

YEAR

8

Mathematics

STUDENT COMPANION



Pearson

Secondary
Teaching Hub

Pearson Secondary Teaching Hub Maths 8 Student Companion

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459–471 Church Street
Level 1, Building B
Richmond, Victoria 3121
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First published 2024 by Pearson Australia
2027 2026 2025 2024
10 9 8 7 6 5 4 3 2 1

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Series Design: Watershed Art

Typesetters: Integra Software Services

Desktop Operator: Jit-Pin Chong

Printed in Australia by Pegasus

ISBN 978 0 6557 1383 8

Pearson Australia Group Pty Ltd ABN 40 004 245 943

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SAMPLE PAGES

How to use this Student Companion

The *Student Companion* is a complementary resource that offers a print medium for corresponding lessons in *Pearson Secondary Teaching Hub*. It is designed to support teaching and learning by providing learners with a place to create a portfolio of learning to suit their individual needs, whether you are:

- supporting a blended classroom using the strengths of print and digital
- preparing for exams by creating a study guide or bound reference
- needing a tool to differentiate learning or
- looking for meaningful homework tasks.

Learners can develop their portfolio of learning as part of classroom learning or at home as an additional opportunity to engage and re-engage with the knowledge and skills from the lesson.

This could be done as prior learning in a flipped classroom environment or as an additional revision or homework task.

Learning intention and success criteria

Multiply and divide integers

Learning intention: To be able to multiply and divide integers

Success criteria:

SC 1: I can multiply two integers.

SC 2: I can divide two integers.

SC 1: I can multiply two integers

Worked example: Multiplying integers

Learning intentions are provided for every lesson. The learning intentions are goals or objectives that align to the corresponding digital lesson. They describe what learners should know, understand or be able to do by the end of the lesson.

Success criteria clarify expectations and describe what success looks like. The success criteria are specific, concrete and measurable so learners can actively engage with and reflect on their evidence of learning within each lesson.

Worked examples

Worked examples provide learners with a step-by-step solution to a problem. The worked examples in the *Student Companion* correspond to those in the digital lesson and are provided for each skill to:

- scaffold learning
- support skill acquisition
- reduce the cognitive load.

The **worked examples** are an effective tool to demonstrate what success looks like. The 'try yourself' format of the worked examples in the *Student Companion* support the gradual release of responsibility. Learners can view a completed worked example and a video walkthrough of the worked example in the corresponding digital lesson and then apply the scaffolded steps themselves to practise independently.

Practice questions are provided in the *Student Companion* so that learners can apply the knowledge and skills obtained in the worked example given. These questions are designed to ensure learners build confidence and demonstrate efficiency. They follow on from the Check your understanding questions beside the corresponding worked example in the digital lesson.

Each lesson in the *Student Companion* contains a space for students to reflect on their understanding. The simple and intuitive design of the **lesson reflection tool** allows students to scale their confidence, reflect on their learning and identify areas in which they need support.

Operations with integers, fractions and decimals

SC 2: I can multiply and divide integers in word problems

Worked example: Solving word problems with integers

The product of two integers is -22 and their sum is 9 . What are the two numbers?

Thinking	Working
List all the factors of -22 .	
A negative product value means the two factors are opposite in sign. Write the possible factor pairings.	
Identify which pair of factors has the required sum.	
Write the answer.	

- 1 Write each word operation and calculate its value.
 - (a) Start with 6 and multiply by 3 . _____
 - (b) Start with -6 and triple it. _____
 - (c) The product of -6 and -3 . _____
 - (d) The quotient of -6 and 3 . _____
- 2 Solve the following problems.
 - (a) The product of two numbers is -10 and their sum is -3 . What are the two numbers?

 - (b) The product of two numbers is -10 and their sum is 3 . What are the two numbers?

- 3 Solve the following problems.
 - (a) The product of two numbers is 14 and their sum is -9 . What are the two numbers?

 - (b) The product of two numbers is 14 and their sum is -15 . What are the two numbers?

- 4 Team A is trailing team B by 6 points after 10 minutes of play in an 80 -minute match. This scoring trend continues throughout the match. What will team A's final score be in relation to team B's?

- 5 An aircraft approaching an airport descends by 12 m every second. What is the total change in the aircraft's height after 15 seconds?

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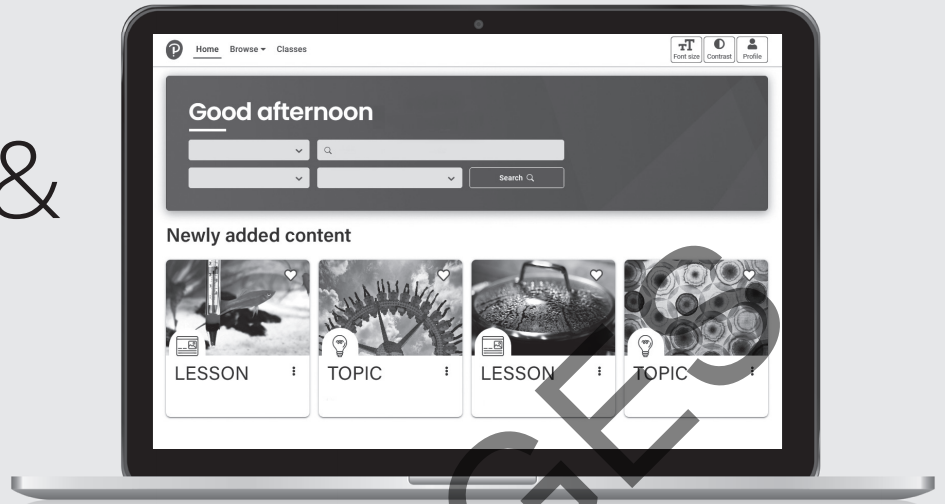


I get it



I am confident

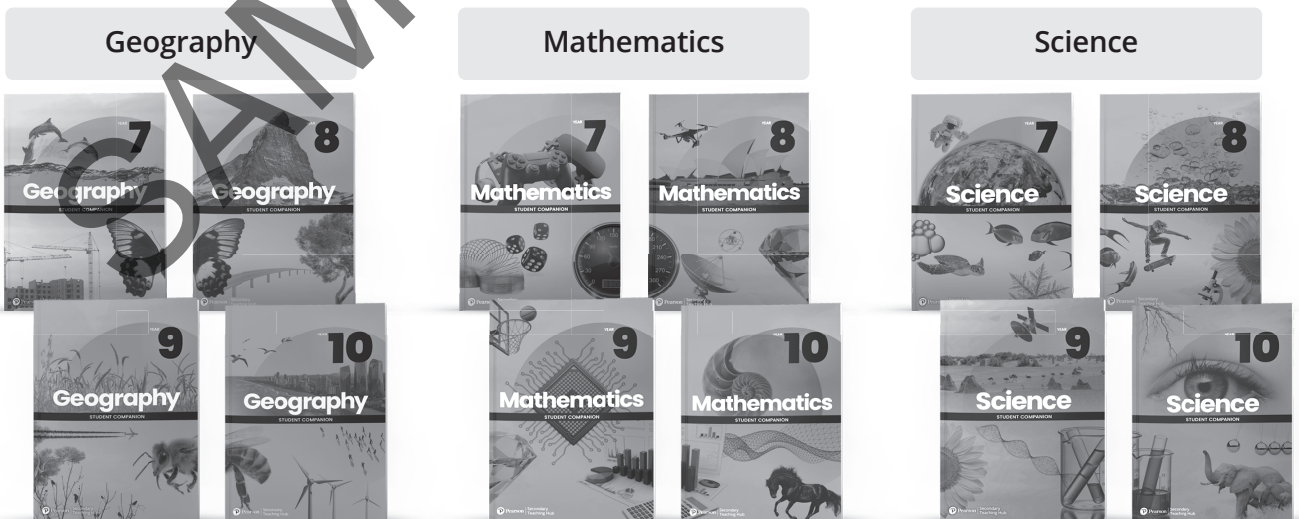
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Number properties

Establish and apply the exponent law for multiplication

Learning intention: To be able to establish and apply the exponent law for multiplication

Success criteria:

- SC 1: I can write the expanded form of a multiplication from exponent form and connect the result to the addition of exponents.
- SC 2: I can multiply numbers using exponent notation.

SC 1: I can write the expanded form of a multiplication from exponent form and connect the result to the addition of exponents

Worked example: Multiplying in expanded form

Multiply $5^4 \times 5^2$. Write your answer in exponent form.

Thinking	Working
Write the terms in expanded form.	
Write the new expression in exponent form.	
Write the answer.	

1 Write the following numbers in expanded form.

(a) 4^1

(b) 4^2

(c) 4^3

(d) 4^4

2 Write the following numbers in exponent form.

(a) 2

(b) 2×2

(c) $2 \times 2 \times 2$

(d) $2 \times 2 \times 2 \times 2$

3 Explain how the exponent form and the expanded form are linked.

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I am confident

Number properties

SC 2: I can multiply numbers using exponent notation

Worked example: Applying the first exponent law

Write the following in simplest exponent form.

(a) $6^4 \times 6^3$

Thinking	Working
Recall the first exponent law.	
To multiply exponent expressions with the same base, add the powers.	
Write the answer.	

(b) $2 \times 2^5 \times 7^2 \times 7^3$

Thinking	Working
Recall the first exponent law.	
To multiply exponent expressions with the same base, add the powers. In this case there are two different bases.	
Write the answer.	

1 Use the first exponent law to write the following in simplest exponent form.

(a) 9×9^2

(b) 9×9^3

(c) $9^3 \times 9^2$

(d) $9^3 \times 9^4 \times 9^5$

2 Write the following in simplest exponent form.

(a) $2^4 \times 2^2$

(b) $5 \times 5^2 \times 5^2$

(c) $7^3 \times 7^5 \times 7^6$

(d) $4^3 \times 4^5 \times 4^5$

3 Write the following in simplest exponent form.

(a) $3 \times 3^2 \times 5 \times 5^3$

(b) $6^4 \times 9^2 \times 9^4$

(c) $3 \times 3^2 \times 3^4 \times 5^3 \times 3^3$

(d) $4^3 \times 4^3 \times 4^3 \times 7^3$

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I am confident

Establish and apply the exponent law for division

Learning intention: To establish and apply the exponent law for division

Success criteria:

- SC 1:** I can write the expanded form of a division from exponent form and connect the result to the subtraction of exponents.
- SC 2:** I can divide numbers using exponent notation.
- SC 3:** I can apply the multiplication and division rules, or a combination of both, to simplify an expression.

SC 1: I can write the expanded form of a division from exponent form and connect the result to the subtraction of exponents

Worked example: Dividing numbers written in exponent form

Express $\frac{3^6}{3^2}$ in simplest exponent form.

Thinking	Working
Write the numerator and denominator in expanded form.	
Recall that any number divided by itself is equal to 1. Cancel common factors.	
Express the result using exponent notation.	
Write the answer.	

1 Write the following in expanded notation, in simplest exponent form and then calculate the answer.

(a) $\frac{3^3}{3}$

(b) $\frac{3^4}{3}$

(c) $\frac{3^4}{3^2}$

(d) $\frac{3^5}{3^2}$

(e) $\frac{3^3}{3^2}$

(f) $\frac{3^5}{3^3}$

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I am confident

Number properties

SC 2: I can divide numbers using exponent notation

Worked example: Applying the second exponent law

Write the following in simplest exponent form.

(a) $6^6 \div 6^2$

Thinking	Working
Recall the second exponent law.	
To divide exponent expressions with the same base, subtract the powers.	
Write the answer.	

(b) $\frac{3^3 \times 5^7}{3^2 \times 5^3}$

Thinking	Working
Recall the second exponent law.	
To divide exponent expressions with the same base, subtract the powers. In this case there are two different bases.	
Write the answer.	

1 Use the second exponent law to simplify the following. Leave your answers in exponent form.

(a) $\frac{8^4}{8}$

(b) $\frac{8^4}{8^2}$

(c) $\frac{8^4}{8^3}$

(d) $\frac{8^6}{8^3}$

2 Use the second exponent law to simplify the following.

(a) $\frac{2^5}{2}$

(b) $\frac{3^{10}}{3^2}$

(c) $\frac{4^9}{4^7}$

(d) $\frac{15^{10}}{15^4}$

3 Use the second exponent law to find the missing exponent in each of the following.

(a) $3^{12} \div 3^x = 3^7$

(b) $7^x \div 7^4 = 7^3$

(c) $\frac{4^8}{4^x} = 4^5$

(d) $\frac{12^x}{12^2} = 12^5$

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SC 3: I can apply the multiplication and division rules, or a combination of both, to simplify an expression

Worked example: Applying the first two exponent laws

Simplify $\frac{9^4 \times 9^7}{9^6}$.

Thinking	Working
Recall the first two exponent laws.	
Use the first exponent law to simplify the multiplication of terms with the same base.	
Use the second exponent law to simplify the division of terms with the same base.	
Write the answer.	

1 Simplify the following.

(a) $\frac{5^3 \times 5^5}{5^4}$

(b) $\frac{5^4 \times 5^5}{5^4}$

(c) $\frac{5^5 \times 5^3}{5^2}$

(d) $\frac{5 \times 5^2 \times 5^4}{5^3}$

2 Simplify the following.

(a) $\frac{4^4 \times 4^7}{4^6}$

(b) $\frac{2^2 \times 2^5}{2^3}$

(c) $\frac{10^4 \times 10^5}{10^3}$

(d) $\frac{8 \times 8^4 \times 8^7}{8^6}$

3 Simplify the following.

(a) $\frac{4^3 \times 4^6 \times 7^3}{4^4}$

(b) $\frac{2^3 \times 2^5}{2^4 \times 9}$

(c) $\frac{5^5 \times 5^4 \times 2^4}{5^2}$

(d) $\frac{7 \times 7^3 \times 7^5}{7^4 \times 12^3}$

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I am confident

Number properties

Establish and apply the exponent law for raising a power to a power

Learning intention: To establish and apply the exponent law for raising a power to a power

Success criteria:

- SC 1: I can use expanded form to simplify a power of a power.
- SC 2: I can use exponent laws to simplify a power of a power.
- SC 3: I can apply the exponent laws of multiplication, division and raising to a power.

SC 1: I can use expanded form to simplify a power of a power

Worked example: Simplifying an exponential expression raised to a power

Simplify $(4^3)^2$. Leave your answer in exponent form.

Thinking	Working
Write the expression in expanded form.	
Use the first exponent law to simplify the multiplication of terms with the same base.	
Write the answer.	

1 Simplify the following by expanding and then applying the first exponent law. Leave your answer in exponent form.

(a) $(2^2)^2$

(b) $(2^2)^4$

(c) $(7^2)^3$

(d) $(7^2)^4$

2 Complete the following table.

Expression	Expansion	Simplified form	Multiplying the exponents
$(4^3)^2$	$4^3 \times 4^3$	4^6	$2 \times 3 = 6$
$(5^4)^2$			
$(15^2)^4$			

3 Explain how to raise a power to a power. You should include an example.

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SC 2: I can use exponent laws to simplify a power of a power

Worked example: Applying the third exponent law

Express $(6^4)^3$ in simplest exponent form.

Thinking	Working
Recall the third exponent law.	
To raise a power to a power, you multiply the exponents. Note that the base number stays the same.	
Write the answer.	

1 Express the following in simplest exponent form.

(a) $(3^2)^3$

(b) $(3^2)^4$

(c) $(3^2)^5$

(d) $(3^3)^3$

(e) $(3^3)^5$

(f) $(3^3)^7$

2 Express the following in simplest exponent form.

(a) $(7^2)^6$

(b) $(4^3)^5$

(c) $(6^4)^3$

(d) $(9^5)^2$

(e) $(10^4)^5$

(f) $(2^5)^4$

3 Express the following in simplest exponent form.

(a) $\left(\left(\frac{2}{5}\right)^2\right)^4$

(b) $\left(\left(\frac{6}{7}\right)^3\right)^5$

(c) $(15.2^3)^4$

(d) $(7.9^4)^5$

(e) $(2.05^5)^3$

(f) $(1.12^4)^4$

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Number properties

SC 3: I can apply the exponent laws of multiplication, division and raising to a power

Worked example: Applying the first three exponent laws

Express $\frac{3^3 \times (3^2)^3}{3^5}$ in simplest exponent form.

Thinking	Working
Use the exponent law to simplify raising a power to a power. To raise a power to a power, multiply the exponents.	
Use the first exponent law to simplify the multiplication of terms with the same base.	
Use the second exponent law to simplify the division of terms with the same base.	
Write the answer.	

1 Simplify the following. Express your answer in simplest exponent form.

(a) $(5^3)^5 \times 5^2$

(b) $(5^3)^5 \times 5^3$

(c) $(5^2)^5 \times 5^2$

(d) $(5^4)^3 \times 5 \times 5^3$

(e) $(4^3)^3 \div 4^2$

(f) $(4^3)^2 \times 4^2 \div 4^5$

(g) $(4^2)^4 \div 4^3$

(h) $(4^4)^3 \div 4^5$

(i) $\frac{7^4 \times 7^8}{(7^2)^5}$

(j) $\frac{2^4 \times 2^5}{(2^2)^4}$

(k) $\frac{10^{10} \times (10^2)^4 \times 10^3}{(10^5)^3}$

(l) $\frac{13 \times (13^3)^4 \times (13^4)^2}{13^{17}}$

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I am confident

Establish and apply the exponent law for raising to the power of 0

Learning intention: To establish and apply the exponent law for raising to the power of 0

Success criteria:

- SC 1: I can demonstrate that any natural number raised to the power of 0 is equal to 1.
- SC 2: I can simplify and evaluate expressions that require multiple exponent laws to be used.

SC 1: I can demonstrate that any natural number raised to the power of 0 is equal to 1

Worked example: Dividing a number written in exponent form by itself

(a) Calculate the value of $\frac{5^3}{5^3}$ by writing the numerator and denominator in expanded form.

Thinking	Working
Write the numerator and denominator in expanded form.	
Recall that any number divided by itself is equal to 1.	
Write the answer.	

(b) Simplify $\frac{5^3}{5^3}$ using the second exponent law.

Thinking	Working
Recall the second exponent law.	
Use the second law to simplify the division of terms with the same base.	
Write the answer.	

(c) What do you conclude from your answers to parts (a) and (b)?

Thinking	Working
Compare the results from parts (a) and (b).	
Write the answer.	

Number properties

1 Complete the following table.

Calculation	Answer	Expanded form	Simplest exponent form answer
$8 \div 8 =$	1		8^0
$6 \div 6 =$			
$3^2 \div 3^2 =$			
$9^3 \div 9^3 =$			
$7^4 \div 7^4 =$			

2 (a) Complete this table.

10^5	10^4	10^3	10^2	10^1	10^0
100000	10000				

(b) Describe the pattern in the exponent values.

(c) Describe the pattern in the value of the numbers.

(d) What does this tell you about the value of 10^0 ?

3 Explain why raising any number to the power of 0 equals 1 (i.e. $x^0 = 1$).

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SC 2: I can simplify and evaluate expressions that require multiple exponent laws to be used

Worked example: Applying the first four exponent laws

Express $\frac{(3^3)^2 \times 5^4}{5^2} \times \frac{5^2}{3^2} \div \frac{5^0}{5^3}$ in simplest exponent form.

Thinking	Working
Use the exponent law to simplify raising a power to a power. To raise a power to a power, multiply the exponents.	
Write the division by a fraction as the multiplication by the inverse fraction.	
Use the first exponent law to simplify the multiplication of terms with the same base.	
Use the second exponent law to simplify the division of terms with the same base.	
Write the answer.	

1 Simplify the following. Write your answer in simplest exponent form.

(a) $\frac{8^0 \times (8^4)^2 \times 7^3}{8^6}$ (b) $\frac{3^5 \times 6^{12}}{3 \times (6^5)^0}$ (c) $\frac{2^4 \times 2^8 \times 10^0}{(2^2)^2}$ (d) $\frac{7^0 \times (7^2)^5 \times 11^4}{7^7 \times 11^2}$

2 Determine the unknown exponent in each of the following.

(a) $2^9 \times 2^0 \div 2^x = 2^6$ (b) $3^x \times 3^7 \div (3^0)^2 = 3^9$

(c) $\frac{2^6 \times 2^0}{2^x} = 2^2$ (d) $\frac{9^x}{9^0 \times 9^2} = (9^5)^2$

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