Mathematics for Australia Year 8 2nd edition

Chapter summaries

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CHAPTER 1: NUMBER

- **A** Operations with negative numbers
- **B** Index notation
- **C** Factors
- **D** Prime and composite numbers
- **E** Highest common factor
- **F** Multiples
- **G** Order of operations
- **H** Problem solving

Keywords:

- base
- BEDMAS
- composite number
- counting number
- exponent
- factor
- factor pair
- factor tree
- highest common factor
- index
- index notation
- infinite
- integer
- lowest common multiple
- multiple
- natural number
- power
- prime factored form
- prime factorisation
- prime number
- repeated division
- whole number

This chapter has been significantly restructured from what appeared in the previous edition. The previous Section A (Natural numbers) covering factors and multiples has been removed, and instead this material is covered in Sections C, E, and F. This allows us to discuss factors in their own right in Section C, then talk about the prime factorisation of numbers in Section D, and then to use the prime factorisation to find highest common factors in Section E.

In the Discussion at the end of Section C, students should conclude that it is not sensible to talk about the factors of zero, since every natural number would be a factor of zero. For example, $0 \div 2 = 0$, $0 \div 3 = 0$, and so on.

In the Investigation at the end of Section F, students should find that the only numbers which cannot be written as the sum of three or fewer perfect squares are the numbers that are 1 less than a multiple of 8. They should be able to explain this by considering the remainders when the perfect squares are divided by 8. When perfect squares are divided by 8, the remainder is either 0, 1, or 4. 7 is the only remainder that is impossible to create from the sum of three such remainders, so we cannot write numbers that are 1 less than a multiple of 8 as the sum of three or fewer perfect squares.

CHAPTER 2: SETS AND VENN DIAGRAMS

- **A** Sets
- **B** Complement of a set
- **C** Intersection and union
- **D** Venn diagrams
- **E** Numbers in regions

F Problem solving with Venn diagrams

Keywords:

- complement
- complementary sets
- disjoint
- element
- empty set
- equal sets
- intersection
- member
- set
- subset
- union
- universal set
- Venn diagram

Section A is largely designed to get students used to the notation and terminology associated with sets. Some students may find the formality of some of the notation off-putting. However, they should be reassured that the ideas explored here are quite simple, it is just a more formal way of writing which becomes more useful as the concepts become harder.

In Section B, students should be able to draw parallels between complementary events which they would have seen in probability in previous years, and the complement of a set.

In Section C, students are most likely to struggle with the idea that elements that are in both sets A and B are included in the union of A and B. This is a good opportunity to discuss how words can be used differently in mathematics than they are in everyday use, as "or" is often used to mean "one or the other, but not both" in everyday use.

We have added a new Section E (Numbers in regions), as this is the most challenging part of the problem solving questions. It also gives students a chance to realise that we have made a conceptual shift from considering the elements of regions of a Venn diagram, to considering the *number* of elements in regions of a Venn diagram.

In Section E students interpret and find numbers in regions in non-contextual situations, then in Section F these skills are applied to contextual problems.

CHAPTER 3: REAL NUMBERS

A Fractions
B Equal fractions
C Adding and subtracting fractions
D Multiplying fractions
E Dividing fractions
F Decimal numbers
G Rounding decimal numbers
H Adding and subtracting decimal numbers
I Multiplying and dividing by powers of 10
J Multiplying decimal numbers
K Dividing decimal numbers
L Square roots
M Cube roots
N Rational numbers
O Irrational numbers

Keywords:

- cube root
- decimal number
- decimal places
- denominator
- equal fractions
- fraction
- improper fraction
- integer
- irrational number
- lowest common denominator
- lowest terms
- mixed number
- number line
- numerator
- proper fraction
- radical
- rational number
- real number
- reciprocal
- recurring decimal
- round
- significant figures
- simplest form
- square root
- terminating decimal

Although there are many more sections to this chapter than there were in the previous edition, this is mainly a result of splitting the content into smaller sections, as opposed to having multiple subsections for each section. This allows us to give a more complete treatment of fractions and decimals, which will be useful for students who have struggled to master these concepts in previous years.

In this edition, the order of operations questions involving fractions have been moved here from Chapter 1.

In the Discussion at the end of Section G, students should find that different results are obtained if 0.945 is rounded to 1 decimal place, compared with if it is first rounded to 2 decimal places, and then this result is rounded to 1 decimal place. Students should be made aware of the inaccuracies that can occur if we round numbers that have already been rounded.

In Section J, we have provided a more intuitive method for multiplying decimals, involving first converting each decimal number to a fraction with a denominator that is a power of 10.

Square roots has been moved to this chapter, which allows Chapter 1 to involve exclusively whole numbers, and, along with cube roots, leads in well to the treatment of rational and irrational numbers in the final two sections.

In the Discussion in Section L, students should conclude that we could talk about "the positive square root of 4", and "the negative square root of 4" to distinguish between these values.

The Discussion at the end of Section O should provide some opportunities for creative thought for the more able students. To show that there are infinitely many rational numbers, students could consider the rational numbers with numerator 1, such as $\frac{1}{1}, \frac{1}{2}, \frac{1}{3}, ...$ which is clearly an infinite list. To determine whether there are infinitely many irrational numbers, students could be asked to think about the result in Question **2** part **c**. This result tells us that for any given irrational number, we can obtain infinitely many irrational numbers by repeatedly multiplying that number by 2. The final part is the most difficult to answer, and Year 8 students are unlikely to have the tools to answer it completely. But it would be useful for students to think about what it would mean to compare the sizes of two infinite sets of numbers.

CHAPTER 4: ALGEBRAIC EXPRESSIONS

- **A** Product notation
- **B** Index notation
- **C** Writing expressions
- **D** Generalising arithmetic
- **E** Algebraic substitution
- **F** The language of algebra
- **G** Collecting like terms
- **H** Algebraic products
- **I** Algebraic quotients
- **J** Algebraic common factors

Keywords:

- algebra
- algebraic fraction
- algebraic product
- algebraic quotient
- coefficient
- constant
- equation
- evaluate
- expression
- index notation
- like terms
- product notation
- pronumeral
- substitute
- term
- variable

This chapter has been renamed from "Algebraic operations" in the previous edition, as much of what is here does not involve performing operations.

Section C has been added to help students read algebraic expressions in words. This is an important skill because it allows students to communicate mathematically with others.

We have included sections on algebraic products and quotients in this edition. At this stage, students find algebraic products by writing the terms in expanded form, and then give their final answer using index notation. Algebraic quotients are simplified by writing the numerator and denominator in expanded form, then cancelling any common factors. We hope that in this process, students will develop a sense that these processes can be made quicker using the index laws that they will encounter more formally in Chapter 6.

Algebraic common factors have been included here, as it is more sensible to talk about alongside algebraic products and quotients. This means that students will already be familiar with the concept when they reach Chapter 6, and they can focus on the process of factorisation.

CHAPTER 5: PERCENTAGE

- **A** Converting percentages into decimals and fractions
- **B** Converting decimals and fractions into percentages
- **C** Expressing one quantity as a percentage of another
- **D** Finding a percentage of a quantity
- **E** Percentage increase or decrease
- **F** Finding a percentage change
- **G** Profit and loss
- **H** Discount
- **I** Goods and services tax

Keywords:

- cost price
- discount
- goods and services tax
- loss
- marked price
- multiplier
- percent
- percentage
- percentage decrease
- percentage loss
- percentage profit
- profit
- selling price

In this edition, the material has been broken up into smaller sections. For example, the Business applications section has been split up into Profit and loss (Section G), Discount (Section H), and Goods and services tax (Section I).

In Section E, students first apply a percentage change in two steps as revision of Year 7. They are then introduced to percentage change in one step using a multiplier.

In the Discussion at the end of Section I, students may initially think that GST is simply 10% of the final price. However, students should be reminded that the 10% GST is added on to the initial price, so the final price is made up of 10 parts initial price and 1 part GST. So the GST makes up $\frac{1}{11}$ of the final price.

CHAPTER 6: LAWS OF ALGEBRA

- **A** Index laws
- **B** Expansion laws
- **C** The zero index law
- **D** The negative index law
- **E** The distributive law
- **F** Factorisation

Keywords:

- distributive law
- expansion
- expansion laws
- factorisation
- index laws
- reciprocal

In Section A, students use the index laws they should have discovered when working with algebraic products and quotients in Chapter 4. They should find that the index laws make it quicker to perform the operations, especially when dealing with large indices.

In the Discussion in Section B, students should conclude that we specify that b cannot be zero since we cannot divide by 0, so the expression would be undefined if $b = 0$.

We have included the negative index law in this edition, as it seems to be natural to introduce this law once the zero index law has been established. It would be useful for students to consider the differences between the index and expansion laws in Sections A and B, which apply to positive indices and flow directly from the original definition of an index, with the zero and negative index laws in Sections C and D. Zero and negative indices do not have any meaning from the original

definition of an index (you cannot multiply 2 by itself -3 times to get 2^{-3}), but we can use the existing index rules to find a sensible interpretation for them.

In Section F, algebraic common factors have been moved to Chapter 4, where they can more sensibly be discussed after algebraic products and quotients.

The Investigation at the end of Section F would be beneficial for more able students who have finished their work before the other students. It gives students an introduction to more advanced types of expansion, which will be covered in Year 9.

CHAPTER 7: EQUATIONS

- **A** Solutions of an equation
- **B** Maintaining balance
- **C** Inverse operations
- **D** Algebraic flowcharts
- **E** Solving equations
- **F** Equations with a repeated unknown

Keywords:

- algebraic flowchart
- equal sign
- equation
- identity
- inverse operation
- left hand side
- right hand side
- solution

In this edition, solution by inspection has been moved into Section A, and solution by guess, check, and improve has been removed.

In the Discussion in Section A, students should recognise that infinitely many solutions means that we could never list all of the solutions, since the set of solutions is infinite. More able students should be able to recognise that, while an identity has infinitely many solutions, not all equations with infinitely many solutions are identities. For example, $\frac{x}{x} = 1$ has infinitely many solutions, but it is not an identity because $x = 0$ is not a solution.

In the Discussion at the end of Section F, students should recognise that Leigh has interchanged the coefficient of x and the constant term. By solving the equation, students can find a value of x for which $5(2 + 3x) = 10x + 15$, but this does not mean that Leigh's expansion is correct. For Leigh's expansion to be correct, it must be true for *all* values of x (or at least all values of x for which the expressions involved are defined).

CHAPTER 8: LINES AND ANGLES

- **A** Angles
- **B** Parallel and perpendicular lines
- **C** Angle properties
- **D** Lines cut by a transversal

Keywords:

- acute angle
- allied angles
- alternate angles
- angle
- arm
- co-interior angles
- collinear
- complementary angles
- concurrent
- corresponding angles
- degrees
- line
- line segment
- obtuse angle
- parallel lines
- perpendicular lines
- point
- ray
- reflex angle
- revolution
- right angle
- straight angle
- supplementary angles
- transversal
- vertex
- vertically opposite angles

This chapter is effectively an expanded version of what previously appeared in Section A (Review of geometrical facts) in Chapter 8 (The geometry of polygons) in the first edition. We feel that it should get a more expansive coverage in Year 8, as this is the only time that this material is presented when students are able to solve equations.

Section B, although very short, is primarily there to present the notation associated with parallel and perpendicular lines, so that it does not need to be introduced in Chapter 9 (Plane geometry).

In the Discussion at the end of Section B, students should realise the difficulties associated with defining parallel and perpendicular for line segments. For example, two line segments might not be parallel, but still never meet because they do not extend far enough. To modify the definition for line segments such as [AB], one would need to talk about the infinite line passing through A and B.

Classes should be able to move through this chapter quickly, as there is no conceptually new material here. The main difference between this chapter and what students studied in Year 7 is that now they can use their skills with solving equations to find unknowns in more complex situations.

CHAPTER 9: PLANE GEOMETRY

- **A** Circles
- **B** Triangles
- **C** Triangle theorems
- **D** Isosceles triangles
- **E** Quadrilaterals
- **F** Angle sum of a quadrilateral
- **G** Angle sum of an n-sided polygon

Keywords:

- acute angled triangle
- apex
- arc
- base
- base angles
- centre of a circle
- chord
- circle
- diameter
- equilateral triangle
- exterior angle
- interior angle
- isosceles triangle
- kite
- obtuse angled triangle
- parallelogram
- plane figure
- polygon
- quadrilateral
- radius
- rectangle
- rhombus
- right angled triangle
- scalene triangle
- sector
- segment
- semi-circle
- square
- tangent
- trapezium
- triangle
- vertex
- vertical angle

We have added a section on circles. This allows us to define the parts of a circle more completely, rather than just defining what is needed for circumference in the Measurement chapter.

For the Puzzle at the end of Section A, students should recognise that by folding the circle of paper in half, the fold line will be a diameter of the circle which passes through the centre of the circle. Two such folds will create two diameters, and the point where the diameters meet must be the centre of the circle.

We have reordered the material on quadrilaterals, introducing the special quadrilaterals first, then exploring the angles of a quadrilateral. This allows us to move directly on to explore the angles of polygons more generally in Section G.

CHAPTER 10: ALGEBRA: FORMULAE

- **A** Number crunching machines
- **B** Finding the formula
- **C** Substituting into formulae
- **D** Geometric patterns
- **E** Practical problems

Keywords:

- formula
- input number
- output number
- subject
- substitute

This chapter has been significantly restructured from what was in the first edition. In the first edition, Section A (Geometric patterns) progressed too quickly, asking students to predict a rule for the number of matchsticks in a pattern immediately. Here, we begin with number crunching machines to get students used to a formula with an input number and an output number. This allows us to define the subject of a formula.

Section B gives students guidance to finding a rule given a set of inputs and outputs, and Section C shows how to evaluate a variable in a formula given the other variables. Since students have already seen how to solve equations, we feel it is appropriate to not only ask students to evaluate the subject of the formula, but also to find other variables in the formula.

Section D puts all this together, asking students to find a formula from a geometric pattern, and then to use substitution to find either the number of matchsticks in a given figure number, or the figure number which contains a given number of matchsticks.

As with Section D, Section E has been extended to consider problems where a variable other than the subject must be found.

CHAPTER 11: MEASUREMENT: LENGTH AND AREA

- **A** Length
- **B** Perimeter
- **C** Circumference
- **D** Area
- **E** Area formulae
- **F** The area of a circle
- **G** Areas of composite figures

Keywords:

- area
- centimetre
- circumference
- composite figure
- diameter
- hectare
- kilometre
- length
- metre
- millimetre
- perimeter
- radius
- square centimetre
- square kilometre
- square metre
- square millimetre

This chapter has been moved after Formulae, so students can use the skills they learnt in formulae substitution here.

In Section B, as with Year 7, we have removed perimeter formulae for specific polygons on the basis that it is more important to understand what the perimeter is, at which point the formulae are not helpful.

In Section C, the definition of a circle has been moved to Chapter 9. This allows us to progress quickly to finding the circumference of a circle without first having to deal with terminology.

The Puzzle at the end of Section C is an interesting one for students to consider. Most people's intuition tells them that an extra metre spread around the Earth will produce a much smaller gap, because it is spread over a much larger distance. However, the gap will be the same in each scenario! To check this, students should think about the impact of increasing the perimeter of a circle by 1 m. They should find that this increases the radius of the circle by $\frac{1}{2\pi}$ metres, regardless of the initial radius of the circle.

In Section E, the area formulae for polygons are presented all together, rather than as separate subsections. We feel that this is appropriate since the kite formula is the only one students have not seen previously.

Section G (Areas of composite figures) has been moved here from Year 9. This will allow students to progress faster to some more complex measurement problems in Year 9.

CHAPTER 12: MEASUREMENT: SURFACE AREA AND VOLUME

- **A** Surface area
- **B** The surface area of a cylinder
- **C** Volume
- **D** The volume of a solid of uniform cross-section

Keywords:

- cubic centimetre
- cubic metre
- cubic millimetre
- net
- solid of uniform cross-section
- surface area
- volume

This chapter is a restructure of the Further measurement chapter in the first edition. Capacity and mass have moved to Year 7, as they are quite simple concepts, and we feel it would be better to return to capacity again in Year 9, once they have considered volumes of some more complex figures. Time has been moved on its own to Chapter 13.

Surface area has been added here from Year 9, thus making this a chapter about 3-dimensional measurement.

In Section D, the volume of prisms and cylinders are presented together as solids of uniform cross-section. This should not be a challenge for students, since prisms were encountered in Year 7, so the cylinder formula is the only one they would not have seen before. It also seems that, in the context of finding volumes, there is little to be gained by drawing a sharp distinction between prisms (with a polygonal cross-section) and cylinders (with a circular cross-section).

The Investigation at the end of Section D introduces students to the volume of a pyramid. Although only very specific types of pyramids are considered here, it should provide an insight into the relationship between the volume of a pyramid and that of a prism with the same base and height.

CHAPTER 13: TIME

- **A** Units of time
- **B** Time calculations
- **C** 24-hour time
- **D** Time zones

Keywords:

- 12-hour time
- 24-hour time
- century
- day
- decade
- duration
- Greenwich Mean Time
- hour
- millennium
- minute
- second
- standard time
- time
- time zone
- year

In this edition, we have made the material on time into its own chapter. This was done because time is conceptually quite different to the other types of measurement that were previously in the Further measurement chapter.

Large units of time (decades, centuries, millennia) have been moved from Year 9 to Year 8. Small units of time will remain in Year 9, as an application of scientific notation.

In the Discussion at the end of Section C, students should find that a clear advantage of 24-hour time is that it removes the ambiguity over whether you are referring to am or pm time. A possible disadvantage is that the 24-hour time may be misinterpreted, for example it is common to mistake 19:00 hours for 9 pm.

Time zones has been moved here from Year 9. By doing this, there is no longer a need to study time in its own right in Year 9, allowing increased time for more rigorous content.

CHAPTER 14: COORDINATE GEOMETRY

- **A** The Cartesian plane
- **B** Straight lines
- **C** Gradient
- **D** Axes intercepts

E Graphing a line of the form $y = mx + c$

Keywords:

- axes
- axes intercepts
- Cartesian plane
- coordinates
- equation of a straight line
- gradient
- gradient-intercept form
- horizontal line
- ordered pair
- origin
- quadrant
- vertical line
- x-axis
- x-coordinate
- x-intercept
- y-axis
- y-coordinate
- y-intercept

In this edition, we have removed the idea of "movement from the origin" in order to plot points. Students should instead be encouraged to think of the axes as number lines, and to plot points on the number plane in the same way they would plot numbers on a number line.

Rather than leaving horizontal and vertical lines as an afterthought, we introduce straight lines by investigating horizontal, vertical, and other straight lines from the outset.

In Section B, students use a table of values to draw the graphs of straight lines, before gradient is even mentioned. The students should think about the form of an equation which results in a straight line.

Gradients are introduced in Section C, to give students somewhere to go beyond what was done in Year 7. The gradient formula is not given yet, and gradient calculations are only done in terms of horizontal and vertical steps. In this Section students are asked to relate the equation of a line to its gradient.

Axes intercepts are studied in Section D, and students are asked to relate the equation of a line to its y-intercept. In the Discussion at the end of Section D, students should find that we cannot find the gradient of a line from its axes intercepts if the line passes through the origin, as both axes intercepts are 0.

Section E brings all this together, relating the equation of a line with its gradient and y-intercepts, and asking students to use this information to draw a graph from an equation.

CHAPTER 15: RATIO

A Ratio
B Equal ratios
C Lowest terms
D Proportions
E Using ratios to divide quantities
F Scale diagrams

Keywords:

- equal ratios
- lowest terms
- proportion
- ratio
- scale
- scale diagram
- scale factor
- simplest form

In Section B, students can determine whether two ratios are equal by multiplying or dividing parts by whole numbers. In Section C, the pairs of ratios may involve fractions or decimals, and cannot as easily be compared by multiplying and dividing parts by whole numbers. This gives motivation to write the ratios in lowest terms, as two ratios are equal if they can be written in the same lowest terms.

In the Discussion at the end of Section C, students should find that, since π is irrational, the ratio cannot be written in terms of whole numbers, so the ratio cannot be written in lowest terms. This is a good example of why we have changed our wording from "simplest form" to "lowest terms". "Simplest form" is somewhat ambiguous, and it could be argued that $\pi : 1$ is in "simplest form"!

Students struggling with the Puzzle at the end of Section E should be encouraged to write the ratios so that the second ratio has twice the total number of parts as the first ratio, to reflect that the second glass has twice the capacity.

CHAPTER 16: RATES AND LINE GRAPHS

- **A** Rates
- **B** Speed
- **C** Density
- **D** Converting rates
- **E** Line graphs

Keywords:

- average speed
- density
- dependent variable
- independent variable
- instantaneous speed
- line graph
- rate
- speed
- travel graph

The Discussion in Section A should emphasise to students that many of the rates we deal with in everyday life are given with respect to time, but students should be able to describe some rates which are not given with respect to time. Examples might include the rate of petrol consumption, or the unit cost of an item (often given in dollars per kg, or dollars per metre).

In the Discussion in Section B, students should find that they would be more interested in instantaneous speed when driving past a police officer or driving past a school, but would be more interested in average speed when planning a holiday road trip or driving to a wedding.

In this edition, we have moved the section on line graphs to the end of the chapter. In the previous edition, most of the line graphs were travel graphs, so the line graphs section was placed after the section on speed. Placing the line graphs section at the end of the chapter allows a greater variety of rate problems to be explored. The section also absorbs some of the material that was in the Linear relationships section of the Coordinate geometry chapter in the first edition. Students should be able to recognise the connection between the gradient of a straight line graph and the corresponding rate involved.

The Discussion in Section D is intended to illustrate why it is useful to convert between rates. Students should find that metres per second is more helpful for shorter journeys, but kilometres per hour is more helpful for longer journeys.

CHAPTER 17: PROBABILITY

- **A** Probability
- **B** Sample space
- **C** Theoretical probability
- **D** Independent events
- **E** Experimental probability
- **F** Probabilities from tabled data
- **G** Probabilities from two-way tables
- **H** Probabilities from Venn diagrams

Keywords:

- 2-dimensional grid
- certain
- complement
- complementary event
- compound events
- experimental probability
- frequency
- impossible
- independent events
- outcome
- probability
- relative frequency
- sample space
- theoretical probability
- two-way table

To achieve a better progression of difficulty for probability through Years 6 to 8, some concepts which were in Year 8 have been moved to Year 7, and material which was previously in Year 9 has been moved here to Year 8.

In this edition, since complementary events has been introduced in previous years, it is not presented in its own section here, instead it is addressed as part of Section A.

In Section B, two-dimensional grids have been included in the ways to illustrate a sample space. Two-dimensional grids are then used to find probabilities in Section C.

Section D (Independent events) have been moved here from Year 9. This will help students become acquainted with the idea of multiplying probabilities.

In the Discussion at the end of Section D, students should recognise that two events are not always independent. Examples of events which depend on each other could include selecting two balls from a bag without replacing the first ball before selecting the second ball. Students may benefit from considering more subtle examples, such as rolling an odd number and rolling a prime number when rolling a dice. These events are not independent, since rolling an odd number makes it more likely that you have rolled a prime number.

This Discussion leads on to an Activity about dependent events. This Activity asks students how the rule for independent events should be adjusted when dealing with dependent events. This concept will be explored more formally in Year 9.

The more able students should enjoy attempting the Puzzle at the end of Section H. The prisoner can maximise his probability of living by placing one white marble in one bowl, and all the other marbles in the other bowl. Students may have trouble actually calculating the probability the prisoner will live in this case, as finding it involves calculating probabilities for dependent events. However, the process is quite intuitive in this case, so students may calculate the probabilities without realising they are dealing with dependent events.

CHAPTER 18: STATISTICS

- **A** Data collection
- **B** Categorical data
- **C** Numerical data
- **D** Grouped data
- **E** Stem-and-leaf plots
- **F** Measures of centre and spread
- **G** Measures of centre and spread from a frequency table

Keywords:

- biased sample
- bimodal
- categorical data
- categorical variable
- census
- class interval
- column graph
- data
- dot plot
- frequency
- horizontal bar chart
- mean
- median
- modal class
- mode
- numerical data
- numerical variable
- outlier
- pie chart
- population
- range
- sample
- statistical enquiry
- statistics
- stem-and-leaf plot
- tally
- tally and frequency table
- variable

We begin this chapter with the Data collection section which was previously at the end of the chapter. The reasons for this are twofold:

- for consistency with the Statistics chapter in Year 7
- to mirror the steps of a statistical investigation, where identifying the population of interest and collecting a sample is often at the *start* of the process

As such, the exercise questions have been adjusted to elicit more qualitative responses.

The Activity at the end of Section A is new and allows students to explore *how* a "good" sample can be selected.

Grouped data and Stem-and-leaf plots have been made into their own sections. We felt this was necessary as grouped data is new for Year 8 and hence requires more careful attention, whereas the latter should be revision from Year 7.

The Measures of centre and spread section has been split into two: Measures of centre and spread and Measures of centre and spread from a frequency table. The latter contains content which is new for this year level. However, we have removed most of the theory for it, as we feel that a worked example is sufficient for demonstrating the procedure.

Outliers are revisited in the Investigation at the end of Section F in the context of measures of centre.

CHAPTER 19: TRANSFORMATIONS AND CONGRUENCE

- **A** Translations
- **B** Reflections
- **C** Rotations
- **D** Congruent figures
- **E** Using transformations to define congruence
- **F** Congruent triangles
- **G** Proof using congruence

Keywords:

- centre of rotation
- congruent figures
- congruent triangles
- image
- mirror line
- object
- reflection
- rotation
- translation

This chapter starts by considering translations, reflections, and rotations. For all of these transformations, the image is congruent to the original object.

In the Discussion in Section B, students should find that, if the vertices of a polygon are labelled in clockwise order, the vertices of its reflection will be labelled in anticlockwise order.

The Discussion at the end of Section C should lead students to the conclusion that, for all of the transformations studied, the size and shape of the figure does not change. This leads into the idea of congruent figures in Section D, and using transformations to define congruence in Section E.

In the Discussion at the end of Section F, students should conclude that quadrilaterals with equal corresponding sides are not necessarily congruent. A good example of this is a square with all sides 5 cm, and a rhombus with all sides 5 cm.

In Section G, when using congruence to prove properties of special polygons, students should be reminded not to use the properties of the shapes to establish congruence, as these are the properties we are trying to prove. They should only use the information given in the diagram. This is where it is important to distinguish between the *definition* of a shape, and its *properties*.

CHAPTER 20: PROBLEM SOLVING

- **A** Writing problems as equations
- **B** Problem solving with algebra
- **C** Solution by search
- **D** Solutions by working backwards
- **E** Miscellaneous problems
- **F** Lateral thinking

Keywords:

- proof by exhaustion

In this final chapter of the book, we provide some general strategies for solving problems given in word form.

The section on Measurement problems in the first edition has been removed, and the problems in that section have been moved to the measurement chapters where appropriate.

In Section E, students are given a range of questions, and they must choose one of the strategies encountered in Sections A to D to solve the problem.

In Section F, students may need to use strategies they have not seen before to solve the problem. Students should be encouraged to "think outside the box" with these problems. We hope that this section will show students mathematics and lateral thinking can be used to solve some interesting and thought-provoking problems.