EMMY NOETHER JUNIOR HIGH-SCHOOL MATHEMATICS DAY
Texas Tech University
May 9, 2007

Write your name, the name of your school and your current grade level on the front of the blue book. Show your reasoning and clearly indicate your answer to each problem. 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.) Determine the value of x and y if $x + \sqrt{y} = 32$ and $y + \sqrt{x} = 54$.

2.) Nancy is walking through a railroad tunnel. She is one-third of the way through when she hears a train approaching the tunnel. The train is going 30 miles per hour. If Nancy immediately turns around and runs back to the entrance of the tunnel, she arrives at the entrance just as the train gets there. If instead, she runs directly ahead to the end of the tunnel, she reaches it just as the train reaches the end of the tunnel. Assuming that Nancy runs at the same constant speed in each direction, how fast does she run?

3.) The city council in Greenville has changed the numbering scheme for the 200 houses on Oak Street. The houses will be renumbered with the natural numbers from 1 through 200, using all such numbers. A city worker is given a box containing 1000 metal digits, 100 of each digit (100 zeroes, 100 ones, 100 twos, etc.). She is to distribute new house numbers in order of the addresses beginning with 1 Oak Street. What address is the first one for which she will not have the necessary metal digits?

4.) Patty and Debra are planning a three-day canoe trip. Their friend Marge will drop them off at Jones Landing. From there they will paddle upstream for 12 hours on the first day. On the second day they paddle upstream for 9 hours. They have been on this river before and know that their paddling rate is twice the rate of the current in the river. At what time will they have to start downstream on the third day in order to meet Marge at Jones Landing at 5:00 pm?

5.) The number 12 is four times the sum of its digits (1+2). What is the smallest positive integer (whole number or natural number) which is 13 times the sum of its digits?

6.) Dates in the United States are normally written in the form month/day/year. In many other countries dates are written in the form day/month/year. If one does not know which system is being used, some dates are ambiguous, i.e. have more than one possible meaning. For example, 5/9/07 in the system used in the United States means May 9, 2007, while 5/9/07 in the system used in many other countries means 5 September 2007. Some dates however, only have one possible valid interpretation. For example 7/20/07 only makes sense as July 20, 2007 and 18/8/07 only makes sense as 18 August 2007. How many expressions xx/yy/07 during the year 2007 are ambiguous, having more than one valid interpretation?