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

Geometry involves the mathematical study of figures, lines and angles. Students begin their work with geometry by learning to identify common plane figures and solid figures. Most plane figures are polygons. Polygons are identified by their number of sides and angles, and solid figures are identified by their number of faces and edges and the shape of the faces. In the early years, students learn to identify polygons that have lines of symmetry. As students progress through the year levels, they learn to calculate the sum of a polygon's angle measures. They also learn to count the number of visible faces on a solid figure or a group of solid figures.

Students calculate various measures for plane figures and solid figures. They learn to calculate the perimeter, circumference and area of plane figures. Starting in year five, students learn to calculate the volume of solid figures such as rectangular prisms, cylinders and spheres. The figures and the calculations increase in complexity as students move through the year levels.

In years seven and eight, students use the Pythagorean theorem to find missing side lengths on right-angle triangles. They also learn about the relationships between the angles formed by two parallel lines and a transversal. Students use their knowledge of supplementary angles, corresponding angles and vertical angles to identify missing angle measures and to solve problems.

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 geometry can help you measure plane and solid figures.

Perimeter is the distance around a figure. The perimeter of a polygon is found by calculating the sum of the polygon's sides. The distance around a circle is called the circumference. Review with students the formula for circumference: $C = \pi d$

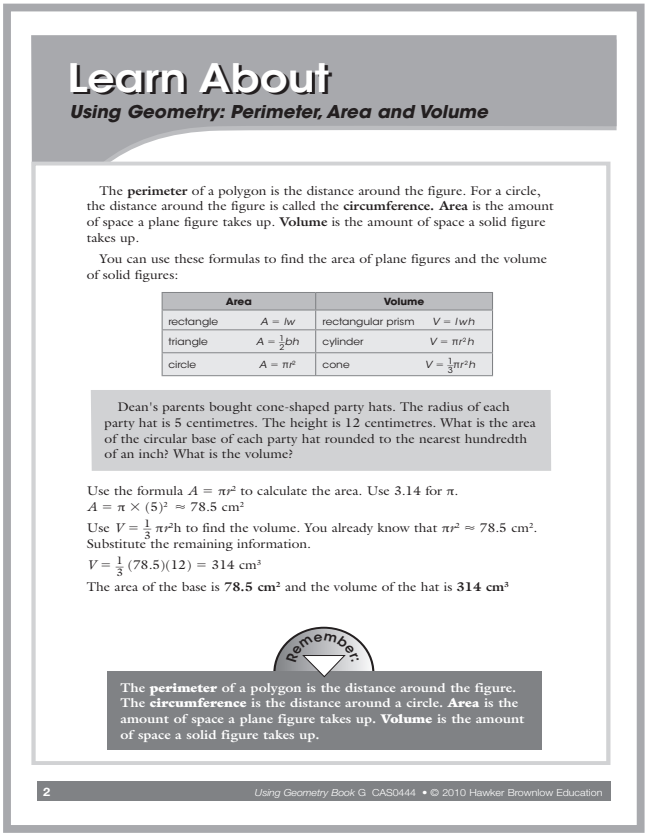
A common error when calculating the circumference of a circle is to divide the diameter by 3.14, rather than multiplying the diameter by 3.14. Check students' work to make sure that they follow the correct procedure when calculating circumference.

Area is the amount of space a plane figure takes up. Point out to students that a plane figure is two-dimensional. As a result, area is always expressed in square units.

A common error when calculating the area of a rectangle is to use the formula for perimeter, and calculate the sum of the side lengths. Visually reinforce the concept of area for students by using grid paper. Explain that the number of squares that it takes to cover the figure is the figure's area. Point out that the total number of squares in the figure can be calculated by multiplying the number of squares along the length of the figure by the number of squares along the width of the figure.

When students calculate the area of a triangle, check their work to ensure that they multiply the product of the base and the height by one half.

In some lessons, students will use the Pythagorean theorem. You may wish to review the relationship among the sides of a right-angled triangle: the square of the hypotenuse equals the sum of the squares of the other two sides, or $a^2 + b^2 = c^2$.



Learn About

Using Geometry: Perimeter, Area and Volume

The **perimeter** of a polygon is the distance around the figure. For a circle, the distance around the figure is called the **circumference. Area** is the amount of space a plane figure takes up. **Volume** is the amount of space a solid figure takes up.

You can use these formulas to find the area of plane figures and the volume of solid figures:

Area		Volume	
rectangle	$A = lw$	rectangular prism	$V = lwh$
triangle	$A = \frac{1}{2}bh$	cylinder	$V = \pi r^2 h$
circle	$A = \pi r^2$	cone	$V = \frac{1}{3}\pi r^2 h$

Dean's parents bought cone-shaped party hats. The radius of each party hat is 5 centimetres. The height is 12 centimetres. What is the area of the circular base of each party hat rounded to the nearest hundredth of an inch? What is the volume?

Use the formula $A = \pi r^2$ to calculate the area. Use 3.14 for π.
$A = \pi \times (5)^2 \approx 78.5$ cm²

Use $V = \frac{1}{3}\pi r^2 h$ to find the volume. You already know that $\pi r^2 \approx 78.5$ cm². Substitute the remaining information.

$V = \frac{1}{3}(78.5)(12) = 314$ cm³

The area of the base is **78.5 cm²** and the volume of the hat is **314 cm³**

Remember:

The **perimeter** of a polygon is the distance around the figure. The **circumference** is the distance around a circle. **Area** is the amount of space a plane figure takes up. **Volume** is the amount of space a solid figure takes up.

2 *Using Geometry Book G* CAS0444 • © 2010 Hawker Brownlow Education

Volume is the amount of space a solid figure takes up. Point out that a solid figure is three-dimensional. As a result, volume is always expressed in cubic units.

A common mistake when calculating the volume of a cylinder is to multiply by the diameter squared, rather than by the radius squared. This mistake is also common with the volume of a cone. Remind students that a circle's radius is half of its diameter. They should read the problem carefully to determine whether the radius or diameter is given.

When calculating the volume of a cone, it is common for students to forget to multiply by $\frac{1}{3}$. Point out that removing $\frac{1}{3}$ from this formula transforms it into the formula for the volume of a cylinder.

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 Geometry, Book G

Lesson 1 *(page 6)*

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

5. Solution: The area of the walkway will be 316 square metres.

Sample Explanation: *First, I found the length and width of the swimming pool and walkway combined by adding the width of the walkway to all sides of the pool.*

$$50 + 2 + 2 = 54 \text{ m}$$

$$25 + 2 + 2 = 29 \text{ m}$$

Then I found the area of the pool and walkway combined.

$$54 \times 29 = 1566 \text{ m}^2$$

Next, I found the area of the swimming pool alone.

$$50 \times 25 = 1250 \text{ m}^2$$

Finally, I subtracted the area of the swimming pool from the area of the swimming pool and walkway combined to find the surface area of the walkway.

$$1566 - 1250 = 316 \text{ m}^2$$

Lesson 2 *(page 8)*

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

5. Solution: The area of the kennel drawing is 5 square units.

Sample Explanation: *First, I found the area of the square portion of the kennel by squaring the length of the sides.*

$$2^2 = 4 \text{ square units}$$

Then I found the area of the triangular portion of the kennel by calculating one half of the base multiplied by the height.

$$\text{base} = 2$$

$$\text{height} = 1$$

$$\frac{1}{2}(2 \times 1)$$

$$\frac{1}{2}(2) = 1 \text{ square unit}$$

Finally, to find the total area of the kennel, I added the area of the square and the area of the triangle.

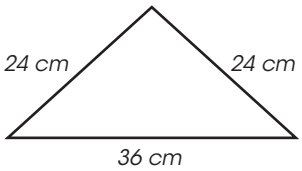
$$4 + 1 = 5 \text{ square units}$$

Lesson 3 *(page 10)*

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

5. Solution: Julia needs 84 centimetres of ribbon.

Sample Explanation: *First, I drew a picture of Julia's piece of wood and labelled the side lengths.*



Then I found the perimeter of the triangle by finding the sum of all three sides.

$$24 + 24 + 36 = 84 \text{ cm}.$$

Lesson 4 *(page 12)*

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

5. Solution: The length of the hypotenuse is 10 centimetres.

Sample Explanation: *I used the Pythagorean theorem to find the length of the hypotenuse.*

$$a^2 + b^2 = c^2$$

$$6^2 + 8^2 = c^2$$

$$36 + 64 = c^2$$

$$100 = c^2$$

$$10 \text{ cm} = c$$

Lesson 5 *(page 14)*

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

5. Solution: The sum of the measures of $\angle 3$ and $\angle 5$ is 210°.

Sample Explanation: *I determined the angle relationships in the figure. Since $\angle 2$ and $\angle 3$ are supplementary angles, I know that the measure of $\angle 3 = 180° - 75° = 105°$. I know that $\angle 3$ and $\angle 7$ are corresponding angles and that $\angle 7$ and $\angle 5$ are vertical angles. Because corresponding angles and vertical angles are congruent, $\angle 3 = \angle 7 = \angle 5 = 105°$. Finally, I found the sum of $\angle 3$ and $\angle 5$.*

$$105° + 105° = 210°$$