

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 Using Estimation, the Mathematics Strategy featured in this *FOCUS* book?

Estimation is the process used to determine approximate values. Estimation is useful in many real-world situations and in determining if a calculated answer is reasonable. Students begin working with estimation by learning to round numbers to given place values. They also learn to perform calculations with rounded numbers.

Students in the early years learn to round whole numbers to the nearest ten and the nearest hundred. They also practise determining which number is closest to a given number. Students round increasingly greater numbers as they progress through the year levels. Students in the later years learn to round time measurements to the nearest hour and the nearest minute.

Beginning in year three, students learn to round decimal numbers. In some situations they round decimals to the nearest whole number. Eventually, students learn to round decimals to the nearest tenth, hundredth and thousandth.

In years one and two, students begin to calculate approximate answers by estimating sums with mainly two-digit numbers. Through the levels, students progress to estimating differences, products and quotients. Students at upper year levels also estimate with mixed numbers, percentages and money amounts.

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

Estimation can be used to round whole numbers or decimal numbers to the nearest given place value and to check the reasonableness of calculations.

Review rounding to the nearest ten, hundred, thousand and ten thousand. Write a five-digit number on the board, such as 52,843. Ask students to identify the closest ten thousand (**50,000**). Have a volunteer explain why 52,843 rounds to 50,000. The explanation should include looking at the digit in the place value to the right of the place being rounded to. In this case, the 2 is in the thousands place, so the number rounds down to 50,000. Continue the activity by having students round the same number to the nearest thousand (**53,000**), hundred (**52,800**) and ten (**52,840**). In each case, ask students to identify the place value they used to help them round the number.

Use a number line to review rounding to the nearest hundred. Draw a number line from 100 to 200 on the board. Insert and label ticks for 100, 150 and 200. Insert unlabelled ticks for all of the tens between the labelled numbers. Have volunteers identify and read the labelled numbers. Show students how to read the number line by starting at 100 and counting by tens to name each tick to 200. Then name a number between 100 and 200. Ask a volunteer to identify the number's approximate location on the number line. For example, if the number is 179, students should point just to the left of the tick for 180. Make sure that students understand how to identify the approximate location of each number. Then ask students to identify the nearest hundred to each given number.

Learn About

Using Estimation: Rounding Numbers

An **estimate** is a number that is close to the actual number you are looking for. To estimate, you can round numbers to the nearest ten, hundred, thousand, ten thousand and so forth. If the digit one place to the right of the place being rounded to is 5 or greater, round up. If the digit one place to the right of the place being rounded to is 4 or less, round down.

Look at the chart, and then read the reason why each number is rounded to the nearest ten or hundred shown.

Number	To The Nearest	Rounded Number
67	ten	70
138	hundred	100

- The number 67 rounded to the nearest ten is 70. The ones place contains the digit 7, which is 5 or greater. Therefore, 67 rounds up to 70.
- The number 138 rounded to the nearest hundred is 100. The tens place contains the digit 3, which is 4 or less. Therefore, 138 rounds down to 100.

Maxwell found out that the population of his town is 15,526. He also knows that 5397 students attend his school. Rounding both numbers to the nearest thousand, about how many people in Maxwell's town are *not* students at his school?

15,526 rounds to 16,000 and 5397 rounds to 5000

$16,000 - 5000 = 11,000$

About 11,000 people in the town are not students at Maxwell's school.



To **estimate**, you can round numbers to the nearest ten, hundred, thousand, ten thousand, and so forth. If the digit one place to the right of the place being rounded to is 5 or greater, round up. If the digit one place to the right of the place being rounded to is 4 or less, round down.

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Using Estimation Book D CAS0062 • © 2009 Hawker Brownlow Education

Draw students' attention to the shaded box on the Learn About page. Write the number 15,526 on the board, and ask a student to round the number to the nearest ten (**15,530**). Then have another student find the difference between the rounded figure and 5000 (**10,530**). Ask another student to round 15,526 to the nearest hundred (**15,500**), and then have a student find the difference between the rounded figure and 5000 (**10,500**). Continue the activity with 15,526 rounded to the nearest ten thousand. Finally, have students subtract 5397 from 15,526, and then compare the estimated differences to determine which was closest to the actual difference.

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 Using Estimation, Book D

Lesson 1 (page 6)

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

5. Solution: The least number that would round to 16,000 is 15,500.

Sample Explanation: *Since I am looking for the least number, the number will have to round up to 16,000. The digit in the thousands place will be a 5. The digit in the hundreds place must also be a 5. The digits to the right of the hundreds place must be 0. I used this information to find that the least number that rounds to 16,000 is 15,500.*

Lesson 2 (page 8)

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

5. Solution: The greatest number that would round to 180,000 is 184,999.

Sample Explanation: *Since I am looking for the greatest number, the number will have to round down to 180,000. The digit in the ten thousands place will be an 8. The digit in the thousands place must be a 4. The digits to the right of the thousands place must be 9. I used this information to find that the greatest number that rounds to 180,000 is 184,999.*

Lesson 3 (page 10)

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

5. Solution: The chef spent about \$1400 on strawberries from January to March.

Sample Explanation: *First, I rounded each amount to the nearest hundred. Then I found the sum of the three rounded amounts.*

$\$389.54$ rounds to $\$400$

$\$412.75$ rounds to $\$400$

$\$556.00$ rounds to $\$600$

$\$400 + \$400 + \$600 = \1400

Lesson 4 (page 12)

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

5. Solution: I agree with William. The height of both trees, rounded to the nearest ten, is 80 metres.

Sample Explanation: *I rounded each height to the nearest ten metres.*

78.9 rounds to 80

75.8 rounds to 80

Lesson 5 (page 14)

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

5. Solution: I do not agree with David. When the distances are rounded to the nearest hundred and then added, the sum is 5400 kilometres.

Sample Explanation: *First, I rounded each distance to the nearest hundred. Then I found the sum of the rounded distances. I found a different answer than David did, so I do not agree with his estimate.*

1027 rounds to 1000

893 rounds to 900

755 rounds to 800

2713 rounds to 2700

$1000 + 900 + 800 + 2700 = 5400$ km

Lesson 6 (page 16)

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

5. Solution: The least number that rounds to 110,000,000 is 105,000,000.

Sample Explanation: *Since I am looking for the least number, the number will have to round up to 110,000,000. The digit in the ten millions place will be a 0. The digit in the millions place must be 5. The digits to the right of the millions place must be zeros. I put this information together to find that the least number that rounds to 110,000,000 is 105,000,000.*

Lesson 7 (page 18)

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

5. Solution: The totals for Queensland and New South Wales are rounded down.

Sample Explanation: *A tens digit is rounded down when the ones digit is 4 or less. I scanned the list for numbers with a 4 or less in the ones place.*

44 rounds down to 40

67 rounds up to 70

25 rounds up to 30

83 rounds down to 80

38 rounds up to 40

I found that Queensland and New South Wales have ones digits that are 4 or less. So, the totals for those states would be rounded down.