California Science Center

CALIFORNIA STATE SCIENCE FAIR
2001 PROJECT SUMMARY

Your Name (List all student names if multiple authors.)

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Project Title (Limit: 120 characters. Those beyond 120 will be ignored. See pg. 9)

Patterns in the Integrals of nth Order Monomials

Science Fair Use Only

S1107

Division

_ Junior (6-8) _X_ Senior (9-12)

Preferred Category (See page 5 for descriptions.)

11 - Mathematics & Software

Abstract (Include Objective, Methods, Results, Conclusion. See samples on page 14.)

Use no attachments. Only text inside these boxes will be used for category assignment or given to your judges.

Objective: This project endeavors to study changes in the values of the integral from 0 to a of cx^n , as one of the parameters a, c, or n, change as the other two remain fixed. That is, how will the integrals, from zero to some constant a, where a is a natural number, of the nth order monomial, cx^n, where c and n are also natural numbers, change, (I) as c increases from 1 to 10, with a and n fixed, (II) as n increases from 1 to 10, with c and a fixed, (III) as a increases from 1 to 10, with c and n fixed, and (IV) as both n and a change, with c fixed at 1?

Procedure: 1)We used the definite integral feature of TI-83 Plus to find a number of definite integrals. We observed how the values of the integrals changed as a, c, and n were changed and looked for a pattern. 2) Using Microsoft Excel and its formula features we were able to create the sub-cases presented here. After having Excel calculate the definite integrals, we used the TI-83 Plus again to confirm that the numbers attained were indeed the correct integrals for the given nth order monomials. 3) Using algebra and calculus we found what the general difference between two concurrent integrals was. The validity of the formulas was confirmed by plugging in values and comparing them to the numerical data that we attained from Excel and the TI 83 Plus.

Conclusion: As a result of this study it was determined that the concurrent values of the integrals do in fact exhibit patterns, though they may be hard to see. The formulas for these differences can be used to find other integrals in the family, without actually using integration techniques.

Summary Statement (In one sentence, state what your project is about.)

This is a study of the patterns that the integrals of nth order monomials reveal as several parameters are changed.

Help Received in Doing Project (e.g. Mother helped type report; Neighbor helped wire board; Used lab equipment at university X under the supervision of Dr. Y; Participant in NSF Young Scholars Program) See Display Regulation #8 on page 4.