E1.1 Identify and use natural numbers, integers (positive, negative and zero), prime numbers, square numbers, common factors and common multiples, rational and irrational numbers, (e.g. \( \pi \), \( \sqrt{2} \)) real numbers, reciprocals.

3–9, 358–359

E1.2 Use language, notation and Venn diagrams to describe sets and represent relationships between sets. Definition of sets e.g. 

\[ A = \{ x : x \text{ is a natural number} \}, \quad B = \{ (x,y) : y = mx + c \}, \quad C = \{ x : a \leq x \leq b \}, \quad D = \{ a, b, c, \ldots \} \]

256–267

E1.3 Calculate with squares, square roots, cubes and cube roots and other powers and roots of numbers.

Embedded throughout book

E1.4 Use directed numbers in practical situations.

3

E1.5 Use the language and notation of simple vulgar and decimal fractions and percentages in appropriate contexts. Recognise equivalence and convert between these forms.

10–13

E1.6 Order quantities by magnitude and demonstrate familiarity with the symbols \( =, \neq, >, <, \geq, \leq \)

62–63

E1.7 Understand the meaning of indices (fractional, negative and zero) and use the rules of indices. Use the standard form \( A \times 10^n \) where \( n \) is a positive or negative integer, and \( 1 \leq A < 10 \).


E1.8 Use the four rules for calculations with whole numbers, decimals and fractions (including mixed numbers and improper fractions), including correct ordering of operations and use of brackets.

2, 10–13

E1.9 Make estimates of numbers, quantities and lengths, give approximations to specified numbers of significant figures and decimal places and round off answers to reasonable accuracy in the context of a given problem.

14–16

E1.10 Give appropriate upper and lower bounds for data given to a specified accuracy. Obtain appropriate upper and lower bounds to solutions of simple problems given data to a specified accuracy.

434–437

E1.11 Demonstrate an understanding of ratio and proportion. Increase and decrease a quantity by a given ratio. Calculate average speed. Use common measures of rate.

52–57, 206–207, 252–255
<table>
<thead>
<tr>
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<th>Pages</th>
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<tbody>
<tr>
<td>E1.12</td>
<td>Calculate a given percentage of a quantity. Express one quantity as a percentage of another. Calculate percentage increase or decrease. Carry out calculations involving reverse percentages.</td>
<td>50–51, 162–163, 248–251</td>
</tr>
<tr>
<td>E1.13</td>
<td>Use a calculator efficiently. Apply appropriate checks of accuracy.</td>
<td>Embedded throughout the book</td>
</tr>
<tr>
<td>E1.14</td>
<td>Calculate times in terms of the 24-hour and 12-hour clock. Read clocks, dials and timetables.</td>
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<tr>
<td>E1.15</td>
<td>Calculate using money and convert from one currency to another.</td>
<td>204–205</td>
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<tr>
<td>E1.16</td>
<td>Use given data to solve problems on personal and household finance involving earnings, simple interest and compound interest. Extract data from tables and charts.</td>
<td>250–251</td>
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<tr>
<td>E1.17</td>
<td>Use exponential growth and decay in relation to population and finance.</td>
<td>390–393</td>
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**E2: Algebra and graphs**

| E2.1    | Use letters to express generalised numbers and express basic arithmetic processes algebraically. Substitute numbers for words and letters in formulae. Construct and transform complicated formulae and equations. | 17–27, 112–113, 322–323 |
| E2.2    | Manipulate directed numbers. Use brackets and extract common factors. Expand products of algebraic expressions. Factorise where possible expressions of the form: $ax + bx + kay + kby$, $a^2x^2 - b^2y^2$, $a^2 + 2ab + b^2$, $ax^2 + bx + c$. | 3–4, 18–21, 108–111, 214–217, 463–468 |
| E2.3    | Manipulate algebraic fractions. Factorise and simplify rational expressions. | 64–67, 364–365 |
| E2.4    | Use and interpret positive, negative and zero indices. Use and interpret fractional indices. Use the rules of indices. | 58–61, 268–271 |
| E2.5    | Derive and solve simple linear equations in one unknown. Derive and solve simultaneous linear equations in two unknowns. Derive and solve simultaneous equations, involving one linear and one quadratic. Derive and solve quadratic equations by factorisation, completing the square and by use of the formula. Derive and solve simple linear inequalities. | 20–23, 62–63, 102–107, 272–275, 360–363, 394–395, 400–403, 438–442 |
| E2.6    | Represent inequalities graphically and use this representation in the solution of simple linear programming problems. | 72–75, 396–399 |
| E2.7    | Continue a given number sequence. Recognise patterns in sequences including the term-to-term rule and relationships between different sequences. Find and use the $n$th term of sequences. | 324–333 |

<table>
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<td>E2.8</td>
<td>Express direct and inverse proportion in algebraic terms and use this form of expression to find unknown quantities.</td>
<td>366–373</td>
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<tr>
<td>E2.9</td>
<td>Use function notation, e.g. $f(x) = 3x - 5$; $f: x \to 3x - 5$, to describe simple functions. Find inverse functions $f^{-1}(x)$. Form composite functions as defined by $g(f(x)) = g(f(x))$.</td>
<td>208–213</td>
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<tr>
<td>E2.10</td>
<td>Interpret and use graphs in practical situations including travel graphs and conversion graphs. Draw graphs from given data. Apply the idea of rate of change to easy kinematics involving distance–time and speed–time graphs, acceleration and deceleration. Calculate distance travelled as area under a linear speed–time graph.</td>
<td>204–205, 314–321</td>
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<tr>
<td>E2.11</td>
<td>Construct tables of values and draw graphs for functions of the form $ax^n$ (and simple sums of these) and functions of the form $ax^n + c$. Solve associated equations approximately, including finding and determining roots by graphical methods. Draw and interpret graphs representing exponential growth and decay problems. Recognise, sketch and interpret graphs of functions.</td>
<td>168–173, 218–221, 276–277, 334–337, 404–411</td>
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<tr>
<td>E2.12</td>
<td>Estimate gradients of curves by drawing tangents.</td>
<td>170–171</td>
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<tr>
<td>E2.13</td>
<td>Understand the idea of a derived function. Use the derivatives of functions of the form $ax^n$, and simple sums of not more than three of these. Apply differentiation to gradients and turning points (stationary points). Discriminate between maxima and minima by any method.</td>
<td>443–462</td>
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</table>

**E3: Coordinate geometry**

| E3.1    | Demonstrate familiarity with Cartesian coordinates in two dimensions. | 28–32 |
| E3.2    | Find the gradient of a straight line. Calculate the gradient of a straight line from the coordinates of two points on it. | 28–32, 68–71 |
| E3.3    | Calculate the length and the coordinates of the midpoint of a straight line from the coordinates of its end points. | 68–71, 82 |
| E3.4    | Interpret and obtain the equation of a straight line graph. | 28–32, 68–71 |
| E3.5    | Determine the equation of a straight line parallel to a given line. | 68–71 |
| E3.6    | Find the gradient of parallel and perpendicular lines. | 278–281 |
### E5: Mensuration

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<td>E5.1</td>
<td>Use current units of mass, length, area, volume and capacity in practical situations and express quantities in terms of larger or smaller units.</td>
<td>76–77, 144</td>
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<tr>
<td>E5.2</td>
<td>Carry out calculations involving the perimeter and area of a rectangle, triangle, parallelogram and trapezium and compound shapes derived from these.</td>
<td>76–77</td>
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<tr>
<td>E5.3</td>
<td>Carry out calculations involving the circumference and area of a circle. Solve problems involving the arc length and sector area as fractions of the circumference and area of a circle.</td>
<td>84–89</td>
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<tr>
<td>E5.4</td>
<td>Carry out calculations involving the surface area and volume of a cuboid, prism and cylinder. Carry out calculations involving the surface area and volume of a sphere, pyramid and cone.</td>
<td>144–149, 222–229</td>
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<tr>
<td>E5.5</td>
<td>Carry out calculations involving the areas and volumes of compound shapes.</td>
<td>144–149, 222–229</td>
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### E6: Trigonometry

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<td>Interpret and use three-figure bearings.</td>
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<td>E6.2</td>
<td>Apply Pythagoras’ theorem and the sine, cosine and tangent ratios for acute angles to the calculation of a side or of an angle of a right-angled triangle. Solve trigonometrical problems in two dimensions involving angles of elevation and depression. Know that the perpendicular distance from a point to a line is the shortest distance to the line.</td>
<td>78–83, 178–193, 478–480</td>
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<td>E6.3</td>
<td>Recognise, sketch and interpret graphs of simple trigonometric functions. Graph and know the properties of trigonometric functions. Solve simple trigonometric equations for values between 0° and 360°.</td>
<td>338–343</td>
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<td>E6.4</td>
<td>Solve problems using the sine and cosine rules for any triangle and the formula area of triangle = ( \frac{1}{2} ab \sin C ).</td>
<td>338–343</td>
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<td>E6.5</td>
<td>Solve simple trigonometrical problems in three dimensions including angle between a line and a plane.</td>
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### E7: Vectors and transformations

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<td>E7.1</td>
<td>Describe a translation by using a vector represented by e.g. ( \begin{pmatrix} x \ y \end{pmatrix} AB ) or a. Add and subtract vectors. Multiply a vector by a scalar.</td>
<td>130–137, 412–423</td>
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<td>E7.2</td>
<td>Reflect simple plane figures. Rotate simple plane figures through multiples of 90°. Construct given translations and enlargements of simple plane figures. Recognise and describe reflections, rotations, translations and enlargements.</td>
<td>122–143</td>
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</table>
This revised edition has been specially prepared to help you achieve your highest potential on the Cambridge IGCSE® Mathematics 0580, extended syllabus. The book is fully up to date and covers the latest syllabus in depth.

The author is an experienced mathematics teacher and an examiner. Packed with carefully chosen examples, helpful tips and plenty of exercises to give you confidence in your abilities, the author’s many years of experience ensure that the book is carefully designed to help you succeed.

The contents are organised into ten units and within each unit the sections are grouped into the broad topics: number, algebra, shape and space, and probability and statistics. Each section concludes with a selection of examination-style questions. A unit is intended to be covered in around 20 hours; this should leave ample time for revision and exam practice if the syllabus is being taught over two years.

In all the examination papers it is permissible to use an electronic calculator provided that it is not an algebraic or graphical calculator. Opportunities to practise using a calculator arise throughout the book, though in practice many questions will not require the use of a calculator and candidates should be able to use mental and written methods. Indeed certain questions may require evidence of a written method being used.

Note that because this book is written for the extended syllabus a number of core topics – basic arithmetic, measures, time, money, etc. – are not covered explicitly but are woven into the treatment of more advanced topics.

The support website contains extra exam practice material and presentations, one for each section of the book, that provide many more fully worked examples. All this material can be found online at www.oxfordsecondary.com/9780198424802

<table>
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<tr>
<th>E7.3</th>
<th>Calculate the magnitude of a vector ( \begin{pmatrix} x \ y \end{pmatrix} ) as ( \sqrt{x^2 + y^2} ). Represent vectors by directed line segments. Use the sum and difference of two vectors to express given vectors in terms of two coplanar vectors. Use position vectors.</th>
<th>412–423</th>
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<td>E8: Probability</td>
<td>E8.1 Calculate the probability of a single event as either a fraction, decimal or percentage.</td>
<td>150–157</td>
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<td>E8.2 Understand and use the probability scale from 0 to 1.</td>
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<tr>
<td>E8.3 Understand that the probability of an event occurring = 1 – the probability of the event not occurring.</td>
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<tr>
<td>E8.4 Understand relative frequency as an estimate of probability. Expected frequency of outcomes.</td>
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<tr>
<td>E8.5 Calculate the probability of simple combined events, using possibility diagrams, tree diagrams and Venn diagrams.</td>
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<tr>
<td>E8.6 Calculate conditional probability using Venn diagrams, tree diagrams and tables.</td>
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<tr>
<td>E9: Statistics</td>
<td>E9.1 Collect, classify and tabulate statistical data.</td>
<td>90–93</td>
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<td>E9.2 Read, interpret and draw simple inferences from tables and statistical diagrams. Compare sets of data using tables, graphs and statistical measures. Appreciate restrictions on drawing conclusions from given data.</td>
<td>90–93, 194–197, 344–351, 481–491</td>
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<td>E9.3 Construct and interpret bar charts, pie charts, pictograms, stem-and-leaf diagrams simple frequency distributions, histograms with equal and unequal intervals and scatter diagrams.</td>
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<td>E9.4 Calculate the mean, median, mode and range for individual and discrete data and distinguish between the purposes for which they are used.</td>
<td>41–45</td>
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<td>E9.5 Calculate an estimate of the mean for grouped and continuous data. Identify the modal class from a grouped frequency distribution.</td>
<td>238–241</td>
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<td>E9.6 Construct and use cumulative frequency diagrams. Estimate and interpret the median, percentiles, quartiles and inter-quartile range. Construct and interpret box-and-whisker plots.</td>
<td>344–351, 487–491</td>
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<tr>
<td>E9.7 Understand what is meant by positive, negative and zero correlation with reference to a scatter diagram.</td>
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<tr>
<td>E9.8 Draw, interpret and use lines of best fit by eye.</td>
<td>194–197</td>
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</tbody>
</table>
Order of operations

When a calculation involves more than one operation it is important to do the operations in the correct order.
1. Work out the Brackets first.
2. Work out the Indices next.
3. Work out the Divisions and Multiplications next.
4. Work out the Additions and Subtractions last.

EXERCISE 1.1
Work out:
1. \(2 + 3 \times 5\)  
2. \(8 + 2 \times 4\)  
3. \(3 \times 4 - 5 \times 2\)  
4. \(5 \times 6 - 8 + 2\)  
5. \(7 - 2 \times 3 + 5\)  
6. \(10 - 2 \times 3\)  
7. \(6 + (3 \times 5) - 2\)  
8. \(10 + 3 \times 4\)  
9. \((5 + 4) - 3 \times 2\)  
10. \((5 \times 4) - (3 \times 2)\)  
11. \((4 \times 3) \times 2^2\)  
12. \(12 \times 3 - 4 \times 3\)  
13. \(5 \times (16 - 3)\)  
14. \(38 - 2 \times 4\)  
15. \(56 - (2^3 + 4)\)  
16. \(4 + (3 \times 2)^2\)  
17. \((4 + 3 \times 2)^2\)  
18. \((2 \times 3)^2 + 4\)  
19. \(4^2 - 5 \times 6\)  
20. \(5 \times (2^2 + 3^2)\)

EXERCISE 1.2
Copy these and use brackets (where necessary) to make the statements true.
1. \(2 + 3 \times 4 + 5 = 25\)
2. \(2 \times 3 + 4 \times 5 = 26\)
3. \(2 + 3 \times 4 + 5 = 29\)
4. \(2 \times 3 + 4^2 = 80\)
5. \(2 \times 3 + 4 \times 5 = 46\)
6. \(5 + 4 \times 3 - 2 = 15\)
7. \(2 \times 3 + 4 \times 5 = 50\)
8. \(2 \times 3 + 4 \times 5 = 70\)
9. \(2 \times 3 + 4 \times 5 = 45\)
10. \(2 + 3 \times 4^2 = 50\)

Directed numbers

The positive and negative whole numbers are called integers. They can be shown on a number line. The number line can be used in practical situations. To find the difference between a temperature of 5 °C and a temperature of −3 °C, you find the gap between these two numbers on the number line. The difference is 8 °C.

Adding and subtracting directed numbers
The rules for adding and subtracting directed numbers are:

Change \(-2 + +5\) to \(-2 + 5 = 3\)
Change \(-2 + −5\) to \(-2 − 5 = −7\)
Change \(-2 − +5\) to \(-2 − 5 = −7\)
Change \(-2 − −5\) to \(-2 + 5 = 3\)

EXAMPLE
Work out:
(a) \((-9) − (−3)\)
(b) \((+8) − (+15)\)
(c) \((29) + (−12)\)

(a) \(-9 − −3 = −9 + 3 = −6\) change − − to +
(b) \(+8 − +15 = +8 − 15 = −7\) change − + to −
(c) \(29 + −12 = 29 − 12 = 17\) change + − to −

EXERCISE 1.3
Work out:
1. \((-3) + (−5)\)
2. \(6 − (−4)\)
3. \(8 + (−10)\)
4. \(2 + (−5)\)
5. \((−4) − (−2)\)
6. \(−15 + (−3)\)
7. \(36 + (−8)\)
8. \(29 − (+1)\)
9. \(−52 − (−38)\)
10. \(−54 + (−3)\)
11. \(−16 + (−2)\)
12. \(−20 − (−20)\)
13. \(−57 + (−5)\)
14. \(41 + (−16)\)
15. \(52 − (−3)\)
16. \(−5 − (−10)\)
17. \(−7 − (−14)\)
18. \(−42 + (−5)\)
19. \(−8 + (−2) + (−5)\)
20. \(−6 + (−2) − (−3)\)
21. \(7 − (−2) − (−3)\)
22. \((+9) + (−6) + (−6)\)
23. \(7 − (+9) + (−3)\)
24. \(46 − (−12) − (−5)\)
Multiples, factors, primes, squares and cubes

THIS SECTION WILL SHOW YOU HOW TO

• Identify and use factors, multiples, primes, squares and cubes

Factors

The whole numbers that divide exactly into 15 are called factors of 15. The factors of 15 are 1, 3, 5 and 15.

**EXAMPLE**

List all the factors of 24.

\[ 24 = 1 \times 24 \]
\[ 24 = 2 \times 12 \]
\[ 24 = 3 \times 8 \]
\[ 24 = 4 \times 6 \]
Factors of 24 = 1, 2, 3, 4, 6, 8, 12 and 24.

write 24 as the product of two factors
repeat until all pairs have been found

**EXAMPLE**

Find the highest common factor (HCF) of 20 and 36.

Factors of 20 = 1, 2, 4, 5, 10, 20
Factors of 36 = 1, 2, 3, 4, 6, 9, 12, 18, 36
Common factors of 20 and 36 are 1, 2, and 4.
Highest common factor of 20 and 36 is 4.

list the factors of both 20 and 36
find the numbers that are in both lists
select the highest number

Multiples

The multiples of 6 are the numbers 6, 12, 18, 24, 30 …

**EXAMPLE**

Find the lowest common multiple (LCM) of 12 and 9.

Multiples of 12 = 12, 24, 36, 48, 60, 72, 84 …
Multiples of 9 = 9, 18, 27, 36, 45, 54, 63, 72, 81 …
Common multiples of 12 and 9 are 36, 72 …
Lowest common multiple of 12 and 9 is 36.

list the multiples of 12 and 9
find the numbers that are in both lists
select the lowest number

EXERCISE 1.4

Work out:

1. \((−12) \times (−5)\)
2. \((−8) \times (+4)\)
3. \((+16) \times (−2)\)
4. \((−52) \div (−13)\)
5. \((−55) \div (+5)\)
6. \((−145) \div (−5)\)
7. \((+20) \div (−2)\)
8. \((−95) \div (−19)\)
9. \((−11) \div (−11)\)
10. \((−3) \times (−4) \times (−5)\)
11. \((−2) \times (+8) \times (−4)\)
12. \((+6) \times (−3) \times (−7)\)
13. \((−2) \times (−5) \times (+6)\)
14. \((−9)^3\)
15. \((−15)^2\)
16. \((−5)^3\)
17. \((−60)^3\)
18. \((−4)^3 \times (−1)^3\)
19. \((−2)^3 \times (−10)^2\)
20. \((−1)^3\)
21. \((−1)^{15} \times (−1)^{20}\)
22. \(\frac{−6}{3} \times (−10)^3 \div (+3)\)
23. \(\frac{−10}{−15} \times (+3)\)
24. \(\frac{−12}{−2} \times (+5) \times (+10)\)

Check your answers to questions 1 to 18 using a calculator.

Find the missing numbers:

26. \(\frac{−12}{8} \times (+2) = 48\)
27. \(\frac{−5}{10} \times (−3) = 3\)
28. \(\frac{−3}{−2} \times (−6) = −1\)

KEY WORDS

positive
negative
integer

Multiplying and dividing directed numbers

The rules for multiplying and dividing directed numbers are:

<table>
<thead>
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<th>Division</th>
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<tr>
<td>+ \times + = +</td>
<td>+ \div + = +</td>
</tr>
<tr>
<td>+ \times − = −</td>
<td>+ \div − = −</td>
</tr>
<tr>
<td>− \times + = −</td>
<td>− \div + = −</td>
</tr>
<tr>
<td>− \times − = +</td>
<td>− \div − = +</td>
</tr>
</tbody>
</table>

If the two signs are the same, the answer will be positive.
If the two signs are different, the answer will be negative.

EXAMPLE

**Work out**

a. \((−6) \div (−2) = 3\) the two signs are the same so the answer is positive
b. \(5 \times (−8) = −40\) the two signs are different so the answer is negative
c. \((−4)^3 = −4 \times −4 \times −4\) first multiply −4 by −4
then multiply by −4 again
= 16 \times −4
= −64

EXERCISE 1.4

Find the missing numbers:

26. \(\frac{−12}{8} \times (+2) = 48\)
27. \(\frac{−5}{10} \times (−3) = 3\)
28. \(\frac{−3}{−2} \times (−6) = −1\)
**Primes**

A **prime** number is a number that has exactly two factors.

5 is a prime number because it has exactly two factors (1 and 5)

- **EXAMPLE**
  
  The prime numbers are: 2, 3, 5, 7, 11, 13, 17, 19, 23 and 29

A **prime factor** is a factor that is also a prime number.

- **EXAMPLE**
  
  List the prime factors of 30.
  
  The factors of 30 are: 1, 2, 3, 5, 6, 10, 15 and 30
  
  The prime factors of 30 are: 2, 3 and 5.

Numbers can be written as the **product of prime factors**.

For example 120 = 2 × 60 = 2 × 2 × 30 = 2 × 2 × 2 × 15 = 2 × 2 × 2 × 3 × 5 = 2³ × 3 × 5

The next example shows how a factor tree can be used.

- **EXAMPLE**
  
  Write 84 as the product of prime factors.
  
  Expressing numbers as the product of prime factors can help you to find highest common factors (HCF) and lowest common multiples (LCM).

- **EXAMPLE**
  
  Find the HCF and the LCM of 270 and 420.
  
  First write 270 and 420 as the product of prime factors.
  
  270 = 2 × 3 × 3 × 3 × 5 and 420 = 2 × 2 × 3 × 5 × 7
  
  Write the prime factors on a diagram.
  
  The HCF is the product of the numbers in the intersection = 2 × 3 × 5 = 30.
  
  The LCM is the product of all the numbers in the diagram = 3 × 3 × 2 × 3 × 5 × 2 × 7 = 3780.
Square and cube numbers

The numbers 1, 4, 9 and 16 are called square numbers.
The number 169 is also a square number because $13 \times 13 = 169$
$13 \times 13$ can be written as $13^2$

The numbers 1, 8 and 27 are called cube numbers.
The number 8000 is a cube number because $20 \times 20 \times 20 = 8000$.
$20 \times 20 \times 20$ can also be written as $20^3$.

EXERCISE 1.7

1 Which is biggest $2^3$ or $3^2$?

2 a Write down the numbers that are square numbers.
   b Write down the numbers that are cube numbers.

3 The number 64 is a square number because $8 \times 8 = 64$.
   It is also a cube number because $4 \times 4 \times 4 = 64$.
   Can you find another number (bigger than 1) that is both a square and a cube number?
Adding and subtracting fractions

To add or subtract fractions a common denominator is needed as shown below.

**EXAMPLE**

Calculate $\frac{2}{3} + \frac{1}{5}$

- $\frac{2}{3} + \frac{1}{5} = \frac{10}{15} + \frac{3}{15} = \frac{13}{15}$

and

Calculate $\frac{3}{5} - \frac{2}{3}$

- $\frac{3}{5} - \frac{2}{3} = \frac{9}{15} - \frac{10}{15} = \frac{1}{15}$

**EXERCISE 1.9**

Calculate:

1. $\frac{1}{2} + \frac{2}{3}$
2. $\frac{3}{4} + \frac{1}{5}$
3. $\frac{5}{6} + \frac{2}{7}$
4. $\frac{2}{3} + \frac{4}{5}$
5. $\frac{5}{6} + \frac{3}{4}$
6. $\frac{5}{7} + \frac{1}{3}$
7. $\frac{3}{7} + \frac{1}{5}$
8. $\frac{2}{3} + \frac{7}{9}$
9. $\frac{4}{5} - \frac{1}{2}$
10. $\frac{5}{7} - \frac{2}{3}$
11. $\frac{6}{7} - \frac{3}{9}$
12. $\frac{7}{8} - \frac{3}{5}$
13. $\frac{5}{8} - \frac{3}{5}$
14. $\frac{2}{5} + \frac{1}{6}$
15. $\frac{6}{7} - \frac{3}{4}$
16. $\frac{7}{8} - \frac{3}{4}$
17. $\frac{5}{6} + \frac{1}{2}$
18. $\frac{4}{3} + \frac{2}{3} - \frac{1}{3}$
19. $\frac{2}{1} + \frac{3}{3} - \frac{1}{4}$
20. $\frac{1}{2} - \frac{2}{3} - \frac{5}{6}$
21. $\frac{1}{5} - \frac{2}{3}$
22. $\frac{2}{5} - \frac{2}{3} + \frac{1}{3}$
23. Use a calculator to check your answers to questions 1 to 22.
12 Solve.
   (a) \( 5(2x - 1) = 7 \) \[3\]
   (b) \( \frac{12 - 5x}{6} = 3 - 2x \) \[3\]

13 Solve.
   (a) \( 10 - 2(x - 4) = 5(3x + 2) \) \[3\]
   (b) \( \frac{2x - 3}{5} = 1 - \frac{4x}{3} \) \[3\]

14 Ali hires a car.
   There is a fixed charge of $170 and then an extra charge of $40 for each day that the car is hired.
   Write down a formula for the total cost \( T \), in dollars, when the car is hired for \( n \) days. \[2\]

15 Peaches cost 80 cents each and apples cost 65 cents each.
   Anna buys \( x \) peaches and 14 apples and spends a total of $17.90
   (a) Write down an equation, in terms of \( x \), for the total cost of this fruit. \[2\]
   (b) Solve your equation in part (a). \[2\]

16 \( e = 2f + 5g^0 \)
   Find the value of \( e \) when \( f = 4 \) and \( g = -5 \). \[2\]

17 The equation of a straight line is \( 3x + 2y = 6 \).
   (a) Write down the gradient of this line, \[1\]
   (b) Write down the coordinates of the point where the line crosses the \( y \)-axis. \[1\]

18 \( A \) is the point \((5, -3)\) and \( B \) is the point \((-9, 4)\).
   Find the gradient of the line \( AB \). \[2\]

19 \( P \) is the point \((-4, 5)\) and \( Q \) is the point \((2a, -3a)\).
   The gradient of the line \( PQ \) is \(-2\).
   Find the value of \( a \). \[2\]

20 \( P \) is the point \((p, 15)\) and \( Q \) is the point \((-4, q)\).
   The line \( PQ \) has gradient \(-2\).
   Find an expression for \( q \) in terms of \( p \). \[3\]

21 The line \( y = mx + 4 \) passes through the point \((5, -6)\).
   Find the value of \( m \). \[2\]
22

ABCD is a trapezium with AB parallel to CD.
Find the value of x and the value of y.

23

For the diagram above, write down
(a) the order of rotational symmetry,
(b) the number of lines of symmetry.

24

The diagram shows a prism.
The cross-section of the prism is a regular hexagon.
(a) Write down the order of rotational symmetry of this prism about
the axis shown.
(b) Write down the number of planes of symmetry for this prism.

25

The interior angle of a regular polygon is 162°.
Find the number of sides for this polygon.

26

The interior angle of a regular polygon is seven times the size of
the exterior angle.
How many sides does this polygon have?

27

The diagram shows a regular hexagon joined to a square.
Find the value of x.

28

Alan counts the number of sweets in each of 8 packets.
The results are shown below.

<table>
<thead>
<tr>
<th>Number of sweets</th>
<th>22</th>
<th>25</th>
<th>28</th>
<th>29</th>
<th>24</th>
<th>26</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>10</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

(a) (i) Find the range.
(ii) Write down the mode.
(iii) Find the median.
(iv) Calculate the mean.

(b) Alan buys another n packets of sweets.
The mean for these n packets is 26.
Find, in terms of n, an expression for the mean number of
sweets in the (n + 8) packets.

29

A six-sided dice, numbered 1 to 6, is rolled 40 times.
The frequency table shows the results.

<table>
<thead>
<tr>
<th>Score</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>10</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

(a) Write down the modal score.
(b) Find the median score.
(c) Calculate the mean score.
(d) The dice is then rolled another 10 times.
The mean score for these 10 rolls is 3.4
Calculate the mean score for all 50 rolls.

30

The table shows information about the number of text messages received, in
one hour, by each student in a class.

<table>
<thead>
<tr>
<th>Number of text messages</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>7</td>
<td>12</td>
<td>15</td>
<td>x</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

The mean number of text messages is 1.8
Calculate the value of x.