



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

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Project Title Mysterious Number 6174	
Abstract Objectives/Goals To determine if a formula can be derived to find the number iterations it takes to reach zero or a Kaprekar Constant without going through the Kaprekar Routine. Methods/Materials Write a program to find the number of iterations it takes for numbers 1 to 10,000 to hit 0 or a Kaprekar Constant. Then create a graph that shows the number of iterations it takes each number to complete the Kaprekar routine to get a visual representation of the patterns. After, import the data from the program into Excel. Use Excel functions to find patterns between the starting number and the number of iterations. Results 1. Based on the difference found in the first iteration of the Kaprekar Routine the number of iterations it takes to reach zero or a Kaprekar Constant can be predicted. If the difference is a Kaprekar Constant, the order of the digits matter, otherwise the order of the digits in the difference does not matter. Since all two, three and four digit numbers all lead to one of 43 numbers, once the difference for those numbers is found, one can find the number of iterations for all the two through four digit numbers. 2. For two digit numbers based on the difference of the digits alone, the number of iterations can be predicted. If the difference is 0, 1, 3 or 4, add 1 to the difference to get the number of iterations. For numbers with a difference of 5 or 7, subtract 2 to find the difference. For 6 and 8 divide by 2 to find the number of iterations, and if the difference is 2, the number of iterations will be 6. 3. The sum of the digits in the differences will always be zero or a multiple of 9 for two to four digit numbers. For three digit numbers the middle digit in the difference is always a nine, and the sum of the other two digits is nine, which mean the sum is 18, except for the numbers that lead to zero. 4. The sum of the digits in the Kaprekar Constants for three and four digit numbers is always a multiple of 9. Conclusions/Discussion A generic formula was not found to derive the number of iterations it takes for a number to reach zero or a Kaprekar Constant. However several patterns were established that allow one to find the number of iterations needed without going through the Kaprekar Series for each number.	
Summary Statement A program was written with Scratch and patterns were found in the Kaprekar Numbers.	
Help Received My technology teacher, Mr. Appelbaum, gave me the idea for my project, and introduced me to Scratch, free programming software that I used.	