

# Contents

<b>Foreword</b>	<b>xi</b>
<b>Preface</b>	<b>xiii</b>
<b>1 Dimensions</b>	<b>1</b>
1.1 Economics: The power of multinational corporations	1
1.2 Newtonian mechanics: Free fall	3
1.3 Guessing integrals	7
1.4 <i>Summary and further problems</i>	11
<b>2 Easy cases</b>	<b>13</b>
2.1 Gaussian integral revisited	13
2.2 Plane geometry: The area of an ellipse	16
2.3 Solid geometry: The volume of a truncated pyramid	17
2.4 Fluid mechanics: Drag	21
2.5 <i>Summary and further problems</i>	29
<b>3 Lumping</b>	<b>31</b>
3.1 Estimating populations: How many babies?	32
3.2 Estimating integrals	33
3.3 Estimating derivatives	37
3.4 Analyzing differential equations: The spring–mass system	42
3.5 Predicting the period of a pendulum	46
3.6 <i>Summary and further problems</i>	54
<b>4 Pictorial proofs</b>	<b>57</b>
4.1 Adding odd numbers	58
4.2 Arithmetic and geometric means	60
4.3 Approximating the logarithm	66
4.4 Bisecting a triangle	70
4.5 Summing series	73
4.6 <i>Summary and further problems</i>	75

<b>5</b>	<b>Taking out the big part</b>	<b>77</b>
5.1	Multiplication using one and few	77
5.2	Fractional changes and low-entropy expressions	79
5.3	Fractional changes with general exponents	84
5.4	Successive approximation: How deep is the well?	91
5.5	Daunting trigonometric integral	94
5.6	<i>Summary and further problems</i>	97
<b>6</b>	<b>Analogy</b>	<b>99</b>
6.1	Spatial trigonometry: The bond angle in methane	99
6.2	Topology: How many regions?	103
6.3	Operators: Euler–MacLaurin summation	107
6.4	Tangent roots: A daunting transcendental sum	113
6.5	<i>Bon voyage</i>	121
	<b>Bibliography</b>	<b>123</b>
	<b>Index</b>	<b>127</b>