

CONTENTS

Preface	xi
Chapter 0 Historical Strands of Geometry	1
Art/Pattern Strand	2
Building Structures Strand	7
Navigation/Stargazing Strand	9
Motion/Machines Strand	14
Chapter 1 What is Straight?	21
History: How Can We Draw a Straight Line?	22
Problem 1.1 When Do You Call a Line Straight?	26
The Symmetries of a Line	29
Local (and Infinitesimal) Straightness	33
Chapter 2 Straightness on Sphere	35
Early History of Spherical Geometry	35
Problem 2.1 What is Straight on a Sphere?	38
Symmetries of Great Circles	41
Every Geodesic is a Great Circle	43
Intrinsic Curvature	44
Chapter 3 What is an Angle?	46
Problem 3.1 What is an Angle?	46
Problem 3.2 Vertical Angle Theorem (VAT)	48
Hints for Three Different Proofs	49
Chapter 4 Straightness on Cylinders and Cones	51
Problem 4.1 Straightness on Cylinders and Cones	52
Cones with Varying Cone Angles	53
Geodesics on Cylinders	56
Geodesics on Cones	57
Problem 4.2 Global Properties of Geodesics	58
n -Sheeted Coverings of a Cylinder	58
n -Sheeted (Branched) Coverings of a Cone	60
Locally Isometric	62
Is "Shortest" Always "Straight"?	62
Relations to Differential Geometry	63