



9

Cambridge**MATHS** NSW

STAGE 5 – CORE AND STANDARD PATHS

THIRD EDITION

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Contents

<i>About the authors</i>	<i>viii</i>
<i>Acknowledgements</i>	<i>x</i>
<i>Introduction</i>	<i>xi</i>
<i>Guide to the working programs in exercises</i>	<i>xiii</i>
<i>Guide to this resource</i>	<i>xiv</i>

1

Integers, decimals, fractions, ratios and rates

2

Strand: Number and Algebra

Warm-up quiz	4
1A Adding and subtracting positive and negative integers CONSOLIDATING	6
1B Multiplying and dividing positive and negative integers CONSOLIDATING	11
1C Decimal places and significant figures (Core)	17
1D Rational numbers and irrational numbers CONSOLIDATING	23
1E Adding and subtracting fractions CONSOLIDATING	30
Progress quiz	35
1F Multiplying and dividing fractions CONSOLIDATING	36
1G Ratios CONSOLIDATING	42
1H Rates CONSOLIDATING	47
Maths@Work: Cooks and chefs	54
Working mathematically: Painting makeover	56
Puzzles and challenges	58
Chapter summary	59
Chapter checklist with success criteria	60
Chapter review	63

2

Financial mathematics

66

Strand: Number and Algebra

Warm-up quiz	68
2A Percentages, fractions and decimals CONSOLIDATING	69
2B Applying percentages CONSOLIDATING	75
2C Percentage increase and decrease CONSOLIDATING	79
2D Profits and discounts CONSOLIDATING	85
2E Income (Core)	91
Progress quiz	97
2F Taxation (Core)	98
2G Simple interest (Core)	103
2H Applications of simple interest (Core)	108
Maths@Work: Online cake-decorating business	113
Working mathematically: Saving for a holiday	115
Puzzles and challenges	117

Chapter summary	118
Chapter checklist with success criteria	119
Chapter review	121

3 Expressions and equations 124

Strand: Number and Algebra

Warm-up quiz	126
3A Algebraic expressions CONSOLIDATING	127
3B Adding and subtracting algebraic expressions CONSOLIDATING	135
3C Multiplying and dividing algebraic expressions CONSOLIDATING	140
3D Expanding algebraic expressions (Core)	145
3E Linear equations with a pronumeral on one side CONSOLIDATING	151
3F Linear equations involving fractions (Core)	156
Progress quiz	161
3G Linear equations involving brackets (Core)	162
3H Equations with pronumerals on both sides (Core)	166
3I Using linear equations to solve problems (Core)	171
3J Using formulas (Core)	177
Maths@Work: Plumber	183
Working mathematically: Theme parks	185
Puzzles and challenges	187
Chapter summary	188
Chapter checklist with success criteria	189
Chapter review	191

4 Right-angled triangles 194

Strand: Measurement and Space

Warm-up quiz	196
4A Exploring Pythagoras' theorem CONSOLIDATING	197
4B Finding the length of the hypotenuse CONSOLIDATING	202
4C Finding the lengths of the shorter sides CONSOLIDATING	208
4D Using Pythagoras' theorem to solve two-dimensional problems CONSOLIDATING	213
4E Introducing the trigonometric ratios (Core)	219
4F Finding unknown sides (Core)	226
Progress quiz	233
4G Solving for the denominator (Core)	235
4H Finding unknown angles (Core)	241
4I Using trigonometry to solve problems (Core)	247
Maths@Work: Carpenter	253
Working mathematically: Viewing angle	255
Puzzles and challenges	257
Chapter summary	258

Chapter checklist with success criteria	259
Chapter review	261

5 Linear relationships 266

Strand: Number and Algebra

Warm-up quiz	268
5A Points and lines on the Cartesian plane (Core)	269
5B The x -intercept and y -intercept (Core)	277
5C Graphing straight lines using intercepts (Path) EXTENDING	283
5D Lines with only one intercept (Core)	288
5E Gradient from rise and run (Core)	295
5F Gradient and direct variation	304
5G Gradient–intercept form (Core)	310
Progress quiz	317
5H Finding the equation of a line using $y = mx + c$ (Core)	319
5I Midpoint and length of a line segment from diagrams (Core)	325
5J Linear relationships in real-life contexts (Core)	331
Maths@Work: Trading in foreign currencies	336
Working mathematically: Running in a triathlon	338
Puzzles and challenges	340
Chapter summary	341
Chapter checklist with success criteria	342
Chapter review	345

Semester review 1 350

6 Length, area, surface area and volume 358

Strand: Measurement and Space

Warm-up quiz	360
6A Length and perimeter CONSOLIDATING	361
6B Circumference of circles and perimeter of sectors CONSOLIDATING	367
6C Area of quadrilaterals and triangles CONSOLIDATING	373
6D Area of circles CONSOLIDATING	380
6E Perimeter and area of composite shapes (Core)	385
6F Surface area of prisms (Core)	391
Progress quiz	397
6G Surface area of cylinders (Core)	399
6H Volume of prisms (Core)	404
6I Volume of cylinders (Core)	411
Maths@Work: Vegetable and fruit growers	416
Working mathematically: Pressing a new road	418
Puzzles and challenges	420

Chapter summary	421
Chapter checklist with success criteria	422
Chapter review	424

7 Indices 428

Strand: Number and Algebra

Warm-up quiz	430
7A Index notation (Core)	431
7B Index laws for multiplying and dividing (Core)	440
7C The zero index and power of a power (Core)	447
7D Index laws extended (Core)	453
7E Negative indices (Core)	460
Progress quiz	466
7F Scientific notation (Core)	467
7G Scientific notation using significant figures (Core)	472
Maths@Work: Lab technician	479
Working mathematically: Rabbits and hares	481
Puzzles and challenges	483
Chapter summary	484
Chapter checklist with success criteria	485
Chapter review	487

8 Properties of geometrical figures 490

Strand: Measurement and Space

Warm-up quiz	492
8A Angles and triangles CONSOLIDATING	493
8B Parallel lines CONSOLIDATING	504
8C Quadrilaterals CONSOLIDATING	511
8D Polygons (Path) EXTENDING	517
Progress quiz	524
8E Enlargement and similar figures (Core)	525
8F Applying scale factor to similar triangles (Core)	533
Maths@Work: Animator	538
Working mathematically: Ocean ironman	540
Puzzles and challenges	542
Chapter summary	543
Chapter checklist with success criteria	544
Chapter review	546

9 Quadratic expressions and algebraic fractions 550

Strand: Number and Algebra

Warm-up quiz	552
9A Reviewing algebra CONSOLIDATING	553
9B Expanding binomial products (Core)	558
9C Expanding perfect squares (Core)	563

9D	Difference of two squares (Core)	569
9E	Using HCF to factorise algebraic expressions	
	CONSOLIDATING	573
	Progress quiz	578
9F	Simplifying algebraic fractions: multiplication and division (Core)	579
9G	Simplifying algebraic fractions: addition and subtraction (Core)	585
	Maths@Work: Automotive technology	590
	Working mathematically: Square castle moats	592
	Puzzles and challenges	594
	Chapter summary	595
	Chapter checklist with success criteria	596
	Chapter review	597

10

Probability and data analysis

600

Strand: Statistics and Probability

	Warm-up quiz	602
10A	Probability review CONSOLIDATING	603
10B	Venn diagrams and two-way tables (Path) EXTENDING	612
10C	Using arrays for two-step experiments (Core)	622
10D	Using tree diagrams (Core)	629
10E	Using relative frequencies to estimate probabilities (Core)	635
10F	Mean, median, mode and range CONSOLIDATING	640
	Progress quiz	646
10G	Interpreting data from tables and graphs (Core)	648
10H	Stem-and-leaf plots (Core)	659
10I	Grouping data into classes (Core)	667
	Maths@Work: Personal trainer	675
	Working mathematically: The missing data	677
	Puzzles and challenges	679
	Chapter summary	680
	Chapter checklist with success criteria	681
	Chapter review	683

Semester review 2

688

Answers	697
Index	773

About the authors



Stuart Palmer was born and educated in NSW. He is a fully qualified high school mathematics teacher with more than 25 years' experience teaching students from all walks of life in a variety of schools. He has been Head of Mathematics in two schools. He is well known by teachers throughout the state for the professional learning workshops he delivers. Stuart also assists thousands of Year 12 students every year as they prepare for their HSC Examinations. At the University of Sydney, Stuart spent more than a decade running tutorials for pre-service mathematics teachers.



David Greenwood is the Head of Mathematics at Trinity Grammar School in Melbourne and has 25+ years' experience teaching mathematics from Years 7 to 12. He has run numerous workshops within Australia and overseas regarding the implementation of the Australian Curriculum and the use of technology for the teaching of mathematics. He has written more than 30 mathematics titles and has a particular interest in the sequencing of curriculum content and working with the Australian Curriculum proficiency strands.



Sara Woolley was born and educated in Tasmania. She completed an Honours degree in Mathematics at the University of Tasmania before completing her education training at the University of Melbourne. She has taught mathematics in Victoria from Years 7 to 12 since 2006 and is currently a Head of Mathematics. She has written more than 15 mathematics titles and specialises in lesson design and differentiation.



Jennifer Vaughan has taught secondary mathematics for more than 30 years in New South Wales, Western Australia, Queensland and New Zealand, and has tutored and lectured in mathematics at Queensland University of Technology. She is passionate about providing students of all ability levels with opportunities to understand and to have success in using mathematics. She has had extensive experience in developing resources that make mathematical concepts more accessible and hence, facilitating student confidence, achievement and an enjoyment of maths.



Jenny Goodman has taught in schools for more than 25 years and is currently teaching at a selective high school in Sydney. Jenny has an interest in the importance of literacy in mathematics education, and in teaching students of differing ability levels. She was awarded the Jones Medal for Education at Sydney University and the Bourke Prize for Mathematics. She has written for *CambridgeMATHS NSW* and was involved in the *Spectrum* and *Spectrum Gold* series.



Karen McDaid has more than 20 years' experience teaching mathematics in primary and secondary schools, and as a lecturer teaching mathematics education to primary pre-service teachers at university. As an executive member and Past President of the Mathematics Association of NSW, she has been heavily involved in Mathematics K–10 Curriculum Consultation in NSW and across Australia. Karen co-authored the *CambridgeMATHS NSW GOLD* books Years 7 to 10. Karen is currently working in primary mathematics education at The Australian Catholic University.

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Introduction

The third edition of CambridgeMATHS NSW Stages 4 and 5 has been carefully prepared for the NSW Syllabus implemented from 2024 onwards. The series is packed with new features. It is intended for students across a wide range of ability levels and has been designed to provide the best possible preparation for students as they make their way from the end of Stage 3 towards Stage 6 mathematics.

Coverage of Core and optional Path topics in Stage 5

As with the previous editions, Stage 5 is covered with two differentiated pairs of books:

- The *Core & Standard Paths* books replace the old Stage 5.1/5.2 books,
- The *Core & Advanced/Extension Paths* books replace the Stage 5.1/5.2/5.3 books.

Care has been taken to choose the content in each book carefully and to present it in a way that reflects the spirit of the new syllabus as well as the practicalities of the classroom. ‘Paths’, in the plural, refers to the fact that the Path topics are optional, and that a student’s journey through Stage 5 may incorporate the core content in combination with none, some or all the Path topics in the books, depending upon the student’s needs. Detailed teaching programs and Scope and Sequence documents are available via the Online Teaching Suite.

Beyond Stage 5

Students who have used these *Core & Standard Paths* books in Years 9 and 10 will be thoroughly prepared for Year 11 Mathematics Standard. These books are not recommended for students who have aspirations of studying Mathematics Advanced in Stage 6.

Learning Intentions, Success Criteria checklist, and ‘Past, present and future learning’

Every lesson now includes a set of Learning Intentions that describe what the student can expect to learn in the lesson. At the end of the chapter, these appear again in the form of a checklist of Success Criteria; students can use this to check their progress through the chapter. Every criterion is listed with an example question to remind students of what the mathematics mentioned looks like. These checklists can also be downloaded and printed so that students can physically check them off as they accomplish their goals.

Also included at the beginning of each section, under the Learning Intentions, is a short set of dot points that place the topic at hand in the context of **past, present and future learning**.

Now you try

Every worked example now contains additional questions, without solutions, called ‘Now you try’, which give students immediate practice at the same type of question as the example. We also anticipate these questions will be useful for the teacher to do in front of the class, given that students will not have seen the solution beforehand.

Working Mathematically tasks

A Working Mathematically activity now accompanies an Investigation in each chapter, with the goal of familiarising students with using the Working Mathematically process to define, solve, verify and then communicate their solutions when solving non-routine problems.

Maths@Work

An activity called ‘Maths@Work’ is now included at the end of every chapter. The intention of these activities is to show students how the maths learnt in the chapter is relevant to the workplace in a range of industries. The first part of the activity involves students doing the work by hand, while the second part involves the use of technology – often spreadsheets – to allow for greater efficiency, power and accuracy.

Guide to the working programs in exercises

The suggested working programs in the exercises in the Year 9 and 10 Core & Standard Paths books provide two pathways to allow differentiation for Building and Progressing students (schools will have their own names for different ability levels or streams).

Each exercise is structured in subsections that match the working mathematically components of Understanding, Fluency, Problem-solving and Reasoning, as well as Enrichment (Challenge). In the exercises, the questions suggested for each pathway are listed in two columns at the top of each subsection:

- The left column (lightest shaded colour) is the Building pathway
- The right column (darkest shaded colour) is the Progressing pathway.

Building	Progressing
UNDERSTANDING	
1–4	4
FLUENCY	
5–7($\frac{1}{2}$)	5–8($\frac{1}{2}$)
PROBLEM-SOLVING AND REASONING	
9–10	10–12
ENRICHMENT: The missing y-intercept	
–	13

The working program for Exercise 5G in Year 9. The questions recommended for a Building student are: 1, 2, 3, 4, 5, 6, 7($\frac{1}{2}$), 9 and 10.

Gradients within exercises and proficiency strands

The working programs make use of the two difficulty gradients contained within exercises. A gradient runs through the overall structure of each exercise – where there is an increasing level of mathematical sophistication required from Understanding to Fluency through to Problem-solving and Reasoning, and Enrichment – but also within each Working Mathematically component; the first few questions in Fluency, for example, are easier than the last Fluency question.

The right mix of questions

Questions in the working programs are selected to give the most appropriate mix of *types* of questions for each learning pathway. Students going through the Building pathway should use the left tab, which includes all but the hardest Understanding and Fluency questions as well as the easiest Problem-solving and Reasoning questions. The Progressing pathway, while not challenging, spends a little less time on basic Understanding questions and a little more time on Fluency and Problem-solving and Reasoning questions.

Choosing a pathway

There are a variety of ways to determine the appropriate pathway for students through the course. Schools and individual teachers should follow the method that works for them. If required, the Warm-up quiz at the start of each chapter can be used as a tool for helping students select a pathway. The following are recommended guidelines:

- A student who gets 40% or lower should heavily revise core concepts before attempting the Buildings questions.
- A student who gets above 40% and below 75% should complete the Building questions
- A student who gets 75% or higher should complete the Progressing questions.

* The nomenclature used to list questions is as follows:

- 3, 4: complete all parts of questions 3 and 4
- 1–4: complete all parts of questions 1, 2, 3 and 4
- 10($\frac{1}{2}$): complete half of the parts from question 10 (a, c, e, or b, d, f,)
- 2–4($\frac{1}{2}$): complete half of the parts of questions 2, 3 and 4
- 4($\frac{1}{2}$), 5: complete half of the parts of question 4 and all parts of question 5
- — : complete none of the questions in this section.

Guide to this resource

PRINT TEXTBOOK FEATURES

- 1 NSW Syllabus:** content strands, outcome groups and outcomes are listed at the beginning of the chapter to assist with course planning (see teaching programs and Syllabus mapping grids for more detailed guidance)
- 2 Chapter introduction:** sets context for students about how the topic connects with the real world and the history of mathematics
- 3 Warm-up quiz:** a quiz for students on the prior knowledge and essential skills required before beginning the chapter
- 4 NEW Learning intentions:** sets out what a student will be expected to learn in the lesson
- 5 NEW Past, present and future learning:** shows how the lesson builds on previous or extends to future lessons in the context of the syllabus
- 6 Lesson starter:** an activity, which can often be done in groups, to start the lesson
- 7 Key ideas:** summarises the knowledge and skills for the lesson
- 8 Worked examples:** solutions and explanations of each line of working, along with a description that clearly describes the mathematics covered by the example
- 9 NEW Now you try:** try-it-yourself questions provided after every worked example in exactly the same style as the worked example to give immediate practice

The image shows a textbook page for '28 Applying percentages'. It includes sections for Learning intentions, Past, present and future learning, Lesson starter, Key ideas, Worked example, Now you try, Exercise 28, and Working programs. Red numbers 4 through 11 are placed around the page to indicate specific features: 4 points to Learning intentions, 5 to Past, present and future learning, 6 to Lesson starter, 7 to Key ideas, 8 to Worked example, 9 to Now you try, 10 to Exercise 28, and 11 to Working programs.

- 10 Gentle start to exercises:** the exercise begins at Understanding to ensure comprehension of the lesson's Key Ideas before progressing to the other Working Mathematically components
- 11 Working programs:** differentiated question sets for two ability levels in exercises

- 12 NEW Progress quiz** about two-thirds of the way through each chapter provides a check-in to establish how students are going with the topic so far
- 13 NEW Maths@Work:** a set of questions that gives practice at applying the mathematics of the chapter to real-life contexts
- 14 NEW Working Mathematically investigative tasks:** in each chapter that apply the Working Mathematically process to the topic to give students guided practice
- 15 Puzzles and challenges:** in each chapter provide problem-solving practice in the context of puzzles and challenges connected with the topic
- 16 NEW Chapter checklist with success criteria:** a checklist of the learning intentions for the chapter, with example questions
- 17 Chapter reviews:** with short-answer, multiple-choice and extended-response questions; questions that are extension are clearly signposted

Online cake-decorating business

More and more people are setting up businesses using the internet. For example, a successful cake-decorating business can be run from home while looking after the kids or while working normal business hours at other jobs.

As with any business, an understanding of financial mathematics is important to the success of the business. Skills such as calculating costs and profits, percentages and taxation are important for any business.

1 Calculate the total cost of buying each of the following cake tin sets:
Round set: 6, 8, 9 and 12 inches by 3 inches deep at \$64.
Round set: 6, 8, 10 and 12 inches by 4 inches deep at \$69.
Square set: 6, 8 and 10 inches by 3 inches deep at \$45.
Square set: 6, 8, 10 and 12 inches by 4 inches deep at \$46.

2 Convert the following measurements from inches (US standard) to whole number of centimetres by using the following conversion rate: 1 inch = 2.54 cm.
a 3 inches b 4 inches c 9 inches d 10 inches

3 Imagine that you spend 2 hours out of $\frac{7}{8}$ work hours on the internet promoting your business. Write this as a percentage, rounded to the nearest whole percentage.

4 Fonda is using cakes in different colours and in different-sized tins. Managing your budget means looking for the best buy.

5 Which of the following represents the best buy for each colour of fondant listed below?

White fondant	Red fondant	Blue fondant
100 g at \$1.25	75 g at \$1.50	100 g at \$1.25
50 g at \$1.25	1 kg at \$1.10	500 g at \$1.25
4 kg at \$4.00	100 g at \$1.25	750 g at \$1.10
2 kg at \$2.00	100 g at \$1.25	2 kg at \$1.25

b What is the average cost per 100 grams for white fondant icing?

c Under what circumstances would someone buy a size that was not the best buy?

6 A customer has the following queries for a large 21st birthday cake from four different online cake suppliers: \$108, \$266, \$228 and \$215.

For each of the following, state answers to the nearest whole number.

a What is the mean or average cost for this type of cake?

b What is the percentage change from the lowest price to the highest price?

Chapter checklist with success criteria

A printable version of this checklist can be downloaded from the Interactive Textbook.

1 I can convert between percentages and fractions.
e.g. 80% a) as a percentage b) 17.5% as a fraction

2 I can convert between percentages and decimals.
e.g. 80% a) 0.8 as a percentage b) 72% as a decimal

3 I can write a quantity as a percentage.
e.g. 80% of 10 is 8 or 80% of 10 is 80%

4 I can find a percentage of a quantity.
e.g. Find 15% of 379

5 I can find the original amount from a percentage.
e.g. Determine the original amount if 115% of the amount is \$72

6 I can increase and decrease by a percentage.
e.g. a) Increase 300 by 12% b) Decrease 540 by 8%

7 I can find a percentage change.
e.g. The price of a game membership increased from \$320 to \$376. Find the percentage increase correct to one decimal place.

8 I can find the original amount after an increase or decrease.
e.g. A decrease of 25% reduced the population of a town to 1015. What was the original population of the town?

9 I can calculate the selling price from a mark-up or discount.
e.g. A store makes an 8% profit on goods by \$2.10. If the cost of a fridge is \$1 100, what will be its selling price?

10 I can determine percentage profit.
e.g. A retail trader makes a profit of 10% and sells them for \$1.1. Find the profit and express this as a percentage of the original price.

11 I can calculate the original price before discount.
e.g. A department store discounts all Christmas items by 15%. If the sale price of a new train is \$16.25, what was the original price?

12 I can compare expenses and salaries.
e.g. Tony has an annual salary of \$50 000 and Joelle earns \$72 per hour. Calculate a) Tony's hourly rate of pay b) Joelle's hourly rate of pay c) Joelle's annual salary d) Joelle's quarterly income if she works an average 22 hours per week.

14

Running in a triathlon

Jack, Levi and Max compete in a junior triathlon event, first swimming 200 m, then cycling 12 km and finally running 10 km.

Jack was the first to start the running leg and he runs at an average speed of 7 m/s. Levi runs at 5.5 m/s and Max runs at 4 m/s. However, Max and Levi take longer to complete the swimming and cycling and start the run after Jack started. Calculate the time each runner took to complete the triathlon.

Find the rank of runners in the distance travelled by a runner and seconds in the time to complete after Jack starts running.

Write a report for the following tasks and ensure that you show clear mathematical workings, explanations and diagrams where appropriate.

Working problems

a Find the time, in seconds, when Max runs 1200 m at an average speed of 4 m/s.
b Write an equation for distance of a runner when running at a speed of 4 m/s.
c An equation describing a different runner is given by $d = 2.5 - 30t$. Let $d = 1200$ and solve the equation to find the runner's finishing time.

Non-routine problems

Explain how Jack's times of the first, second and third legs compare and their time differences.
a Write down all the relevant information that will help solve the problem.
b Using a table, a graph of paper or digital graphing software, progress over time shows three lines. One red line, a horizontal axis showing time from 0 to 100 seconds and a vertical axis showing distance of 0 to 1200 m.

Problem-solving

a Write down all the relevant information that will help solve the problem.
b Using a table, a graph of paper or digital graphing software, progress over time shows three lines. One red line, a horizontal axis showing time from 0 to 100 seconds and a vertical axis showing distance of 0 to 1200 m.

Extension problem

A fourth runner, Eliza, started 10 seconds after Jack started and finished at the same time as Jack.
a Answer the following questions about the line on the graph that would show Eliza's run.
i State the coordinates of the start and point that would be on Eliza's line.
ii Calculate the gradient of this line that joins these two points.
iii What feature of Eliza's running does this problem represent?
iv The line equation is in the form $y = mx + c$. Find the values of m and c , and hence the equation of the line that would represent Eliza's run.

17

Short-answer questions

1 Express each of the following in index form.
a $3 \times 3 \times 3 \times 3$ b $2 \times 2 \times 2 \times 2 \times 2$
c $3 \times 3 \times 3 \times 3 \times 3$ d $2 \times 2 \times 2 \times 2 \times 2$

2 Write the following as a product of prime factors in index form.
a 45 b 300

3 Simplify using index laws.
a $3^4 \times 3^5$ b $2a^3 \times 3a^2 \times 4a$ c $3a^2 \times 3a^3 \times 3a^4$
d $a^3 \times a^4$ e $a^3 \times a^4$ f $a^3 \times a^4 \times a^5$

4 Simplify:
a $(a^2)^3$ b $(3a^2)^3$ c $-3a^2 \times 3a^3$ d $3a^3 \times 2a^3 \times 3a^3$ e $\frac{3a^3}{4a^2}$

5 Express each of the following with positive indices.
a 2^{-3} b 3×4^{-2} c 6×10^{-2} d $\frac{5}{1000}$ e $\frac{1}{10000}$

6 The index laws to simplify each of the following.
a $\frac{3a^2 \times 4a^3}{5a^4}$ b $\frac{2a^3 \times 3a^2}{4a^5}$ c $\frac{3a^2 \times 4a^3}{5a^4}$ d $\frac{3a^2 \times 4a^3}{5a^4}$
e $\frac{3a^2 \times 4a^3}{5a^4}$ f $\frac{3a^2 \times 4a^3}{5a^4}$

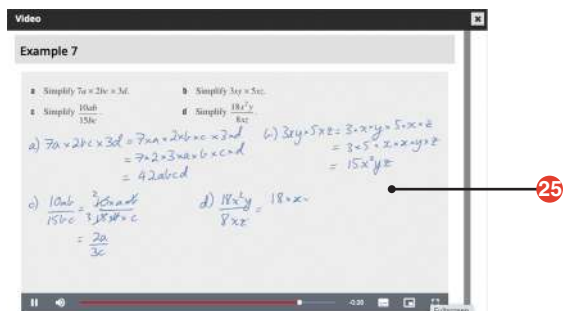
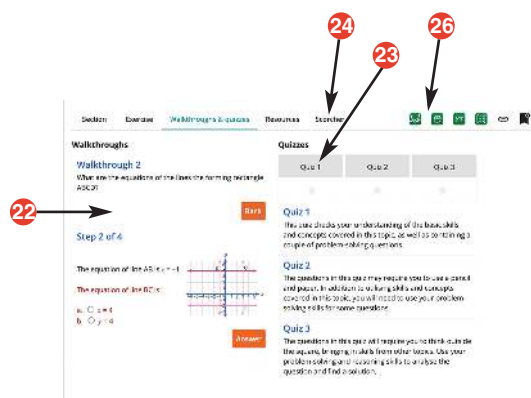
7 Write each of the following numbers as a basic numeral.
a 3.2×10^3 b 1.23×10^4 c 2.75×10^5 d 4.8×10^6

8 Write each of the following using scientific notation correct to three significant figures.
a The population of Australia in 2010 was approximately 22 473 000.
b The area of the USA is 9 529 000 km².
c The time taken for light to travel 1 metre (a vacuum) is 0.0000000333565 seconds.
d The wavelength of ultraviolet light is 0.000000299 m.

9 Write each of the following using scientific notation in the units given in brackets.
a 1 metre = 1000 mm
b 270 years (years)
c 3 million years (months)
d 450 tonnes (kg)
e 5 tonnes (grams)

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- 19 **Workspaces**: almost every textbook question – including all working-out – can be completed inside the Interactive Textbook by using either a stylus, a keyboard and symbol palette, or uploading an image of the work
- 20 **Self-assessment**: students can then self-assess their own work and send alerts to the teacher. See the Introduction on page xi for more information.
- 21 **Interactive working programs** can be clicked on so that only questions included in that working program are shown on the screen
- 22 **HOTmaths resources**: a huge catered library of widgets, HOTsheets and walkthroughs seamlessly blended with the digital textbook
- 23 A revised set of **differentiated auto-marked practice quizzes** per lesson with saved scores
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- 37 Worksheets and two differentiated chapter tests in every chapter**, provided in editable Word documents
- 38 More printable resources:** all warm-up quizzes, Progress quizzes and Working Mathematically tasks are provided in printable worksheet versions

33

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38

Student Name	Exercise Level 1	Exercise Level 2	Exercise Level 3
Student 1	Feb 27, 2018 100% complete	Jan 31, 2018 100% complete	
Student 2	Jan 25, 2018 100% complete	Jan 31, 2018 100% complete	
Student 3	Feb 1, 2018 100% complete	Jan 31, 2018 100% complete	
Student 4	Jan 25, 2018 100% complete	Jan 31, 2018 100% complete	