

Contents

| | | |
|----------|---|----------|
| | <i>Preface</i> | page vii |
| | <i>Notation</i> | xi |
| 1 | Euclidean geometry | 1 |
| | 1.1 The axiomatic approach | 1 |
| | 1.2 The Cartesian model | 13 |
| 2 | Curve theory | 22 |
| | 2.1 Curves in \mathbb{R}^n | 22 |
| | 2.2 Plane curves | 34 |
| | 2.3 Space curves | 57 |
| 3 | Classical surface theory | 81 |
| | 3.1 Regular surfaces | 81 |
| | 3.2 The tangent plane | 93 |
| | 3.3 The first fundamental form | 98 |
| | 3.4 Normal fields and orientability | 103 |
| | 3.5 The second fundamental form | 106 |
| | 3.6 Curvature | 110 |
| | 3.7 Surface area and integration on surfaces | 126 |
| | 3.8 Some classes of surfaces | 132 |
| 4 | The inner geometry of surfaces | 149 |
| | 4.1 Isometries | 149 |
| | 4.2 Vector fields and the covariant derivative | 152 |
| | 4.3 Riemann curvature tensor and <i>Theorema Egregium</i> | 160 |
| | 4.4 Riemannian metrics | 168 |
| | 4.5 Geodesics | 171 |
| | 4.6 The exponential map | 183 |
| | 4.7 Parallel transport | 192 |
| | 4.8 Jacobi fields | 196 |

| | | |
|----------|---|------------|
| vi | CONTENTS | |
| | 4.9 Spherical and hyperbolic geometry | 201 |
| | 4.10 Cartography | 210 |
| | 4.11 Further models of hyperbolic geometry | 217 |
| 5 | Geometry and analysis | 223 |
| | 5.1 The divergence theorem | 223 |
| | 5.2 Variation of the metric | 233 |
| 6 | Geometry and topology | 239 |
| | 6.1 Polyhedra | 239 |
| | 6.2 Triangulations | 242 |
| | 6.3 The Gauss–Bonnet theorem | 259 |
| | 6.4 Outlook | 262 |
| | Appendix A Hints for solutions to (most) exercises | 266 |
| | Appendix B Formulary | 305 |
| | Appendix C List of symbols | 309 |
| | <i>References</i> | 311 |
| | <i>Index</i> | 313 |

The plates are to be found between pages 148 and 149