Table of Contents

1 THE COORDINATE PLANE 1

1.1 Introduction 1
1.2 The Coordinate Line 1
1.3 Order and Absolute Value 2
1.4 Coordinates in the Plane 7
1.5 Analytic Geometry 8
1.6 Summary 15

2 FUNCTIONS AND THEIR GRAPHS 19

2.1 The Function Concept 19
2.2 More on Functions 27
2.3 Constructing New Functions 30
2.4 Graphs of Functions 32
2.5 Inverse of a Function 40
2.6 Periodic Functions 45
2.7 Even and Odd Functions 49
2.8 Summary 50

3 THE CIRCULAR FUNCTIONS 55

3.1 The Coordinate Function 55
3.2 The Circular Functions 59
3.3 Properties of the Sine and Cosine Functions 64
3.4 The Other Circular Functions 73
3.5 Tables of Functional Values 80
3.6 Line Values 82
3.7 Summary 84

4 EQUALITIES IN THE CIRCULAR FUNCTIONS 88

4.1 Equivalence 88
4.2 Equalities 89
4.3 Identities in the Circular Functions 90
4.4 Equations in the Circular Functions 96
4.5 Summary 103

5 GRAPHS AND PERIODICITY 108

5.1 Introduction 108
5.2 Graph of the Sine Function 108
5.3 Sinusoidal Curves 111
5.4 Graphs of the Other Circular Functions 116
5.5 Graphs by Composition of Ordinates 120
5.6 Applications 122
5.7 Summary 128

6 THE INVERSE CIRCULAR FUNCTIONS AND THEIR GRAPHS 131

6.1 Introduction 131
6.2 The Inverse Sine Function 131
6.3 The Other Inverse Circular Functions 136
6.4 Uses of Inverse Circular Functions 139
6.5 Summary 144

7 CIRCULAR FUNCTIONS OF COMPOSITE ARGUMENTS 147

7.1 Introduction 147
7.2 The Sum and Difference Identities 147
7.3 Other Identities 153
7.4 More on Simple Harmonic Motion 161
7.5 Summary 162

8 TRIGONOMETRIC FUNCTIONS OF ANGLES 167

8.1 Introduction 167
8.2 Directed Angles and Measure of Angles 167
8.3 Trigonometric Functions of Angles 173
8.4 Trigonometric Ratios 177
8.5 The General Triangle 182
8.6 Summary 185

9 NUMERICAL TRIGONOMETRY 192

9.1 Introduction 192
9.2 Solving Right Triangles 193
9.3 Applications of Right Triangle Trigonometry 196
9.4 Solving Oblique Triangles 199
9.5 More Applications 209
9.6 Other Methods 212
9.7 Vectors 214
9.8 Addition of Vectors 216
9.9 Summary 221

10 POLAR COORDINATES AND COMPLEX NUMBERS 225

10.1 Introduction 225
10.2 Polar Coordinates 225
10.3 Relationships Between Polar and Cartesian Coordinates 228
10.4 Complex Numbers 231
10.5 Complex Numbers in Standard Form 235
10.6 Geometric Representation 238
10.7 Polar Representation of Complex Numbers 241
10.8 Multiplication and Division Using the Polar Form 245
10.9 De Moivre's Theorem 247
10.10 Roots of Complex Numbers 250
10.11 Roots of Unity 254
10.12 Summary 257

APPENDIX 263

Table 1: The Greek Alphabet 264
Table 2: Circular Functions of Real Numbers 265
Table 3: Trigonometric Functions of Angles 267

SELECTED ANSWERS 273

INDEX 293