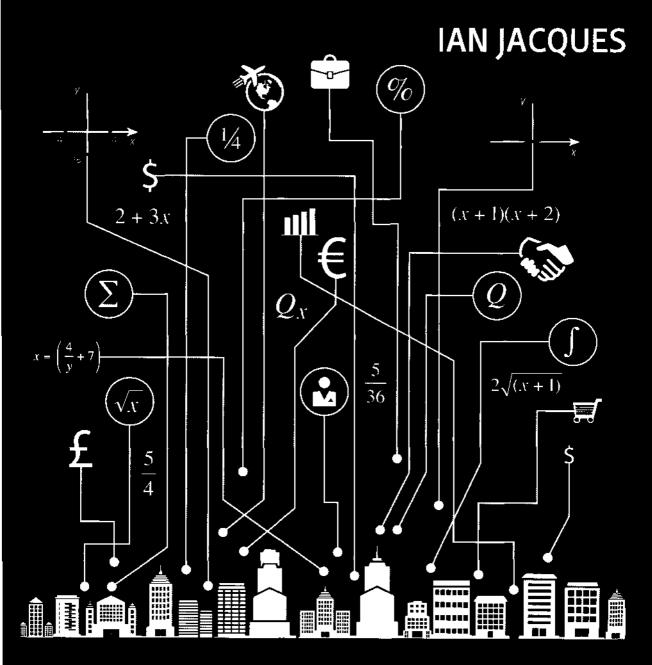
## MATHEMATICS



**PEARSON** 

|           | Preface   | хi         |
|-----------|---|------------|
| INTRODUCT | ION: Getting Started                                    | 1          |
|           | Notes for students: how to use this book                | 1          |
| CUARTER 4 | Lineau Parationa  | 5          |
| CHAPTER 1 | Linear Equations  |            |
|           | 1.1 Introduction to algebra                             | 6          |
|           | 1.1.1 Negative numbers                                  | 7          |
|           | 1.1.2 Expressions                                       | 9          |
|           | 1.1.3 Brackets  | 12         |
|           | Key Terms   | 17<br>18   |
|           | Exercise 1.1 Exercise 1.1*                              | 20         |
|           |   |            |
|           | 1.2 Further algebra                                     | 22<br>22   |
|           | 1.2.1 Fractions 1.2.2 Equations                         | 29         |
|           | 1.2.3 Inequalities                                      | 33         |
|           | Key Terms   | 36         |
|           | Exercise 1.2  | 36         |
|           | Exercise 1.2*   | 38         |
|           | 1.3 Graphs of linear equations                          | 40         |
|           | Key Terms   | 51         |
|           | Exercise 1.3  | 52         |
|           | Exercise 1.3*   | 53         |
|           | 1.4 Algebraic solution of simultaneous linear equations | 55         |
|           | Key Term  | 65         |
|           | Exercise 1.4  | 65         |
|           | Exercise 1.4*   | 66         |
|           | 1.5 Supply and demand analysis                          | 67         |
|           | Key Terms   | 80         |
|           | Exercise 1.5  | 80         |
|           | Exercise 1.5*   | 82         |
|           | 1.6 Transposition of formulae                           | 84         |
|           | Key Terms   | 91         |
|           | Exercise 1.6 Exercise 1.6*                              | 91<br>92   |
|           |   |            |
|           | 1.7 National income determination                       | 93         |
|           | Key Terms Exercise 1.7                                  | 105<br>105 |
|           | Exercise 1.7*   | 105        |
|           |   |            |
|           | Formal mathematics                                      | 109        |

|           |  | CONTENTS vii                                  |
|-----------|--|---|
| CHAPTER 2 | Non-linear Equations   | 113   |
|           | 2.1 Quadratic functions  Key Terms  Exercise 2.1  Exercise 2.1*  | 114<br>128<br>129<br>130                      |
|           | 2.2 Revenue, cost and profit Key Terms Exercise 2.2 Exercise 2.2*  | 132<br>140<br>140<br>142                      |
|           | 2.3 Indices and logarithms 2.3.1 Index notation 2.3.2 Rules of indices 2.3.3 Logarithms 2.3.4 Summary Key Terms Exercise 2.3 Exercise 2.3* | 143<br>143<br>147<br>153<br>159<br>160<br>160 |
|           | 2.4 The exponential and natural logarithm functions  Key Terms  Exercise 2.4  Exercise 2.4*  | 164<br>174<br>174<br>175                      |
|           | Formal mathematics   | 178   |
| CHAPTER 3 | Mathematics of Finance   | 183   |
|           | 3.1 Percentages 3.1.1 Index numbers 3.1.2 Inflation Key Terms Exercise 3.1 Exercise 3.1*   | 184<br>190<br>194<br>196<br>196               |
|           | 3.2 Compound interest  Key Terms  Exercise 3.2  Exercise 3.2*  | 202<br>212<br>212<br>214                      |
|           | 3.3 Geometric series Key Terms Exercise 3.3 Exercise 3.3*  | 216<br>224<br>225                             |
|           | 3.4 Investment appraisal Key Terms Exercise 3.4 Exercise 3.4*  | 227<br>239<br>239<br>241                      |
|           | Formal mathematics   | 243   |
| CHAPTER 4 | Differentiation  | 247   |
|           | 4.1 The derivative of a function  Key Terms  Exercise 4.1  Exercise 4.1*   | 248<br>257<br>257<br>258                      |

4.2 Rules of differentiation

|           |      | Rule 1 The constant rule  | 259         |
|-----------|------|---|-------------|
|           |      | Rule 2 The sum rule   | 260         |
|           |      | Rule 3 The difference rule  | 261         |
|           |      | Key Terms   | <b>2</b> 66 |
|           |      | Exercise 4.2  | 266         |
|           |      | Exercise 4.2*   | 268         |
|           | 4.3  | Marginal functions  | 270         |
|           |      | 4.3.1 Revenue and cost  | 270         |
|           |      | 4.3.2 Production  | 277         |
|           |      | 4.3.3 Consumption and savings                                     | 279         |
|           |      | Key Terms   | 281         |
|           |      | Exercise 4.3  | 281         |
|           |      | Exercise 4.3*   | 2 <b>82</b> |
|           | 4.4  | Further rules of differentiation                                  | 284         |
|           |      | Rule 4 The chain rule   | 285         |
|           |      | Rule 5 The product rule   | 287         |
|           |      | Rule 6 The quotient rule  | 290         |
|           |      | Exercise 4.4  | 292         |
|           |      | Exercise 4.4*   | 293         |
|           | 4.5  | •   | 294         |
|           |      | Key Terms   | 306         |
|           |      | Exercise 4.5  | 306         |
|           |      | Exercise 4.5*   | 307         |
|           | 4.6  | Optimisation of economic functions                                | 309         |
|           |      | Key Terms   | 325         |
|           |      | Exercise 4.6  | 325         |
|           |      | Exercise 4.6*   | 327         |
|           | 4.7  | Further optimisation of economic functions                        | 328         |
|           |      | Key Terms   | 3 <b>39</b> |
|           |      | Exercise 4.7*   | 339         |
|           | 4.8  | The derivative of the exponential and natural logarithm functions | 341         |
|           |      | Exercise 4.8  | 350         |
|           |      | Exercise 4.8*   | 351         |
|           | Forn | nal mathematics   | 353         |
|           |      |   |             |
| CHAPTER 5 | Par  | rtial Differentiation   | 357         |
|           | 5.1  | Functions of several variables                                    | 358         |
|           |      | Key Terms   | 368         |
|           |      | Exercise 5.1  | 369         |
|           |      | Exercise 5.1*   | 370         |
|           | 5.2  | Partial elasticity and marginal functions                         | 372         |
|           |      | 5.2.1 Elasticity of demand  | 372         |
|           |      | 5.2.2 Utility   | 375         |
|           |      | 5.2.3 Production  | 381         |
|           |      | Key Terms   | 383         |
|           |      | Exercise 5.2  | 384         |
|           |      | Exercise 5.2*   | 386         |
|           | 5.3  |   | 388         |
|           |      | Key Terms   | 397         |
|           |      | Exercise 5.3*   | 397         |

259

| CONTENTS | iх |
|----------|----|
|----------|----|

|           | 5.4 Unconstrained optimisation  Key Terms  Exercise 5.4  Exercise 5.4*  | 401<br>412<br>412<br>413                                    |
|-----------|---|---|
|           | 5.5 Constrained optimisation Key Terms Exercise 5.5 Exercise 5.5*   | 415<br>424<br>425<br>426                                    |
|           | 5.6 Lagrange multipliers  Key Terms  Exercise 5.6  Exercise 5.6*  | 428<br>436<br>437<br>438                                    |
|           | Formal mathematics  | 440   |
| CHAPTER 6 | Integration   | 443   |
|           | 6.1 Indefinite integration  Key Terms  Exercise 6.1  Exercise 6.1*  | 444<br>453<br>454<br>455                                    |
|           | 6.2 Definite integration 6.2.1 Consumer's surplus 6.2.2 Producer's surplus 6.2.3 Investment flow 6.2.4 Discounting Key Terms Exercise 6.2 Exercise 6.2*   | 457<br>461<br>462<br>464<br>466<br>467<br>467               |
|           | Formal mathematics  | 470   |
| CHAPTER 7 | Matrices  7.1 Basic matrix operations 7.1.1 Transposition 7.1.2 Addition and subtraction 7.1.3 Scalar multiplication 7.1.4 Matrix multiplication 7.1.5 Summary Key Terms Exercise 7.1 Exercise 7.1* | 473<br>474<br>476<br>477<br>480<br>481<br>489<br>489<br>490 |
|           | 7.2 Matrix inversion  Key Terms  Exercise 7.2  Exercise 7.2*  | 495<br>510<br>510<br>512                                    |
|           | 7.3 Cramer's rule  Key Term  Exercise 7.3  Exercise 7.3*  | 514<br>522<br>522<br>523                                    |
|           | Formal mathematics  | 526   |

| CHAPTER 8    | Linear Programming   | 529        |
|--------------|--|------------|
|              | 8.1 Graphical solution of linear programming problems          | 530        |
|              | Key Terms Exercise 8.1   | 544<br>545 |
|              | Exercise 8.1*  | 546        |
|              | 8.2 Applications of linear programming                         | 548        |
|              | Key Terms  | 556        |
|              | Exercise 8.2   | 556        |
|              | Exercise 8.2*  | 558<br>561 |
|              | Formal mathematics   | 201        |
| CHAPTER 9    | Dynamics   | 563        |
|              | 9.1 Difference equations                                       | 564        |
|              | 9.1.1 National income determination                            | 570        |
|              | 9.1.2 Supply and demand analysis                               | 572        |
|              | Key Terms  | 575        |
|              | Exercise 9.1  Exercise 9.1*                                    | 575        |
|              |  | 576        |
|              | 9.2 Differential equations 9.2.1 National income determination | 579<br>585 |
|              | 9.2.2 Supply and demand analysis                               | 587        |
|              | Key Terms  | 589        |
|              | Exercise 9.2   | 590        |
|              | Exercise 9.2*  | 591        |
|              | Formal mathematics   | 594        |
| Answers to F | Problems   | 595        |
|              | Chapter 1  | 595        |
|              | Chapter 2  | 603        |
|              | Chapter 3  | 611        |
|              | Chapter 4  | 615        |
|              | Chapter 5  | 624        |
|              | Chapter 6  | 631        |
|              | Chapter 7  | 632        |
|              | Chapter 8  | 638        |
|              | Chapter 9  | 641        |
|              | Glossary   | 645        |
|              | Index  | 652        |