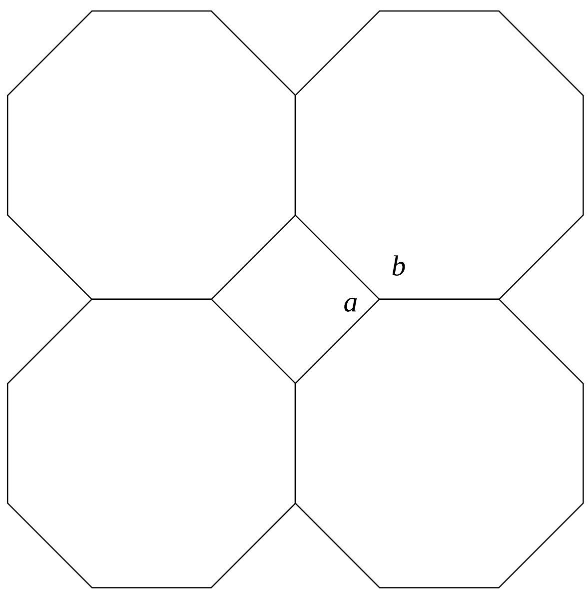
Mathematical problem solving — Russell Brown
Final — 3 May 1999

Answer all of the questions on the answer sheets provided. Each question is weighted equally. Provide as much explanation as possible. Good luck!

1. State the pigeonhole principle.
2. Suppose that we have a draw that contains 11 red socks, 14 orange socks and 3 blue socks. How many do we have to select in order to be sure that we have two socks of the same color?
3. Compute the sum of the first 100 odd numbers. (Hint: The first odd number is 1.)
4. A blue soccer ball is on sale for 1/3 off. If the sale price is \$8.88, what was the original price?
5. What is the remainder when 1,000,000,100,000,000,200,000,000,001 is divided by 9?
6. If today is Tuesday, what day of the week will it be in 6^{101} days?
7. Consider the pattern below consisting of a square and regular octagons. Find the measure of the angles marked a and b.



8. (a) We we roll two six sided dice and add the two numbers which we obtain. What is the probability of obtaining a sum of 8?

   (b) Suppose we roll the dice a 4532 times. Approximately how many times do we expect to obtain a sum of 8?

9. Two circles are drawn at the corners of a square whose sidelength is 1 inch. Find the area of the intersection of the two circles. This is the region marked a in the picture below.