

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 Algebra, the Mathematics Strategy featured in this *FOCUS* book?

Algebra is the strand of mathematics that focuses on relationships among quantities and on the different ways to represent these relationships. One such representation uses numbers, symbols and variables. These elements can be combined to describe a mathematical situation. In the earlier years, students learn to use number sentences, which consist of numbers, symbols such as $+$, $-$, \times , \div , $=$ and variables that identify missing information. Variables are typically shown as blanks or boxes in years one and two. Beginning in year three, letter variables are introduced.

As they progress through the year levels, students learn about different kinds of representations of relationships. They write and solve equations, expressions and inequalities. Students learn to translate among different representations, such as equations, tables of values and graphs. These concepts lead to more comprehensive understanding of functions.

Patterns appear frequently in algebra problems. Some patterns appear as a list of sequentially ordered numbers. Other patterns appear as IN and OUT boxes or in tables. Students find missing elements and extend both number and geometric patterns. Patterns are one more way of representing relationships.

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

Using algebra can help you complete patterns.

Patterns appear in several forms. Some patterns consist of numbers. The numbers may appear in a sequentially ordered list, in a table or in written descriptions. Patterns made up of numbers are called number patterns. Other patterns consist of shapes or figures. These are called figure patterns.

Some patterns are a combination of number and figure patterns. For example: Sandra used building blocks to build a tower. There were fifteen blocks in the first row, twelve blocks in the second row, nine blocks in the third row and six blocks in the fourth row. This pattern includes both a description of a figure and numbers.

Patterns follow rules. Increasing number patterns follow addition and multiplication rules. Decreasing number patterns often follow subtraction and division rules.

You can find the rule for a number pattern by comparing the numbers in the pattern. First, determine whether the numbers are increasing or decreasing. Then find the operation used to increase or decrease the numbers. Make sure this operation works with each given element of the pattern.

For example: $2\frac{1}{2}$, 4, $5\frac{1}{2}$, 7, $8\frac{1}{2}$. The numbers in this pattern are increasing. Each number is one and a half greater than the preceding number. The pattern rule is **add $1\frac{1}{2}$** .

Learn About

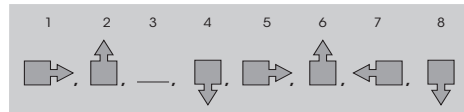
Using Algebra: Patterns

Some **patterns** use shapes or figures. These patterns follow **rules**. The **rule** is used to change from the first figure to the next figure. A line can represent a missing figure in the pattern.


To find the rule, look at a series of figures. Ask these questions:

- What was done to the first figure to get the second figure?
- Is the same thing done to the second figure to get the third figure?
- Is this true for the rest of the figures in the pattern?

Look at the pattern. Try to find the rule.



Find the rule. The figures appear in order. From the first to second figure, the shape makes a $\frac{1}{4}$ turn. The arrow first points right and second points up. The pattern of the arrow is right, up, left, down. The order is repeated beginning with the fifth figure in the pattern.

The missing figure is .



Some **patterns** use shapes or figures. These patterns follow **rules**. The **rule** is used to change from the first figure to the next figure. A line can represent a missing figure in the pattern.

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The rules for figure patterns control how the figures change. You can find the rule for a figure pattern by comparing the figures in the pattern.

For example: ○, ○○, ○○○, ○○○○. The figures in this pattern are growing larger. First there is one circle, then two circles, then three circles, and finally four circles. The pattern rule is to add one circle each time.

You can use a pattern rule to find a missing number or figure in a pattern. Simply apply the rule to find the missing number or figure. For example: 64, 16, 4, ____, $\frac{1}{4}$. The rule for this pattern is **divide by 4**. Four divided by 4 is 1. The missing number is **1**.

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 Algebra, Book D

Lesson 1 (page 6)

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

5. Solution: He will ride his bicycle 142 kilometres.

Sample Explanation: *I compared the number of kilometres he rode each week to find the pattern.*

The pattern is add 5.

$$28 \text{ km} + 5 \text{ km} = 33 \text{ km}$$

$$33 \text{ km} + 5 \text{ km} = 38 \text{ km}$$

$$38 \text{ km} + 5 \text{ km} = 43 \text{ km}$$

I added the weekly amounts to find the total for the month.

$$43 \text{ km} + 38 \text{ km} + 33 \text{ km} + 28 \text{ km} = 142 \text{ km}$$

Lesson 2 (page 8)

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

5. Solution: Mia sold 47 pieces of jewellery.

Sample Explanation: *The number of pins is double the number of bracelets, so I multiplied 2 and 9.*

$$9 \times 2 = 18$$

The number of necklaces is two more than the number of pins, so I added 18 + 2.

$$18 + 2 = 20$$

I found that she sold 20 necklaces. Then I added the number of bracelets, pins and necklaces together.

$$9 + 18 + 20 = 47$$

Lesson 3 (page 10)

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

5. Solution: The Wombats will win 9 games in their seventh season.

Sample Explanation: *I compared the number of games the Wombats won each season to find the pattern. The pattern is subtract 1 then add 3.*

$$3 - 1 = 2 \qquad 2 + 3 = 5$$

$$5 - 1 = 4 \qquad 4 + 3 = 7$$

Then I continued the pattern to find the number of wins for the sixth and seventh seasons.

$$7 - 1 = 6 \qquad 6 + 3 = 9$$

Lesson 4 (page 12)

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

5. Solution: Mike's chess set cost \$48.

Sample Explanation: *I solved the first equation to find the value of the triangle.*

$$112 \div 7 = 16$$

Then I multiplied the value of the triangle by 3 to find the cost of Mike's chess set.

$$16 \times 3 = 48$$

Lesson 5 (page 14)

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

5. Solution: The band must raise \$275 through the book sale.

Sample Explanation: *First, I wrote an equation to represent the amount of money that the band must still raise.*

$$\$825 - (\$336 + \$214) = t$$

Then I solved the equation to find the amount of money that the band still needs to raise.

$$\$825 - (\$336 + \$214) = t$$

$$\$825 - \$550 = t$$

$$\$275 = t$$

Lesson 6 (page 16)

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

5. Solution: Mary bought her doll in 2003.

Sample Explanation: *I started with the year Eve bought her doll, which was 1986. I added 13 to find the year that Ruth bought her doll.*

$$1986 + 13 = \square$$

$$\square = 1999$$

Then I added 4 to find the year that Mary bought her doll.

$$1999 + 4 = \square$$

$$\square = 2003$$

Lesson 7 (page 18)

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

5. Solution: Miss Clarke will likely teach 108 students two years from now.

Sample Explanation: *First, I found the difference between 18 and 24.*

$$24 - 18 = 6$$

Then I found the difference between 24 and 36 and between 36 and 54.

$$36 - 24 = 12$$

$$54 - 36 = 18$$

So the pattern is add 6, then 12, then 18, and so on. The number added increases by 6 each time. I continued the pattern to find the number of students for the next two years.

$$54 + 24 = 78$$

$$78 + 30 = 108$$