Cut a circle with seven straight lines so as to get as many triangular pieces as possible. "Triangles" with curved sides don't count, nor do cut triangles(a triangle made up of smaller triangles or polygons).

A team has a stronger solution for this problem if it is able to present a drawing that has more triangles.

3. Cut 7 round pizzas into wedges in such a way as to be able to equally divide these pizzas between 8 people. Make as few cuts as possible. (a cut is a straight line that starts and ends at an outer edge of a pizza. Everybody should get the same share, and there should

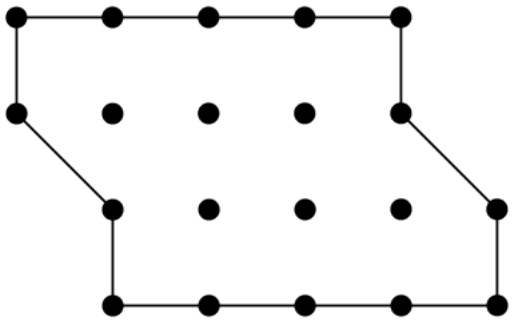
be no leftovers. Different people can get a different assortment of slices as long as they add up to equal shares.)

A team has a stronger solution for this problem if it is able to cut the pizza using fewer cuts.

4. Eli the trader has a gold chain with 20 links. (the chain is not fastened into a loop.) During one of his expeditions, Eli hires a guide for a 20-day trip through the desert. The guide asks him for one gold link per day as payment – and he wants to be paid at the end of each day. In order to make the daily payments, Eli has to open several links of his chain. Since unfastening a link costs money, Eli does not want to open too many links. The good news is that the guide is willing to trade links with Eli to make things even. For example: if Eli pays with a single link on day one, he can give the guide a two-link chain on day two and get the single link back. What is the smallest number of links Eli the Trader would need to open to be able to pay his guide for the trip?

A team has a stronger solution for this problem if it is able to present a solution with fewer open links.

5. The famous chef, Patty Cake, cooks a cake that has the shape below. This cake is to be cut into four equal parts of exactly the same size and shape. Find as many different ways to cut this cake into four pieces of the same size and shape.



A team has a stronger solution to the problem if they can find a new way to do it that hadn't been presented.