

MATH AUCTION

November 18, 2009

Rules:

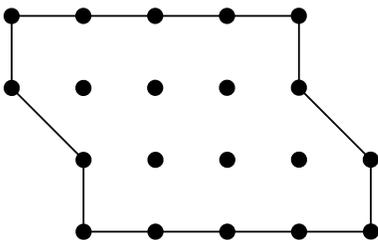
- 1) We divide into teams and work for a fixed amount of time to solve the problems below.
- 2) Each team is given \$1000 to start.
- 3) The best solution to a problem is worth \$200.
- 4) The problems are put up for auction in the order given. The team with the highest bid is allowed to present its solution.
- 5) The problem is then put up for bid again (and again), but each time the solution must be better than the previous solution.
- 6) When no other team wants to buy the problem, the team with the best solution collects the value of the problem. Every team that "bought" the problem pays for its bid, even if it did not have the winning solution.
- 7) If a team can show that it has found the best solution (by showing that no better solution is possible), then that team gets an additional \$50 prize money for the problem.

Problems:

1. Start with the number 1234512345123451234512345 and cross out ten digits so that the remaining number is as large as possible.
2. Let $n = ABC$ be a three-digit number, where A , B , and C are the three digits. Compute the largest possible value of:

$$\frac{n}{A + B + C}$$

3. What is the minimum possible number of straight cuts necessary to split a $5 \times 5 \times 5$ cube into 125 unit cubes if the pieces can be rearranged arbitrarily between cuts?
4. You can drop a nut to the ground from any floor of a 100-story building. A nut will always break when dropped from higher than a certain unknown threshold floor. You have two identical nuts, and you can experiment by dropping them from different floors, but once a nut is broken you can't use it again. Present an algorithm to find the threshold floor that uses as few drops as possible in the worst case.
5. The famous chef, Patty Cake, cooks a cake that has the shape below. The cake is to be cut into four equal parts of exactly the same size and shape. Find as many different ways as possible to cut this cake into four pieces of the same size and shape.



6. Draw 7 lines in the plane so that you produce as many triangles as possible.