2007-2008 OUTSTANDING SCHOLARLY ACHIEVEMENT AWARD

The Outstanding Scholarly Achievement Award is given each year to a Sacramento State faculty member who has, over many years, made significant contributions to a discipline through scholarly activity, creative/artistic endeavors, research and publication. The award is intended to recognize work accomplished at Sacramento State. Each year the Research and Creative Activity Subcommittee of the Faculty Senate solicits nominations and selects a faculty member to receive this award. This year's recipient Marcus M. Marsh, Professor of Mathematics, is the forty-sixth recipient of this award.

Dr. Marsh did his undergraduate work in Mathematics at Auburn University. His graduate work was done at the University of Houston. In 1976 he received a Master of Science in Mathematics degree and in 1981 he was awarded his PhD. His doctoral dissertation was entitled "Fixed Point Theorems for Certain Tree-Like Continua."

Marsh joined the Sacramento State faculty in 1981 and has been Professor of Mathematics since 1987. He has served as the department's Graduate Coordinator and from 19991-1994 was Chair of the department. In addition he served as the college's elected representative to the Faculty Senate's Research and Creative Activity subcommittee and, for five years, was a member of the Athletic Advisory Board.

Under a grant from the National Science Foundation, Marsh directed the 1991 Annual Spring Topology Conference. His interest is in continuum theory, a fundamental area of topology. The results of his work on fixed points apply to three different topological areas: fixed points in inverse limit spaces; cones and products of spaces with the fixed point property; and fixed points in geometric topology.

Marsh has fifteen papers published in the top peer-reviewed journals in his filed and is currently working on two additional papers; *K-to-1 Mappings on Manifolds, Relation to Degree, and Fixed Points* and *Span Zero Mappings and Factoring through Arcs*. In addition, he has made two dozen presentations at professional conferences or colloquium series.

In nominating him for this award, Dr. Charles Hagopian noted:

> The impact of Marsh's research is clear. Other mathematicians continue to use concepts and techniques he developed and many of his theorems generalize classical results that have been applied by generations of mathematicians. The immediate impact of Marsh's research is best gauged by the usefulness of and interest in his results … His national and

international reputation is evidenced by invitations to speak about his research at national and international meetings.

GENERALIZATIONS OF THE BROUWER FIXED POINT THEOREM

Marcus March, Professor
Mathematics & Statistics

Although almost 100 years old, new uses of L.E.J. Brouwer's fixed point theorem are still being discovered. His theorem is of interest and utility to mathematicians, physical scientists, and social scientists alike. In this presentation, I will discuss Brouwer's theorem and my two generalizations of his result. We will begin with some basic examples of spaces with and without the fixed point property and proceed to more complicated abstract examples. All examples will be discussed from a visual perspective.

A transformation f on a space X has a fixed point if f leaves some point x fixed. That is, for some x in X, $f(x)=x$. A space X has the fixed point property if every continuous transformation on X has a fixed point. Brouwer's theorem states that each n-dimensional "cube" has the fixed point property. A 1-dimensional cube is the interval $[0,1]$ on the number line. A 2-dimensional cube is a square plus its interior. A 3-dimensional cube is a box plus its interior. For $n > 3$, an n-dimensional cube is harder to visualize, but is, nonetheless, a higher dimensional version of the 3-cube. The n-dimensional version of Brouwer's theorem was first proved in 1910. In applications, fixed point results are primarily used to establish existence theorems. A few examples of existence theorems that follow from Brouwer's result are

- existence of solutions of ordinary differential equations
- existence of Nash equilibria in economics
- existence of equilibria in game theory
- existence of best approximations in optimization theory