

Graphing Calculator Instruction Guide

for

Calculus Concepts: An Informal Approach to the Mathematics of Change

HOW TO USE THIS GUIDE

Use the following table to locate the part of this *Guide* in which your calculator model is discussed:

Part	Calculator Model
C	Hewlett Packard HP48G/GX Graphing Calculators

The section references in the following detailed table of contents should be read as follows:

Section $x.y.z$ of this *Guide* refers to discussion in Chapter x , Section y of the *Calculus Concepts* text. The discussion is the z th topic in the *Guide* that refers to that particular chapter and section.

For example, the detailed contents indicate that there are 3 different sections in the *Guide* (1.2.1 through 1.2.3) pertaining to Section 1.2 of *Calculus Concepts*. The discussion in Section 1.2.2 of this *Guide* is the second technology discussion pertaining to Chapter 1, Section 1.2 of your text.

CONTENTS

PART C

SETUP	Page	C-1
--------------------	-------------	------------

BASIC OPERATION

1. Calculating	C-2
2. Using the ANS Memory	C-3
3. Answer Display	C-3
4. Storing Values	C-4
5. Error Messages	C-4

CHAPTER

1 THE INGREDIENTS OF CHANGE: FUNCTIONS AND LINEAR MODELS

1.1.1 Entering an Equation to be Graphed	C-5
1.1.2 Drawing a Graph	C-5
1.1.3 Manually Changing the View of a Graph	C-6
1.1.4 Automatically Changing the View of a Graph	C-6
1.1.5 Tracing	C-7
1.1.6 Estimating Outputs	C-7
1.1.7 Evaluating Outputs	C-8
1.2.1 Determining Outputs	C-8
1.2.2 Solving for Input Values	C-9
1.2.3 Graphically Finding Intercepts	C-11
1.3.1 Graphing Piecewise Continuous Functions	C-12
1.4.1 Entering Data	C-13
1.4.2 Editing Data	C-15
1.4.3 Deleting Old Data	C-15
1.4.4 Aligning Data	C-15
1.4.5 Plotting Data	C-16
1.4.6 Finding First Differences	C-16
1.4.7 Finding a Linear Model	C-17
1.4.8 Pasting a Model into the Function List	C-17
1.4.9 Graphing a Model	C-18
1.4.10 Predictions Using a Model	C-18
1.4.11 Copying Graphs to Paper	C-18
1.4.12 What is "Best Fit?"	C-19
1.4.13 Naming Data Lists on the TI-83, 85, 86 (optional)	C-19

2 INGREDIENTS OF CHANGE: NON-LINEAR MODELS

2.1.1 Entering Evenly-Spaced Input Values	C-21
2.1.2 Finding Percentage Change	C-21
2.1.3 Finding an Exponential Model	C-22
2.1.4 Finding a Logistic Model	C-23
2.1.5 Recalling Model Parameters	C-24
2.1.6 Random Numbers	C-25
2.2.2 Finding Future Value	C-25
2.2.3 Finding Present Value	C-26
2.3.1 Finding Second Differences	C-27
2.3.2 Finding a Quadratic Model	C-27
2.3.3 Finding a Cubic Model	C-28

3	DESCRIBING CHANGE: RATES	
3.1.1	Finding Average Rates of Change	C-29
3.3.2	Magnifying a Portion of a Graph	C-30
3.3.3	Drawing a Tangent Line	C-31
3.5.1	Calculating Percentage Change	C-33
3.5.2	Calculating Percentage Rate of Change	C-34
4	DETERMINING CHANGE: DERIVATIVES	
4.1.1	Numerically Investigating Slopes on the Home Screen	C-35
4.3.1	Derivative Notation and Calculator Notation	C-36
4.3.2	Drawing Tangent Lines From the Graphics Screen	C-38
4.3.3	Calculating dy/dx From the Graphics Screen	C-38
4.4.1	Numerically Checking Slope Formulas	C-39
4.4.2	Graphically Checking Slope Formulas	C-40
4.4.3	Symbolically Finding Slope Formulas	C-41
5	ANALYZING CHANGE: EXTREMA AND POINTS OF INFLECTION	
5.1.1	Finding x -Intercepts of Slope Graphs	C-43
5.1.2	Finding Optimal Points	C-44
5.2.1	Finding x -Intercepts of a Second Derivative Graph	C-46
5.2.2	Finding Inflection Points With Your Calculator	C-47
6	ACCUMULATING CHANGE: LIMITS OF SUMS AND THE DEFINITE INTEGRAL	
6.1.1	Approximations With Left Rectangles	C-49
6.1.2	Approximations With Right Rectangles	C-51
6.2.1	Simplifying Area Approximations	C-54
6.3.1	Limits of Sums	C-56
6.5.1	The Fundamental Theorem of Calculus	C-57
6.5.2	Drawing Antiderivative Graphs	C-58
6.6.1	Evaluating a Definite Integral Using Symbolic Mode	C-59
6.6.2	Evaluating a Definite Integral From the Graphics Screen	C-60
7	ANALYZING ACCUMULATED CHANGE: MORE APPLICATIONS OF INTEGRALS	
7.1.1	Finding the Area Between Two Curves	C-62
7.3.1	Future Value of a Discrete Income Stream	C-64
7.4.1	Consumers' Surplus	C-65
7.4.2	Producers' Surplus	C-66
7.5.1	Average Value of a Function	C-67
7.5.2	Geometric Interpretation of Average Value	C-68

9 INGREDIENTS OF MULTIVARIABLE CHANGE: MODELS, RATES, GRAPHS

9.1.1 Finding Cross-Sectional Models (holding the first input variable constant) C-75

9.1.2 Finding Cross-Sectional Models (holding the second input variable constant) C-76

9.1.3 Evaluating Outputs of Multivariable Functions C-76

9.2.1 Sketching Contour Curves C-78

9.3.1 Numerically Checking Partial Derivative Formulas C-79

9.3.2 Symbolically Checking Partial Derivative Formulas C-81

9.3.3 Visualizing and Estimating Partial Rates of Change C-82

9.3.4 Finding Partial Rates of Change Using Cross-Sectional Models .. C-83

9.4.1 Evaluating Partial Derivatives of Multivariable Functions C-84

9.4.2 Compensating for Change C-85

10 ANALYZING MULTIVARIABLE CHANGE: OPTIMIZATION

10.2.1 Finding Critical Points C-87

10.2.2 The Determinant Test C-88

10.3.1 Classifying Optimal Points Under Constrained Optimization .. C-90

APPENDIX C-93