



**CALIFORNIA STATE SCIENCE FAIR  
2006 PROJECT SUMMARY**

<b>Name(s)</b> Marie E. Nielsen	<b>Project Number</b> <b>J1223</b>
<b>Project Title</b> <b>Searching for Perfection: Utilizing Patterns to Calculate Perfect Numbers</b>	
<b>Abstract</b> <b>Objectives/Goals</b> The objective is to discover some pattern or equation that shows one how to find perfect numbers. <b>Methods/Materials</b> Using a calculator, a pencil, and paper, patterns were sought among the factors of the first three perfect numbers and tested. Then, using those patterns, logic, and algebra, an equation was developed to identify more perfect numbers. Algebra was used to prove what the experimental work was showing. <b>Results</b> Two patterns in the factors of perfect numbers were found. The first pattern is that there is one more factor inside the parentheses than outside - the parentheses are a trick that was used to clarify between the factors that were powers of two and the remaining factors beginning with a prime number (which happened to be a mersenne prime) that then doubled. The other pattern that was found was that each factor doubled to get the next factor in the sequence but the factors on the inside didn't double to get the first factor on the outside; the sum of the factors on the inside became the first factor on the outside. From these patterns, an equation for finding perfect numbers was discovered. <b>Conclusions/Discussion</b> A perfect number is a number in which all of its factors except itself add up to itself. It was found that non-perfect numbers, and perfect numbers, can be classified by their prime factorization. These categories showed the difference between the number and the sum of its factors except itself. As the prime factors increased, the difference increased. It was shown that the difference between the numbers would never reach zero. For these classes, each factor must be a prime factor and the number 1 is included as one of the prime factors. Proofs showed that only certain combinations and amounts of factors would work out to produce a perfect number. It was proven that most of the factor classes do not produce perfect numbers.	
<b>Summary Statement</b> Experimentation with perfect and non-perfect numbers was used to identify patterns and discover an equation to generate perfect numbers.	
<b>Help Received</b> Mathematical concepts were explained by Mr. Koens and my father; proofreading by my parents.	