

CHAPTER 1 INTRODUCTION TO PROGRAMMING

1.1	The Basic Program Structure	1-1
1.2	Example # 1 (Function Evaluation) -- Adding Controls	1-2
1.3	Entering Code in Example # 1	1-4
	Security Issues ; Opening Files Created on Other Computers	1-7
1.4	Examining the Program Components	1-9
	1.4.1 Declaration of Variables & Constants	1-9
	1.4.2 Initializing & Setting Variable Values	1-11
	1.4.3 Read & Write Statements	1-11
	1.4.4 Calculation Statements & Operator Precedence	1-13
	1.4.5 Program Flow Control Statement	1-13
1.5	Example # 2 a) Temperature Converter.	1-14
	Example # 2 b) : Temperature Converter (MsgBox/ InputBox version)	1-15
1.6	If Statements	1-18
	1.6.1 Single Outcome If Statements	1-18
	1.6.2 Double Outcome If Statements	1-19
	1.6.3 Nested If Statements	1-21
	Example # 3 : Retail Store --- Double Outcome If Statement	1-22
1.7	Writing Your Own Code	1-23
1.8	Miscellaneous Tips & Difficulties	1-27
	Problems	1-28 to 30

CHAPTER 2 VECTOR ADDITION, INTRODUCTION TO LOOPS, MESSAGE BOX FUNCTIONS

2.1	The Message Box and Message Box Function	2-1
	2.1.1 Message Box Syntax	2-1
	Visual Basic Constants (vbconstants)	2-1
	2.1.2 Message Box Function Syntax	2-3
	Message Box Constants	2-4
	Example # 1 : Temperature Converter (If statement & ...	2-5
2.2	Vector Addition: Background Theory	2-7
	Example # 2 : Rectangular to Polar Conversion	2-8
	Application # 1a) Component Addition of Up to 6 Vectors	2-11
2.3	Using Loops to Reduce the Volume of Code	2-14
	Moving Read and Moving Write Statements	2-15
	Example # 3 : Moving Write / Simple Loop Using If Statement	2-16
	Example # 4 : Moving Read & Write Statements	2-16
	Example # 5 : Adding Colour to a Cell Programmatically	2-17
	Example # 6 : Evaluating an X(t) Function	2-18
	Break Points and the Watch Window	2-19
	Application # 1 b) : Component Addition of Up to 6 Vectors (using Loops)	2-20
2.4	The 1 st Condition of Equilibrium (Translational Equilibrium)	
	(Newton's 1 st & 2 nd Laws Describe Change)	2-22
	Application #2 : Equilibrium Problems With Two Unknown Magnitudes	2-25
	Rounding Errors	2-27
	Problems	2-28-29

CHAPTER 3 LOOPS & RUNNING TOTALS*****Web Site Chapter 3a)**

3.1	Built-in Loops	3-1
	<i>Example # 1 : Mark addition and averaging</i>	3-2
	<i>Example # 2 : Random number generation in a variable loop</i>	3-3
	<i>Example # 3 : Counter</i>	3-4
	<i>Example # 4 : Function Evaluation & Graph Plotting</i>	3-6
3.2	Using a Delay Loop to Slow Down the Speed of Program Execution	3-7
	3.2.1 Stand-Alone Subroutines	3-7
	3.2.2 Delay Loops	3-8
	3.2.3 The Scroll Bar Control	3-9
	<i>Example # 5 : Adding a TimeDelay Loop</i>	3-10
3.3	Nested Loops & Custom Functions	3-9
	<i>Example # 6 : Evaluating a Function of 2 Variables Using Two Nested Loops</i>	3-12
	<i>Example # 7 : Surface Plots</i>	3-13
3.4	Searches	3-14
	<i>Example # 8 : Searching for a Maximum Value</i>	3-14
	3.4.1 Searches for Maximum, Minimum, and Closest Values	3-15
	3.4.2 Radar Searches	3-16
	3.4.3 Polar Searches	3-16
***Web Site Chapter 3b)		
3.5	The DoEvents Loop : Interacting With the Program as it Runs	3-17
	<i>Example # 9 : Random Colour Generator</i>	3-18
	<i>Application # 3 : Two Variable Search for Optimum Angles in a Hanging Weight Lab</i>	3-20
	Problems	3-24 to 33
	Equipotential Lines	3-28
	Planar Refraction	3-32
	Random Number Generator Function Description	3-34

CHAPTER 4 ARRAYS & MATRICES (* Work in Progress***)**

	<i>Application # xx : Component Addition of Up to 6 Vectors (using Arrays & Loops)</i>	4-1
	<i>Exercise # xx : Filling a Triangular Array Using Loops</i>	4-4
	<i>Exercise # xx : Rectangular Array & Loops (Part 1)</i>	4-5
	<i>Exercise # xx : Rectangular Array & Loops (Part 2)</i>	4-6
	<i>Application # xx : Polygon Method of Vector Addition</i>	4-7

CHAPTER # 5 GRAPHS

5.1	<i>Application # 4 a) Animated Graphs $Y = f(X)$</i>	5-1
5.2	<i>Application # 4 b) Adding Graphs Programmatically</i>	5-3
5.3	<i>Application # 4 c) Comet Tail Graphs :</i>	5-5
5.4	Plotting Trajectories	5-7
	<i>Application # 5 2-D Projectile Motion Under Constant Acceleration</i>	5-7
5.5	<i>Application # 6 “Brute Force” Curve Fitting</i>	5-11
5.6	<i>Application # 7 a) Plotting Functions of Two Variables</i>	5-14
	<i>Application # 7 b) Plotting Functions of Two Variables (Without Using a VBA Program)</i>	5-17
	Problems	5-18

CHAPTER # 6 INCREMENTAL ITERATION APPLIED TO TRAJECTORIES*****Web Site Chapter 6a)**

6.1	Incremental Iteration	6-1
6.2	Incremental Iterative Analysis of Trajectories	6-2
6.3	Incremental Iteration Applied to 1-D Situations	6-5
	<i>Application # 8 : Horizontal Motion of Rocket Car with Drag</i>	6-5
	<i>Application # 9 : Projectile Launched Vertically Upward with Drag</i>	6-7
	Programming the Reversal of Force Directions	6-7
	Air Resistance	6-7
	<i>Application # 10 : Block Bouncing Off Spring on Horizontal Surface with Friction & Drag</i>	6-9
	<i>Application # 11 : Oscillatory motion of a block bouncing off spring at bottom of incline with friction and drag.</i>	6-11
	Input/Output Bound	6-13
	Displaying Motion on an Incline	6-13
	<i>Application # 12 : Vertical rocket with drag, constant mass & thrust during engine burn</i>	6-14
	Complete Sets of Data	6-16
	File Size Warning (the .Clear method)	6-16
	Variable Thrust Rockets	6-17
	Variable Mass Rockets	6-18
	Determining Fuel Burn Rate, k	6-19
	Specifying Forces as Functions of Time and Position	6-19
6.4	Making the programs Interactive	6-20
	6.4.1 The Pause Button Approach	6-20
	<i>Application # 13 : 2-D Projectile Motion Simulation</i>	6-22
	6.4.2 The On-the-Fly Approach	6-24
	<i>Application # 14 : Interactive Rocket Car with Variable Thrust</i>	6-24
	<i>Application # 15 : Ball-In-A-Box (Combination Pause & On-the-Fly Changes)</i>	6-27
6.5	Hidden Loops	6-30
	<i>Application # 16 : Damped Oscillatory Motion of Mass Attached to Spring (with Friction, and Applied Force)</i>	6-31
	Programming to Obtain the Maximum Extension of the Spring	6-33
	Interpreting Negative Signs in Physics	6-33
	<i>Application # 17 : Simple Harmonic Motion of a Mass Hanging Vertically from a Spring</i>	6-34
6.6	Implicitly Defined Boundary Conditions	6-37
6.7	Maximum, Minimum, and Closest Value Searches Revisited Problems	6-38
		6-40 to 46

CHAPTER # 7 2-D DYNAMICS: INCREMENTAL ITERATION
APPLIED TO MORE COMPLEX TRAJECTORIES

7.1	General Components of 2-D Central Forces (Gravitational Force)	7-2
	Method 1 : Calculating components using the side length ratio definitions of sine & cosine	7-2
	Method 2 : Finding the components by determining the angle and using trig functions	7-5
	Components of the Coulombic Force	7-5
7.2	Motion of Charges and Masses in the Presence of Other Charges and Masses	7-6
	7.2.1 <i>Application # 18</i> : Orbiting Satellite	7-6
	7.2.2 General Components of Coulombic Forces	7-9
	<i>Application # 19</i> : A Moving Charge Collides with a Stationary Charge	7-10
7.3	“Contact” Collisions versus “Field” Collisions	7-13
7.4	Iterative Analysis of Circular Motion Problems	7-14
	7.4.1 <i>Application # 20</i> : Block Sliding in a Frictionless Bowl	7-14
	7.4.2 General Expressions for objects Moving on the Inside and Outside of Circular tracks	7-18
7.5	The Virtual Space Craft	7-20
	<i>Application # 21</i> : The Virtual Spaceship	7-22
	Problems	7-26 to 32

CHAPTER # 8 ITERATIVE TECHNIQUES APPLIED
TO NUMERICAL INTEGRATION

8.1	Numerical Integration	8-1
	<i>Example # 1</i> : Numerical Integration	8-2
	<i>Example # 2</i> : Convergence of Numerical Integrals	8-3
8.2	Incremental Iterative Approximations of the Electric and Gravitational Fields	8-6
	<i>Application # 22 a</i>) : Chop & Sum Calculation of Moment of Inertia	8-6
	<i>Application # 22 b</i>) : Chop & Sum Calculation of Moment of Inertia (About Off Axis Point)	8-8
	Problems	8-10

CHAPTER 9 DEBUGGING & ERROR MESSAGES

9.1	Setting Breakpoints in the Code	9-1
9.2	Using Debug.Print Statements to Write Out Variable Values	9-2
9.3	Dye Tracing --Using Debug.Print Statements to Trace Program Execution	9-3
	Note : Also refer to the Watch Window discussion Section 2.4.2 page 2-11	
9.4	Common Error Messages	9-4
	Index of Error messages	9-10

APPENDICES

Appendix 1	Haikus	A-1
Appendix 2	Docking & Restoring the Windows	A-2
Appendix 3	Events	A-2
Appendix 4	Variable Prefixes	A-3
Appendix 5	Control Prefixes	A-3
Appendix 6	Data Types	A-4
Appendix 7	Calculation Statements	A-5
Appendix 8	Implicit Declaration	A-6
Appendix 9	Explicit Declaration Using the Option Explicit Statement	A-6
Appendix 10	Public Versus Private Variables, Constants, Functions and ...	A-7
Appendix 11	Message Box Constants	A-8
Appendix 12	Comparison Operators	A-9
Appendix 13	Truth Tables for Logic Operators	A-10
Appendix 14	Looping Statements : <i>Do ...Until / While</i> Loops	A-11
Appendix 15	<i>For ...Next</i> Loops	A-12
Appendix 16	Custom Functions (User Defined Functions)	A-13
Appendix 17	Built-in & Derived Functions	A-14
Appendix 18	The Rnd() Function (with the Randomize command)	A-15
Appendix 19	Legal Plagiarism Using the Macro Recorder	A-15
Appendix 20	“With...End With” Statements	A-17
Appendix 21	Methods of Selecting More Than 1 Cell	A-18
Appendix 22	Referencing non-contiguous data columns	A-18
Appendix 23	Select Case Statement	A-18
Appendix 24	Automatic Numbering of Pages That Includes Chapter Numbers	A-20
Appendix 25	Adding Diagrams on the Worksheet	A-21
Appendix 26	Using an Array to Avoid Dumping the Data Back on the Worksheet	A-21
Appendix 27	Using arrays to store the data sets	A-22
Appendix 28	Math Functions & Derived Math Functions	A-22
Appendix 29	Adding Series to Graphs & Setting Data Source Locations	A-24