

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 is used to calculate an approximate value when a precise figure is not necessary. Estimation is also used to check the reasonableness of calculations.

Rounding is the first step to estimation. Use a number line to review rounding with students. Draw a number line from 100 to 1000 on the board, and place a labelled tick at each multiple of 100. Between the multiples of 100, place unlabelled ticks to represent multiples of 10. Have students determine whether 660 is closer to 600 or to 700 (**700**). Continue the activity by having students locate other numbers on the number line and identify the nearest multiple of 100. Explain to students that numbers located exactly halfway between two multiples of 100, such as 750, are rounded up to the next multiple of 100. Extend the activity by using a number line from 1000 to 10,000, with multiples of 1000 labelled.

Review the procedure used for rounding by discussing the following steps:

- 1) Circle the digit in the place that the number is being rounded to.
- 2) Underline the digit to the right of the circled digit. If the underlined digit is 4 or less, then the circled digit remains the same. If the underlined digit is 5 or greater, add 1 to the circled digit.
- 3) Change every digit to the right of the circled digit to 0.

Ask students to use these steps to round the following numbers to the given places: 8763 rounded to the hundreds place (**8800**); 312,955 rounded to the ten thousands place (**310,000**); 9,742,817 rounded to the hundred thousands place (**9,700,000**); and 47.143 rounded to the hundredths place (**47.14**).

Learn About

Using Estimation: Rounding Numbers

An **estimate** is a number that is close to the actual number you are looking for. Numbers can be rounded 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 thousand or ten thousand shown.

Number	Round to the Nearest	Rounded Number
27,654	thousand	28,000
432,156	ten thousand	430,000

- The number 27,654 rounded to the nearest thousand is 28,000 because the hundreds place contains the digit 6, which is 5 or greater.
- The number 432,156 rounded to the nearest ten thousand is 430,000 because the thousands place contains the digit 2, which is less than 5.

You can also round decimals. Decimals are often rounded to the nearest whole number. For example, the number 245.57 rounds up to 246 because the digit in the tenths place is 5 or greater.

Carolyn's aunt and uncle recently bought a new house. The house cost \$237,450. What is this figure rounded to the nearest ten thousand?

The digit 7 is in the thousands place in the number 237,450. The rounded figure is **240,000**.



Numbers can be rounded to the nearest ten, hundred, thousand, ten thousand and so forth. Decimals can be rounded to the nearest whole number. 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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Students commonly use the value of the circled digit, rather than the underlined digit, to determine whether to round up or down. Remind students that the circled digit either rounds up or stays the same. Stress that its neighbour to the right, the underlined digit, determines whether the circled digit changes or stays the same.

If students repeatedly make this mistake, have them colour code the digit to the right of the circled digit. For example, they can write the underlined digit in red or highlight it. This visual cue will help them remember that the value of the colourful digit determines whether the circled digit changes or stays the same.

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 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 E

Lesson 1 (page 6)

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

5. Solution: The estimated distance of the entire trail was 20,000 metres.

Sample Explanation: *First, I rounded each distance to the nearest thousand metres.*

$$3200 \text{ rounds to } 3000$$

$$5800 \text{ rounds to } 6000$$

$$4100 \text{ rounds to } 4000$$

$$6600 \text{ rounds to } 7000$$

Then I added the rounded distances to estimate the total distance.

$$3000 + 6000 + 4000 + 7000 = 20,000 \text{ metres}$$

Lesson 2 (page 8)

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

5. Solution: The total attendance at the six games was about 420,000.

Sample Explanation: *First, I rounded the average to the nearest ten thousand.*

$$73,931 \text{ rounds to } 70,000$$

Then I multiplied this rounded figure by 6.

$$70,000 \times 6 = 420,000$$

Lesson 3 (page 10)

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

5. Solution: The Magpies' total attendance for 2007 was about 1,110,000.

Sample Explanation: *First, I rounded both attendance figures to the nearest ten thousand.*

$$573,684 \text{ rounds to } 570,000$$

$$543,362 \text{ rounds to } 540,000$$

Then I added to find the total.

$$570,000 + 540,000 = 1,110,000$$

Lesson 4 (page 12)

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

5. Solution: Serena's rounded figure was 42,000,000 kilometres.

Sample Explanation: *There is a 1 in the millions place. The digit to its right is 8, so the number rounds up to the next million. So, 41,840,000 rounds up to 42,000,000.*

Lesson 5 (page 14)

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

5. Solution: A group of seven male Asian elephants would weigh about 35,000 kilograms.

Sample Explanation: *First, I rounded the average weight of a male Asian elephant to the nearest thousand kilograms.*

$$4990 \text{ rounds to } 5000$$

Then I multiplied 5000 kilograms by 7 to find the total weight.

$$5000 \times 7 = 35,000 \text{ kg}$$

Lesson 6 (page 16)

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

5. Solution: The estimated difference is 1,900,000.

Sample Explanation: *First, I rounded the attendance figures to the nearest hundred thousand.*

$$1,439,834 \text{ rounds to } 1,400,000$$

$$3,252,462 \text{ rounds to } 3,300,000$$

Then I subtracted.

$$3,300,000 - 1,400,000 = 1,900,000$$

Lesson 7 (page 18)

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

5. Solution: The total land and water area in Queensland is about 1,800,000 square kilometres.

Sample Explanation: *First, I rounded each area to the nearest hundred thousand.*

$$1,730,648 \text{ rounds to } 1,700,000$$

$$121,994 \text{ rounds to } 100,000$$

Then I added both rounded areas together.

$$1,700,000 + 100,000 = 1,800,000 \text{ square kilometres}$$