

EMMY NOETHER MIDDLE SCHOOL MATHEMATICS DAY
Texas Tech University
May 17, 2012

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. 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.

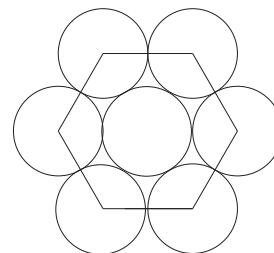
1.) Anne and Betty are planning a three-day canoe trip. Their friend Karen will drop them off at Duncan Landing. From there, they will paddle upstream for 7 hours on the first day. On the second day they will paddle upstream for 8 hours. They have been on this river before and know that their paddling 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 Karen at Duncan Landing at 3:00 pm?

2.) How many three letter words can be formed from the letters A L G E B R A? A word is any three of the above letters in a specified order, e.g. GLR. A word does not have to have “meaning” or be pronounceable in any particular language.

3.) How many times between noon and midnight does a digital clock display a time with at least three digits the same? The digits do not have to be consecutive. For example, at 12:11 there are three 1’s displayed. Only hours and minutes are displayed, not seconds. Any initial 0 in hours is not displayed, i.e. 1:00 is displayed, not 01:00. Two digits are always displayed for minutes.

4.) Lassie has two litters of puppies. There are five puppies in the first litter and four puppies in the second litter. Each puppy is either sable and white in color (the color of Lassie) or is tricolor. There are four sable and white puppies in the two litters combined. Each litter has exactly one tricolor female puppy. How many tricolor male puppies are there in the two litters combined?

5.) The most efficient way to pack non-overlapping circular discs of the same size in the plane is the hexagon centered arrangement, with a circle centered at each corner of a regular hexagon (six-sided polygon with each side of equal length and each angle equal) and another circle at the center of the hexagon. What fraction of the area of the hexagon is included in the circular discs?



6.) Kay has ten coins with a total value of 85 cents. Each coin is either a nickel (five cents), a dime (10 cents) or a quarter (25 cents). There is at least one coin of each type. How many coins of each type does Kay have? Determine if your answer is unique.