

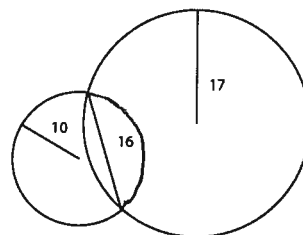
EMMY NOETHER MIDDLE SCHOOL MATHEMATICS DAY
Texas Tech University
May 15, 2013

Write your name, the name of your school and your current grade level on the front of the blue book. Work all problems. Show your reasoning and clearly indicate your answer to each problem. Do not simply claim an answer. Partial credit may be given where appropriate. Each problem is worth 10 points. If you are not sure how to approach a problem, you are strongly encouraged to experiment and to try to discover.

1.) The positive even integers (whole numbers) are written one immediately after the other 2468101214161820.... What is the 1000th digit in this writing? A digit is one of the symbols 1, 2, 3, 4, 5, 6, 7, 8, 9 or 0.

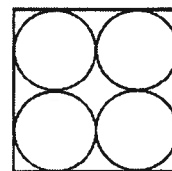
2.) How many four letter words can be formed from the letters G E O M E T R Y? A word is any four of the above letters in a specified order, e.g. MGTE. A word does not have to have "meaning" or be pronounceable in any particular language.

3.) Two circles overlap with a common chord of length 16. The radii of the circles are 10 and 17. Determine the distance between the centers of the circles.



4.) A biologist wants to count the number of fish in a lake. She cannot do this directly, so she uses the following procedure to estimate the number of fish. On the first day she drags a net through the lake and collects 30 fish. She marks all of the fish and returns them to the lake. The next day she again drags a net through the lake. This time she collects 40 fish of which 2 are ones that she marked the previous day. She again returns all of the fish to the lake. Approximately how many fish are there in the lake? Give your reasoning. Do not simply guess or claim an answer.

5.) A square has sides of length 4. Four identical circles fit tightly inside the square. What is the diameter of the largest circle which will fit in the central hole?



6. Alice has 14 coins with a total value of \$1.45. Each coin is either a nickel (five cents), a dime (10 cents) or a quarter (25 cents). How many coins of each type does Alice have? Determine if your answer is unique. Either show that your answer is unique or determine all possible answers.