

INTRODUCTION

What is the *FOCUS* series?

FOCUS is a mathematics-strategy practice series. Each student book in the series provides brief instruction and concentrated practice for students in one targeted Mathematics Strategy. *FOCUS* also allows students the opportunity for self-assessment of their performance. It allows teachers the opportunity to identify and assess a student's level of mastery.

Six Mathematics Strategies featured in the *FOCUS* series:

- Building Number Sense
- Using Estimation
- Using Algebra
- Using Geometry
- Determining Probability and Averages
- Interpreting Graphs and Charts

The *FOCUS* series spans eight year levels, from year one to year eight. The introductory passages in each lesson are written at or below year level, allowing students to focus on the mathematics without struggling with the reading.

Book	Reading Level
Book A	at or below year one readability
Book B	at or below year two readability
Book C	at or below year three readability
Book D	at or below year four readability
Book E	at or below year five readability
Book F	at or below year six readability
Book G	at or below year seven readability
Book H	at or below year eight readability

What is Building Number Sense, the Mathematics Strategy featured in this *FOCUS* book?

Number sense is an understanding of numbers and the relationships between them. As students build number sense, they become familiar with a variety of representations for whole numbers and parts of whole numbers.

Students learn to express numbers in a variety of forms. Three common ways to express numbers are in standard form, in word form and in expanded form. Students in the upper years learn to use exponents, in addition to the other common forms, to express numbers.

Students in years one to three develop counting skills and become familiar with ordinal numbers. They practise counting to identify numbers that come before or after another number. They also learn to use ordinal numbers to identify an item's position in a row or a list.

Students in years four to eight learn several ways to represent the parts of a whole. Students in year four are introduced to fractions. They learn to understand the parts of a fraction and to recognise the quantity represented by a fraction. Students in the upper years examine the relationship between fractions, decimals and percentages. They also learn to perform mathematical operations with fractions and decimals.

Students in year eight are introduced to prime and composite numbers, and they learn to determine a number's prime factorisation. They also practise following the order of operations when solving problems with parentheses, exponents or square roots.

How should I use the **FOCUS** series in the classroom?

The **FOCUS** series can be used effectively in the classroom in several ways. Here is a suggestion for using the program in **whole class, large group, small group, paired** and **individual** formats.

To the Student

(inside front cover of the student book)

Read and discuss this with the whole class or large group to make sure students understand what they are to do in the book.

Learn About

(pages 2–3 of the student book)

Read the two pages of instruction in the Mathematics Strategy to the whole class or large group. Model using the Mathematics Strategy. Use information from the Mathematics Strategy Tips for the Teacher on pages 12–13 of this teacher guide to prompt additional in-depth discussion of the Mathematics Strategy, as appropriate. Make sure all students understand the features of the Mathematics Strategy and how to apply the Mathematics Strategy before they go on. The Learn About requires approximately 45 minutes.

Lesson Preview

(pages 4–5 of the student book)

Read the boxed directions to the whole class or large group. Emphasise what students should watch for as they read the problem. Have students read the problem individually. Guide the whole class or large group in answering the two selected-response questions. Then discuss why each answer choice is correct or not correct. Make sure all students understand how to answer the Mathematics Strategy questions before they go on. The Lesson Preview requires approximately 45 minutes.

Lessons

(pages 6–45 of the student book)

For each lesson, have students read the directions and the passage individually, in pairs or in small groups. Have students answer the selected-response questions and the constructed-response question individually, in pairs or in small groups.

Have students use the Tracking Chart on page 47 of the student book to note the date that they have finished each lesson. When the questions in all five lessons in a group have been corrected, have students note the number of correct responses for each lesson and then the number of correct responses for the whole group of lessons.

Each lesson, plus tracking, requires approximately 45 minutes. Allow students 30 minutes to read the passage and answer the questions, and allow 15 minutes to discuss the responses. Discuss the answers to the questions with the whole class or large group, or with pairs, small groups or individuals. (See **What is the correction procedure?** on page 4 of this teacher guide.)

Self-Assessment: When students have finished each group of five lessons, have them complete the appropriate Self-Assessment. When students have finished all twenty lessons, have them complete Self-Assessment 5. Each Self-Assessment requires approximately 20 minutes.

Discussion: When students have finished each group of five lessons, discuss their performance individually or in small groups. When students have finished all twenty lessons, discuss their performance individually or in small groups. Each discussion requires approximately 25 minutes.

MATHEMATICS STRATEGY TIPS FOR THE TEACHER

Number sense can be used to determine the value of a digit in a number.

Each digit in a number has a place value. The value of a digit depends on its location in the number. In the example at the top of the Learn About page, the 3 is in the millions place. The value of this digit is $3 \times 1,000,000$ or $3,000,000$.

Remind students that place values to the left of a decimal point represent values greater than or equal to one. Place values to the right of a decimal point represent values that are less than one. Extend the introduction by asking students to identify the value of each 4 in the number.

$$(4 \times 10,000,000 = \mathbf{40,000,000})$$

$$(4 \times 1000 = \mathbf{4000}) \quad (4 \times 0.1 = \mathbf{0.4})$$

Numbers can be expressed in several forms. In standard form, digits are used to express a number. In word form, words are used to express a number. In expanded form, a number is shown as the sum of the value of each digit. Expanded form can be expressed as either multiples of 10 or powers of 10.

Explain to students that both the standard form and the word form of a number are used when writing a cheque. Discuss with students why both forms are used (to reduce the likelihood of misrepresenting an amount). You may extend the discussion by organising the class in groups of three. The first student in each group writes the standard form of a number on a sheet of paper. The next student then writes the number in word form, and the third student writes the number in expanded form. After checking each student's work, have them switch roles and play again.

Learn About

Building Number Sense: Place Value and Writing Numbers

Each digit in a number has a **place value**. The value of a digit depends on its place in a number. The chart below shows the values of the digits in the number 143,674,892.45.

hundred millions (100,000,000)	ten millions (10,000,000)	millions (1,000,000)	hundred thousands (100,000)	ten thousands (10,000)	thousands (1,000)	hundreds (100)	tens (10)	ones (1)	tenths (0.1)	hundredths (0.01)
1	4	3	6	7	4	8	9	2	.4	5

Numbers can be written in different ways.

- Standard form: 143,674,892.45
- Word form: one hundred and forty-three million, six hundred and seventy-four thousand, eight hundred and ninety-two, and forty-five hundredths
- Expanded form: $100,000,000 + 40,000,000 + 3,000,000 + 600,000 + 70,000 + 4000 + 800 + 90 + 2 + 0.4 + 0.05$

The list below shows different ways to write the number 28,000.

- $28,000 = 28$ thousands = 280 hundreds = 2800 tens
- $2(10^4) + 8(10^3)$ or $2.8(10^4)$

The total amount of money donated to the local children's hospital was \$134,526,789.32. What is the value of the 6 in this number?

The 6 is in the thousands place.
Six thousands is 6000.
The value of the 6 is **6000**.



Each digit in a number has a **place value**. The value of a digit depends on its place in a number. Numbers can be written in standard form, in word form or in expanded form.

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Building Number Sense Book F CAS0222 • © 2009 Hawker Brownlow Education

Direct students' attention to the example in the shaded box on the Learn About page. Ask them to name the place value of the 5 in the number ($5 \times 100,000 = \mathbf{500,000}$). Then challenge students to express this number in expanded form.

$$100,000,000 + 30,000,000 + 4,000,000 + 500,000 + 20,000 + 6000 + 700 + 80 + 9 + 0.3 + 0.02$$

How Is *FOCUS on Mathematics* Supported by Research?

FOCUS on Mathematics is supported by research from mathematical researchers and organisations, including the National Math Advisory Panel and National Council of Teachers of Mathematics, both from the US. Much of the research on effective instruction for mathematical students parallels the recommendations of the NMAP (2008). Many of these recommendations are integrated into the *FOCUS on Mathematics* series, including: word-problem focus, explicit instruction with modelling and focused practice.

Word-Problem Focus

Word problems are the proving ground for students to demonstrate their mastery of mathematical fluency and conceptual understanding. Having the ability to transfer what they have learned to new problem-solving situations is one of the major goals for mathematical education (NCTM, 2006; NMAP, 2008). “The issue of transfer, that is, the ability to use skills learned to solve one class of problems, such as similar triangles, to solve another class of problems, such as linear algebra, is a vital part of mathematics learning” (NMAP, 2008, p. 30). And yet, students, on average, have the most difficulty solving word problems.

The *FOCUS on Mathematics* series provides repeated and focused practice of key maths strategies in the context of word problems. With more than 800 word problems in the series, students gain multiple opportunities to practise core maths concepts and strategies.

Explicit Instruction with Modelling

Explicit instruction is a hallmark of effective instruction for struggling and on-level students. Explicit instruction is one of the instructional methods that research has proved to be effective. “By the term *explicit instruction*, it is meant that teachers provide clear models for solving a problem type using an array of examples, that students receive extensive practice in use of newly learned strategies and skills, that students are provided with opportunities to think aloud (i.e. talk through the decisions they make and the steps they take), and that students are provided with extensive feedback” (NMAP, 2008, p. 23). Each of these features, can be found in the *FOCUS on Mathematics* series. With explicit instruction and teacher modelling, skill efficiency is nearly guaranteed by students (Hiebert & Grouws, 2008).

FOCUS on Mathematics uses explicit instruction in the teaching of the mathematical strategies. The explicit instruction occurs in the Learn About section and the Lesson Preview section. Through the Learn About section, students receive explicit instruction consisting of a definition, semi-concrete and visual representations of the maths concepts, and a usage rule for the maths strategy. Additionally, *FOCUS on Mathematics* is a perfect vehicle for struggling students because it does not overwhelm students with the presentation of information. In the Learn About lesson, students initially experience the maths concepts in short presentations, usually three to seven sentences long. A Remember box text feature is a point of reference for students to use while attending to lessons. The Remember box is consistently placed in each book of the series. Struggling or novice maths students usually skip or gloss over text features, which are valuable tools. With repeated exposure and external prompting by the teacher, students learn to pay attention to the text feature.

Focused Practice

One of the major callings from from expert panels and organisations is for deeper learning and practice of mathematical skills and strategies. Focusing on specific key mathematical topics allows “teachers to commit more time each year to topics receiving special emphasis. At the same time, students would have opportunities to explore these topics in depth, in the context of related content and connected applications, thus developing more robust mathematical understandings” (NCTM, 2006, p. 4).

ANSWER KEY

FOCUS on Building Number Sense, Book F

Lesson 1 (page 6)

1. A 2. C 3. C 4. A

5. Solution: There was $\frac{7}{16}$ of a litre of yellow paint left in the can.

Sample Explanation: *In problem 2, I determined that the amount of yellow paint in a can was $\frac{7}{8}$ litre. Since a half can of yellow paint was used, I found the amount remaining in the can by multiplying $\frac{1}{2}$ by the $\frac{7}{8}$ litre.*

$$\frac{7}{8} \times \frac{1}{2} = \frac{7}{16} \text{ litre}$$

Lesson 2 (page 8)

1. B 2. B 3. A 4. C

5. Solution: The number 5,906,370,000 written in word form is five billion, nine hundred and six million, three hundred and seventy thousand.

Sample Explanation: *I identified the place value of each digit greater than zero, and then I wrote the number in word form.*

5: billions

9: hundred millions

6: millions

3: hundred thousands

7: ten thousands

Lesson 3 (page 10)

1. C 2. D 3. B 4. C

5. Solution: Ned walked $1\frac{3}{4}$ kilometres in all.

Sample Explanation: *To find the sum of the three distances, first I found a common denominator.*

$$\frac{1}{3} \text{ km} = \frac{4}{12} \text{ km}$$

$$\frac{3}{4} \text{ km} = \frac{9}{12} \text{ km}$$

$$\frac{2}{3} \text{ km} = \frac{8}{12} \text{ km}$$

Then I added the fractions.

$$\frac{4}{12} + \frac{9}{12} + \frac{8}{12} = \frac{21}{12} \text{ km}$$

Finally, I converted the improper fraction to a mixed number and simplified the fraction.

$$21 \div 12 = 1\frac{9}{12} = 1\frac{3}{4} \text{ km}$$

Lesson 4 (page 12)

1. B 2. C 3. A 4. C

5. Solution: The number 103,488 expressed in word form is one hundred and three thousand, four hundred and eighty-eight.

Sample Explanation: *I thought about the place value of each digit in the number. The first part of the number is one hundred and three thousand. The second part is four hundred and eighty-eight.*

Lesson 5 (page 14)

1. D 2. C 3. D 4. B

5. Solution: There are 50 students who catch the bus and live more than twenty minutes from the school.

Sample Explanation: *First, I found the fraction of students who catch the bus and live more than twenty minutes from the school by multiplying $\frac{1}{5}$ by $\frac{5}{12}$.*

$$\frac{1}{5} \times \frac{5}{12} = \frac{5}{60} = \frac{1}{12}$$

Then I multiplied $\frac{1}{12}$ by 600 to find the number of students who catch the bus and live more than twenty minutes from the school.

$$\frac{1}{12} \times 600 = 50$$

Lesson 6 (page 16)

1. B 2. A 3. C 4. A

5. Solution: Terry and his family spent $\frac{1}{8}$ of their holiday travelling.

Sample Explanation: *To find the fraction of the holiday that was spent travelling, I used 1 to represent the total holiday time. In order to subtract the time spent at the theme park and the time spent at Lamington National Park, I converted 1 and $\frac{1}{2}$ to fractions with a denominator of 8.*

$$1 = \frac{8}{8}$$

$$\frac{1}{2} = \frac{4}{8}$$

Then I found the sum of the fractions of the holiday spent at the theme park and at Lamington National Park.

$$\frac{3}{8} + \frac{4}{8} = \frac{7}{8}$$

Finally, I subtracted this sum from the total holiday time.

$$\frac{8}{8} - \frac{7}{8} = \frac{1}{8}$$