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Introduction

The Calculator Controlled Robots activities are designed to engage students in hands-on inquiry-based missions. These activities address National science and technology standards, as well as specifically focusing on mathematics content and process standards. There are ten missions and three exploration extensions that provide activities for up to one semester.

These activities are geared towards using a graphing calculator with a Norland Research calculator robot. Best results for student engagement have been obtained with each student having her/his own CalcBot (calculator + robot) to use in class. The curriculum is suited for mathematics, science, technology, or after-school classes.

Students create programs in TI-BASIC (*http://en.wikipedia.org/wiki/TI-BASIC*) to run their robots. Missions are sequentially built upon the knowledge of previous activities. Step-by-step programming instructions are provided in the first missions, gradually leading students to create their own programs in later missions. Students use and apply mathematics and science concepts to direct their robots through a variety of challenges.

In addition to the detailed activities, teachers are given opportunities to draw on their students' hands-on experience to reach a deeper understanding of mathematical concepts. Several open-ended questions and extension activities are included to encourage potential scientists, engineers, mathematicians, and computer programmers to explore their fields.

Missions

Each mission starts with a brief introduction, materials list, and an illustration of a robot challenge. Student programming instructions are at the end of the activities. "Teacher Notes" are located at the end of the booklet (pg 58). These notes should be removed from students' activities before duplicating them for students. Using a different color of paper for each mission is helpful for distinguishing one assignment from another.

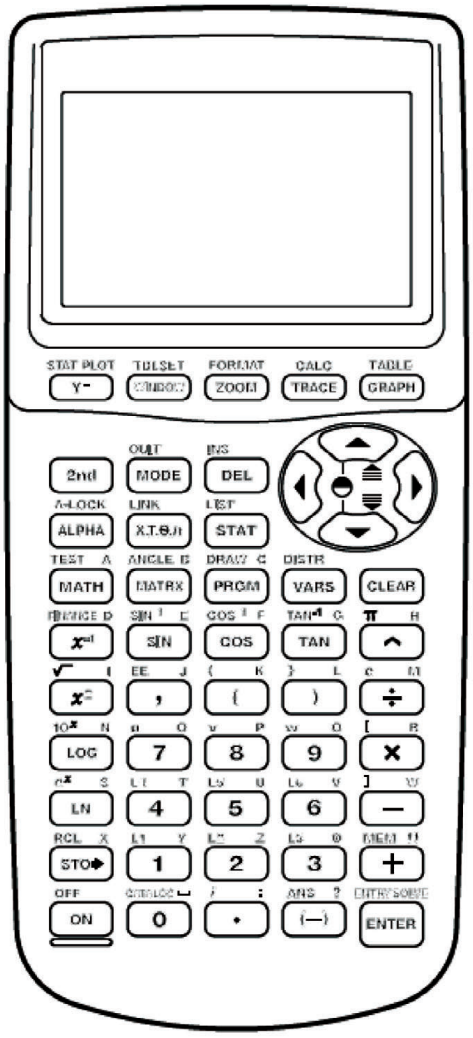
Preface and Credits

This manual was created using the Texas Instruments TI-83 graphing calculator as a model, and can be directly applied to the following TI models: TI-73, TI-82, TI-83, TI-83Plus, TI-83Plus Silver Edition, TI-84Plus, TI-84Plus Silver Edition, TI-85(CBL model), TI-86, TI-89, TI-89 Titanium, TI-92, TI-92 Plus, and Voyage 200 (will not mount on base).

PLEASE NOTE that the basic concepts and instructions in this manual can be applied with modification to any standard graphing calculator and hardware. Users are responsible for determining and implementing these modifications.

The Calculator-Controlled Robot curriculum was developed with support from Texas Instruments Incorporated, Norland Research, Lake County School District #7 in Oregon, and the National Aeronautics and Space Administration (NASA) Office of Education. The curriculum was classroom field-tested for four years at Daly Middle School in Lakeview, Oregon and further developed during at NASA Headquarters in Washington, DC. The activities are designed to lead students to discover mathematical concepts through robotics, programming, and science challenges. Mathematics content and process standards are embedded throughout the curriculum. In many activities math is used as a practical tool for understanding science.

Calculator-Controlled Robots was written by Tyson Tuchscherer. Illustrations in *Calculator-Controlled Robots* were created by Todd Tuchscherer. For their encouragement and support, the author would like to extend a special THANK YOU to: Judy Graham, Superintendent, Lake County School District #7 Will Cahill, Principal, Daly Middle School, Peg Steffen, Former Program Manager, NASA Explorer Schools.



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About the Author

Tyson Tuchscherer has taught mathematics and science at both middle and high school levels for over 18 years, including three years in Australia. As a teacher, he coached MATHCOUNTS and mentored students entering international science and engineering fairs. He has provided math problems for state mathematics assessments and for the MATHCOUNTS National School Handbook. As a tier-one candidate for NASA's Educator Astronaut Program, Tyson was invited to become a select member of the Network of Educator Astronaut Teachers. In 2005, he was honored with an Albert Einstein Distinguished Educator Fellowship and selected by NASA to work with the NASA Explorer Schools Program as a math specialist. Tyson is married and has three children. He is currently a Research Fellow at LMI Government Consulting working on science, technology, engineering and mathematics (STEM) education and workforce development for the Director of the National Defense Education Program.