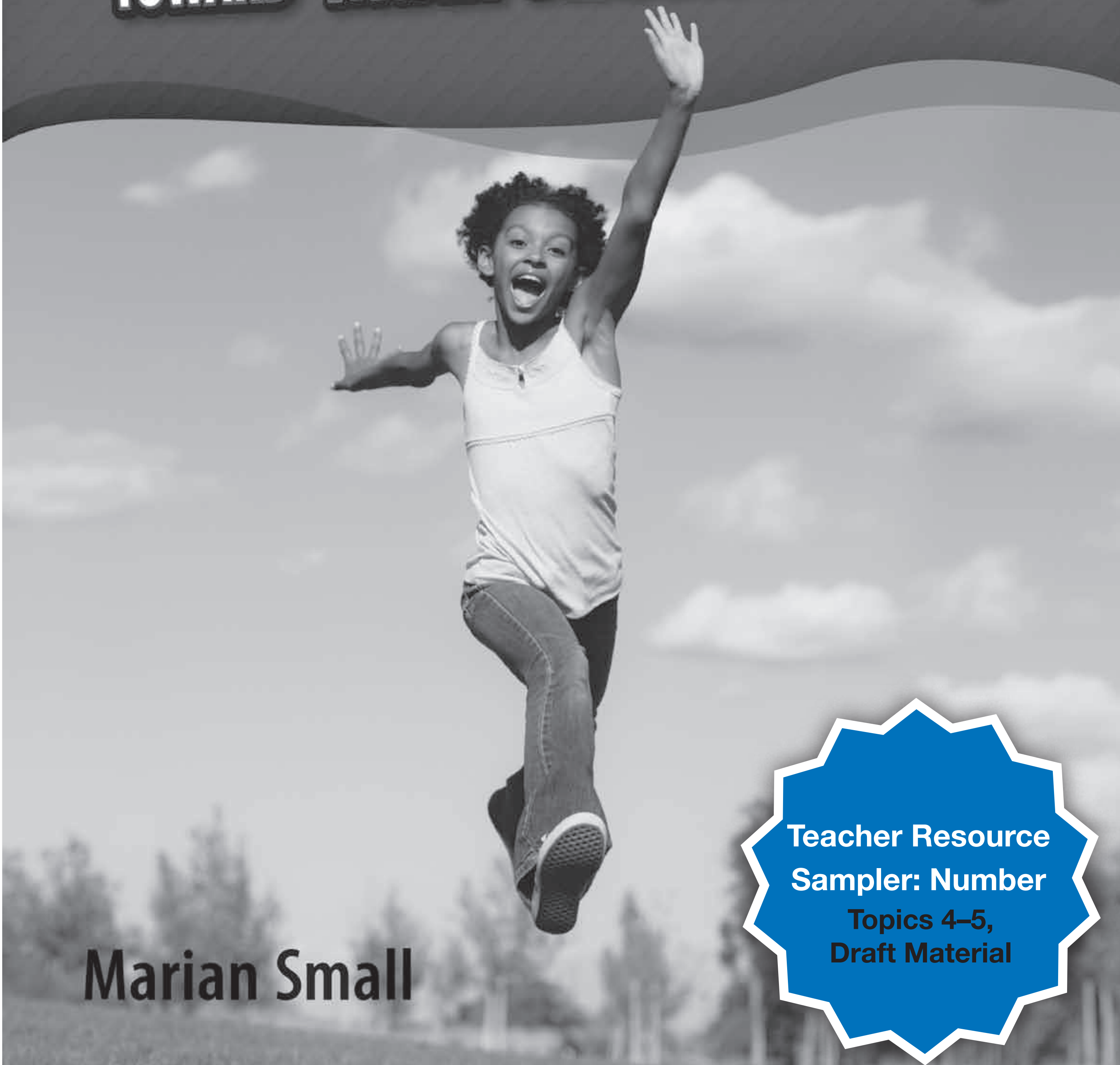
NELSON

TEACHER RESOURCE

5/6

Leaps and Bounds toward Math Understanding



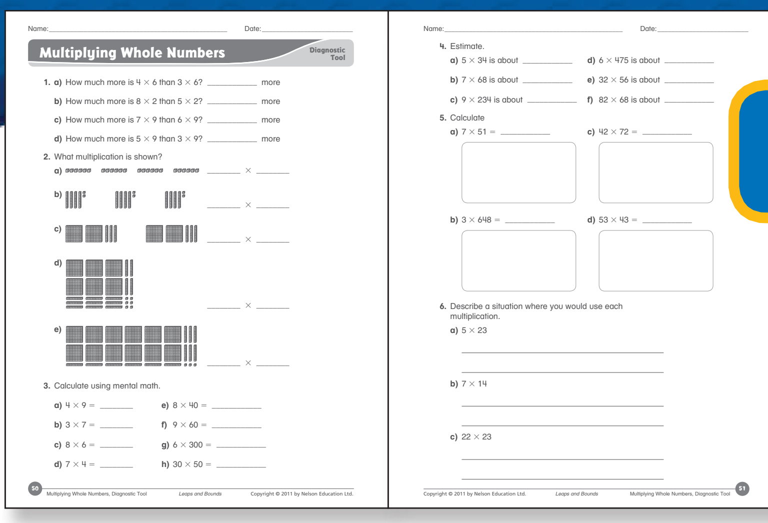
Marian Small

Teacher Resource Sampler: Number

Topics 4–5, Draft Material

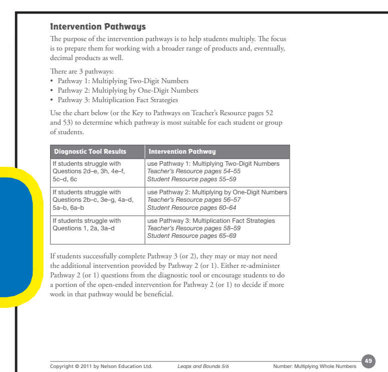
Leaps AND Bounds TOWARD Math Understanding

With Leaps and Bounds, mathematics is as easy as 1, 2, 3!



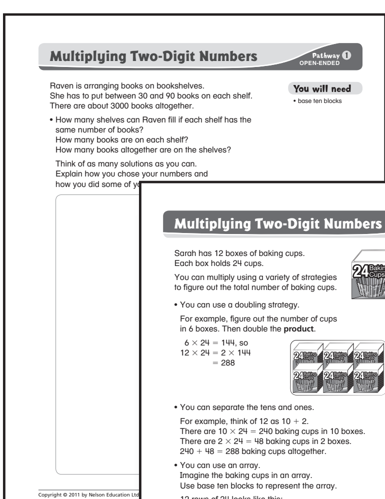
Step 1: Administer the diagnostic assessment

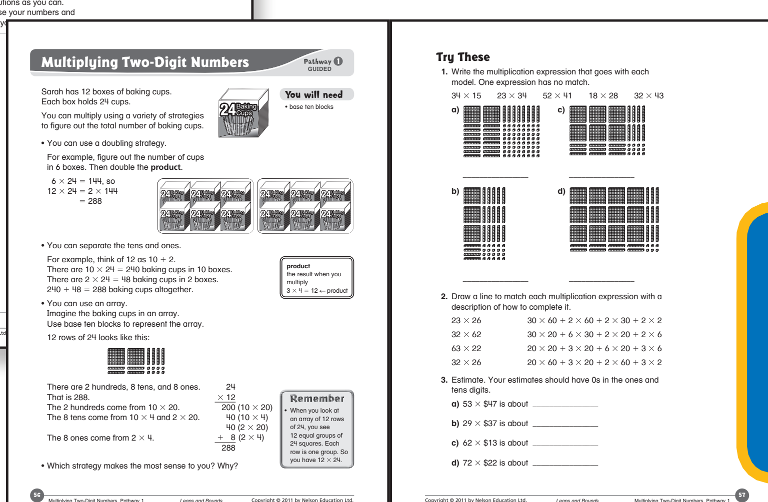
Teacher Resource



Step 2: Select the intervention pathway

Teacher Resource





Step 3: Choose an open-ended intervention or guided intervention based on your students' learning preferences or your instructional situation

Student Resource

Contents

Leaps and Bounds 5/6 covers all math strands. This sampler includes Topics 4 and 5 from the Number strand.

Strand: Geometry

Strand: Measurement

Strand: Data and Probability

Strand: Number

Multiplying Whole Numbers

Planning For This Topic

Materials for assisting students with multiplying whole numbers consist of a diagnostic tool and 3 intervention pathways. Pathway 1 involves multiplying two-digit by two-digit numbers. Pathway 2 involves multiplying three-digit or two-digit numbers by one-digit numbers. Pathway 3 involves strategies for multiplication facts.

Each pathway has an open-ended intervention and a guided intervention. Choose the type of intervention more suitable for your students' needs and your particular circumstances.

Curriculum Connections

Grades 3 to 6 curriculum connections for this topic are provided online. See www.nelson.com/leapsandbounds. The Ontario and WNCP curricula for multiplication are aligned, except that in Grade 4 the WNCP outcomes include two-digit by one-digit and three-digit by one-digit multiplication, whereas the Ontario expectations include only two-digit by one-digit multiplication. Although the WNCP curriculum is somewhat more explicit about what fact strategies students should use, those same strategies are implicit in the Ontario curriculum and should not affect the appropriateness of the various interventions.

Why might students struggle with multiplying whole numbers?

Students might struggle with multiplying for any of the following reasons:

- They might have difficulty skip counting by 2s and 5s, making it difficult to build other facts from these.
- They might not know all of the multiplication facts, making it difficult to perform calculations using several facts.
- They might be unfamiliar with principles such as the commutative principle (that it does not matter in which order you multiply 2 numbers), the associative principle (that when 3 numbers are multiplied, they can be grouped in 2s in any way for the purpose of multiplying), and, particularly, the distributive principle (that to multiply $a \times b$, you can multiply a by the parts of b and add the products)—making it hard for them to relate facts to each other (e.g., they might not realize they could figure out 6×4 by using $5 \times 4 + 1 \times 4$).
- They might multiply 2 two-digit numbers "in columns" just like addition (e.g., they might think of 34×25 as 620 by multiplying the 3×2 and then appending the 4×5).
- They might not be able to relate multiplications (e.g., not realizing that 6×34 is double 3×34).

Professional Learning Connections

PRIME: Number and Operations, Background and Strategies (Nelson Education Ltd., 2005), pages 49–62, 82–89, 94–97

Making Math Meaningful to Canadian Students K–8 (Nelson Education Ltd., 2008), pages 173–182, 186–189

Big Ideas from Dr. Small Grades K–3 (Nelson Education Ltd., 2010), pages 44–48

Big Ideas from Dr. Small Grades 4–8 (Nelson Education Ltd., 2009), pages 25–38

Good Questions (dist. by Nelson Education Ltd., 2009), pages 27, 29, 31, 44, 47, 50–51

Diagnostic Tool: Multiplying Whole Numbers

Use the diagnostic tool to determine the most suitable intervention pathway for multiplying whole numbers. Provide Diagnostic Tool: Multiplying Whole Numbers, Teacher's Resource pages 50 and 51, and have students complete it in writing or orally. Have base ten blocks and counters available for students to use.

See solutions on Teacher's Resource pages 52 and 53.

Intervention Pathways

The purpose of the intervention pathways is to help students multiply. The focus is to prepare them for working with a broader range of products and, eventually, decimal products as well.

There are 3 pathways:
- Pathway 1: Multiplying Two-Digit Numbers
- Pathway 2: Multiplying by One-Digit Numbers
- Pathway 3: Multiplication Fact Strategies

Use the chart below (or the Key to Pathways on Teacher's Resource pages 52 and 53) to determine which pathway is most suitable for each student or group of students.

Diagnostic Tool Results	Intervention Pathway
If students struggle with Questions 2d–e, 3h, 4e–f, 5c–d, 6c	use Pathway 1: Multiplying Two-Digit Numbers *Teacher's Resource pages 54–55* *Student Resource pages 55–59*
If students struggle with Questions 2b–c, 3e–g, 4a–d, 5a–b, 6a–b	use Pathway 2: Multiplying by One-Digit Numbers *Teacher's Resource pages 56–57* *Student Resource pages 60–64*
If students struggle with Questions 1, 2a, 3a–d	use Pathway 3: Multiplication Fact Strategies *Teacher's Resource pages 58–59* *Student Resource pages 65–69*

If students successfully complete Pathway 3 (or 2), they may or may not need the additional intervention provided by Pathway 2 (or 1). Either re-administer Pathway 2 (or 1) questions from the diagnostic tool or encourage students to do a portion of the open-ended intervention for Pathway 2 (or 1) to decide if more work in that pathway would be beneficial.

Name: ____________________ Date: ____________

Multiplying Whole Numbers

Diagnostic Tool

1. a) How much more is 4×6 than 3×6? ________ more

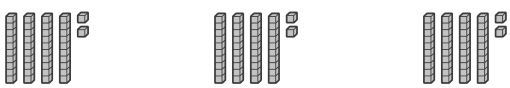
b) How much more is 8×2 than 5×2? ________ more

c) How much more is 7×9 than 6×9? ________ more

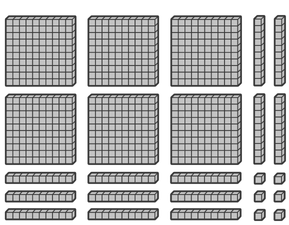
d) How much more is 5×9 than 3×9? ________ more

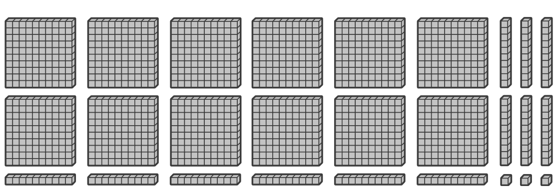
2. What multiplication is shown?

a)  ______ $\times$ ______

b)  ______ $\times$ ______

c)  ______ $\times$ ______

d)  ______ $\times$ ______

e)  ______ $\times$ ______

3. Calculate using mental math.

a) $4 \times 9 =$ ______

b) $3 \times 7 =$ ______

c) $8 \times 6 =$ ______

d) $7 \times 4 =$ ______

e) $8 \times 40 =$ ________

f) $9 \times 60 =$ ________

g) $6 \times 300 =$ ________

h) $30 \times 50 =$ ________

Name: ______________________________ Date: ____________________

4. Estimate.

a) 5 × 34 is about ____________

b) 7 × 68 is about ____________

c) 9 × 234 is about ____________

d) 6 × 475 is about ____________

e) 32 × 56 is about ____________

f) 82 × 68 is about ____________

5. Calculate

a) 7 × 51 = ____________

b) 3 × 648 = ____________

c) 42 × 72 = ____________

d) 53 × 43 = ____________

6. Describe a situation where you would use each multiplication.

a) 5 × 23

____

____

b) 7 × 14

____

____

c) 22 × 23

____

____

Solutions and Key to Pathways

Name:________________________ Date:______________

Multiplying Whole Numbers

Diagnostic Tool

Pathway 3

1. a) How much more is 4×6 than 3×6? 6, or 1×6 more

   b) How much more is 8×2 than 5×2? 6, or 3×2 more

   c) How much more is 7×9 than 6×9? 9, or 1×9 more

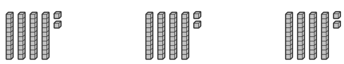
   d) How much more is 5×9 than 3×9? 18, or 2×9 more

2. What multiplication is shown?

Pathway 3

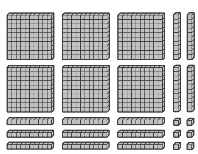
   a) 4 $\times$ 6

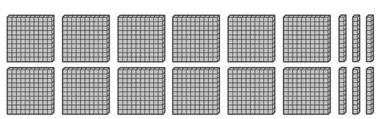
Pathway 2

   b)  3 $\times$ 42

   c)  2 $\times$ 230

Pathway 1

   d)  23 $\times$ 32

   e)  21 $\times$ 63

3. Calculate using mental math.

Pathway 3

   a) $4 \times 9 =$ 36

   b) $3 \times 7 =$ 21

   c) $8 \times 6 =$ 48

   d) $7 \times 4 =$ 28

Pathway 2

   e) $8 \times 40 =$ 320

   f) $9 \times 60 =$ 540

   g) $6 \times 300 =$ 1800

Pathway 1

   h) $30 \times 50 =$ 1500

Name:______________________________ Date:__________________

4. Estimate.

Pathway 2

a) 5×34 is about e.g., 150

b) 7×68 is about e.g., 500

c) 9×234 is about e.g., 1800

Pathway 2

d) 6×475 is about e.g., 3000

Pathway 1

e) 32×56 is about e.g., 1500

f) 82×68 is about e.g., 5500

5. Calculate

Pathway 2

a) $7 \times 51 =$ 357

e.g., $7 \times 1 = 7$
$7 \times 50 = 350$
$7 \times 51 = 357$

b) $3 \times 648 =$ 1944

e.g.,
$$\begin{array}{r} 648 \\ \times \quad 3 \\ \hline 24 \\ 120 \\ \underline{1800} \\ 1944 \end{array}$$

Pathway 1

c) $42 \times 72 =$ 3024

e.g., $2 \times 2 = 4$
$2 \times 70 = 140$
$40 \times 2 = 80$
$40 \times 70 = 2800$
$42 \times 72 = 3024$

d) $53 \times 43 =$ 2279

e.g., $50 \times 40 = 2000$
$50 \times 3 = 150$
$3 \times 40 = 120$
$3 \times 3 = 9$
$53 \times 43 = 2279$

6. Describe a situation where you would use each multiplication.

Pathway 2

a) 5×23

e.g., 5 shirts each cost $23, and you want the total cost.

b) 7×14

e.g., How many days are in 14 weeks?

Pathway 1

c) 22×23

e.g., How much money is collected in a class of 23 students if each one brings in $22?

Pathway 1 OPEN-ENDED

Multiplying Two-Digit Numbers

You will need

- base ten blocks
- Student Resource page 55

Open-Ended Intervention

Before Using the Open-Ended Intervention

Ask students to imagine a school with 12 classes, each with 26 students. Ask:

- How would you figure out how many students are in the school? (e.g., *I would multiply 12 × 26.*)
- How else could you do it? (e.g., *I would multiply 6 × 26 and double it.*)
- How would you use base ten blocks to model 12 × 26? (e.g., *I would make 12 groups of 2 tens blocks and 6 ones blocks.*)
- About how much is 12 × 26? How do you know? (e.g., *about 350 since it's about 12 × 30*)

Using the Open-Ended Intervention **Student Resource page 55**

Read through the task on the student page together. Make sure students understand that, for each situation, they must put the same number of books on each shelf (between 30 and 90 books), and the total must be close to 3000. The number of books on a shelf can change when the number of shelves used changes. Students should come up with several possibilities and describe their thinking each time. Provide base ten blocks for modelling.

Give students time to work, ideally in pairs.

Observe whether students

- estimate to come up with reasonable possibilities for a given number of books on a shelf
- multiply correctly to get the total number of books
- persevere to come up with many possibilities

Consolidating and Reflecting

Ensure understanding by asking questions such as these based on students' work:

- How did you decide on the number of books for 33 shelves? (e.g., *I know that 3000 = 30 × 100, so for 33 shelves, it would have to be less than 100; I tried 90; 90 × 33 = 2970.*)
- Suppose you knew that there were 55 books on a shelf. How would you figure out the number of shelves? (e.g., *I would multiply different numbers by 55 to see which is close to 3000.*)
- How would you explain to someone how you multiply 60 by 49? (e.g., *I would multiply 60 by 50 and take away 60.*)
- Would you multiply 42 by 66 the same way? If not, how would you multiply? (e.g., *No. I would figure out that 10 × 66 = 660, so 40 × 66 is 4 × 660; then I would add 2 × 66.*)

Multiplying Two-Digit Numbers

Guided Intervention

You will need

- base ten blocks
- Student Resource pages 56–59

Before Using the Guided Intervention

Ask students to imagine a school with 12 classes, each with 26 students. Then ask:

- How would you figure out how many students are in the school?
  (e.g., *I would multiply 12 × 26.*)
- How else could you do it?
  (e.g., *I would multiply 6 × 26 and double it.*)
- How would you use base ten blocks to model 12 × 26?
  (e.g., *I would make 12 groups of 2 tens blocks and 6 ones blocks.*)
- About how much is 12 × 26? How do you know?
  (e.g., *About 350; it's just a bit smaller than 12 × 30.*)

Using the Guided Intervention **Student Resource pages 56–59**

Work through the instructional section together. Students should represent the array of 12 by 24 with base ten blocks. Make sure students have an understanding of all 3 strategies—doubling, separating the tens and ones, and using an array.

Have students work through the **Try These** questions in pairs or individually.

Observe whether students

- relate a concrete model to a multiplication situation (Questions 1, 6)
- relate the multiplication of a two-digit number by a two-digit number to the separate multiplication of each of its parts (Question 2)
- estimate products (Questions 3, 7)
- explain multiplication strategies (Questions 4, 6)
- multiply numbers (Questions 4, 5, 8)

Consolidating and Reflecting

Ensure understanding by asking questions such as these based on students' work:

- What are some different ways to calculate 22 × 16?
  (e.g., *I could multiply 20 × 10 + 20 × 6 + 10 × 2 + 6 × 2 and add them, or I could double 22 × 8.*)
- What base ten block model would you create to show 14 × 14?
  (e.g., *I would set up a rectangle 14 wide and 14 deep.*)
- How did you create a big product in Question 8?
  (e.g., *I made the group size really big and had a lot of groups. I wasn't sure if 91 × 75 or 71 × 95 would be greater until I tried.*)
- How can you predict the ones digit of the product for 43 × 36?
  (e.g., *I know that the ones come from 3 groups of 6 ones, so I know 3 × 6 is 18, and there are 8 ones.*)
- How would you estimate 43 × 36? (e.g., *I would think 40 × 40 is 1600.*)

Multiplying by One-Digit Numbers

You will need

- base ten blocks
- Student Resource page 60

Open-Ended Intervention

Before Using the Open-Ended Intervention

Provide base ten blocks and ask:

- How could you use the blocks to show what 4×20 is?
  (e.g., *4 sets of 2 tens blocks is 8 tens, so that is 80.*)
- What about 4×200?
  (e.g., *4 sets of 2 hundreds blocks is 8 hundreds blocks, so that is 800.*)
- Suppose you didn't have enough blocks to show 4×20 or 4×200. Why would you really only need to know what 4×2 is?
  (e.g., *I showed 4 groups of 2 and just knew if it was tens blocks or hundreds blocks.*)
- What does 4×23 mean? (*4 groups of 23*)
- How would you calculate 4×23 if you knew 4×20 and 4×3?
  (e.g., *You would just add the 4 groups of 20 and 4 groups of 3.*)
- How would you calculate 4×213?
  (e.g., *It would be* $4 \times 200 + 4 \times 10 + 4 \times 3$*.*)

Using the Open-Ended Intervention **Student Resource page 60**

Read through the task on the student page together. Make sure students realize that they can use different numbers of crates, but that, for each situation, the crates have the same mass and the total is close to 3000 kg. The mass of a crate can change when the number of crates used changes. Students should come up with several possibilities and describe their thinking. Provide base ten blocks. Give students time to work, ideally in pairs.

Observe whether students

- estimate to come up with reasonable possibilities for a given crate size
- multiply correctly to get the total mass
- persevere to come up with many possibilities

Consolidating and Reflecting

Ensure understanding by asking questions such as these based on students' work:

- How did you decide the crate size for 4 crates?
  (e.g., *I knew it would be 1000 kg for 3 crates, so it had to be less. I know that* $4 \times 700 = 2800$*, so I tried a mass of 730 kg. I decided I could go a bit higher.*)
- Suppose you knew that a crate had a mass of 425 kg. How would you figure out the number of crates the truck could carry?
  (e.g., *I would multiply different numbers by 425 to see which is close to 3000.*)
- How would you explain to someone how you would multiply 6 by 499?
  (e.g., *I would multiply by 500 and take away 6.*)
- Would you multiply 5 by 589 the same way? If not, how would you multiply?
  (e.g., *No. I would calculate* $5 \times 500 + 5 \times 80 + 5 \times 9$*.*)

Multiplying by One-Digit Numbers

Pathway 2
GUIDED

Guided Intervention

You will need

- base ten blocks
- Student Resource pages 61–64

Before Using the Guided Intervention

Provide base ten blocks and ask:

- ▸ How could you use the blocks to show what 4×20 is?
  (e.g., *4 sets of 2 tens blocks is 8 tens, so that is 80.*)
- ▸ What about 4×200?
  (e.g., *4 sets of 2 hundreds blocks is 8 hundreds blocks, so that is 800.*)
- ▸ Suppose you didn't have enough blocks to show 4×20 or 4×200.
  Why would you really only need to know what 4×2 is?
  (e.g., *I showed 4 groups of 2 and just knew if it was tens blocks or hundreds blocks.*)
- ▸ What does 4×23 mean? (*4 groups of 23*)
- ▸ How would you calculate 4×23 if you knew 4×20 and 4×3?
  (e.g., *You would just add the 4 groups of 20 and 4 groups of 3.*)

Using the Guided Intervention (Student Resource pages 61–64)

Work through the instructional section on student page 61 together as students model the multiplication with base ten blocks. Make sure students get an understanding of all 3 strategies—repeated addition, multiplying in parts, and using base ten blocks.

Have students work through the **Try These** questions in pairs or individually.

Observe whether students

- relate a concrete model to a multiplication situation (Questions 1, 2, 7)
- relate the multiplication of a two-digit number to the separate multiplication of each of its parts (Question 3)
- estimate products (Questions 4, 8)
- explain multiplication strategies (Questions 5, 7)
- multiply numbers (Questions 5, 6, 9)

Consolidating and Reflecting

Ensure understanding by asking questions such as these based on students' work:

- ▸ What are some different ways to calculate 5×16? (e.g., *I could multiply 5×10 and 5×6 and add them, or I could double 5×8.*)
- ▸ What model would you create to show 8×281?
  (e.g., *I would make 8 groups of 2 hundreds blocks, 8 tens blocks, and 1 ones block.*)
- ▸ How did you create a big product in Question 9?
  (e.g., *I made the group size really big and a lot of groups. I wasn't sure if it should be 9×75 or 7×95 until I tried.*)
- ▸ How would you estimate 4×236?
  (e.g., *I would think 4×200 is 800, so it's more than that but less than 1000 since $4 \times 250 = 1000$.*)

Pathway 3
OPEN-ENDED

Multiplication Fact Strategies

You will need

- counters (about 50)
- Student Resource page 65

Open-Ended Intervention

Before Using the Open-Ended Intervention

Provide counters and ask:

- ▸ Arrange your counters to show what 5 × 4 means. How does it show that? (e.g., *5 × 4 means 5 groups of 4, and that is what I showed.*)
- ▸ How would 4 × 5 look different? (e.g., *It would be 4 groups of 5 instead.*)

Have students arrange the 4 groups of 5 counters in an array, if they are not already arranged that way, and split the array in 2. Ask:

- ▸ How does this show that 4 × 5 is double 2 × 5? (e.g., *There are 2 sets of 2 × 5.*)
- ▸ How could you split the original array to show that 4 × 5 = 4 × 3 + 4 × 2? (e.g., *Split each 5 into 3 + 2.*)

Using the Open-Ended Intervention (Student Resource page 65)

Read through the tasks on the student page together. Make sure students realize that, first, they need to relate multiplying by 3, 4, 6, 7, 8, and 9 to multiplying by 2 and/or 5, as well as using the value of that number itself. In the second part of the task, students need to replace either the 2 or 5 or both and then repeat the exercise. Provide counters.

Give students time to work, ideally in pairs.

Observe whether students

- think of multiplication as repeated addition or using arrays or the total size of equal groups
- recognize when to use the doubling strategy (e.g., 6 × ■ is twice 3 × ■; 8 × ■ is twice 4 × ■)
- correctly apply the distributive principle (e.g., 6 × ■ is 5 × ■ + ■)
- make reasonable choices for the replacements for 2 and 5

Consolidating and Reflecting

Ensure understanding by asking questions such as these based on students' work:

- ▸ How is multiplying by 3 related to multiplying by 2? (*Just add the number you are multiplying by to the double.*)
- ▸ What are some different strategies you can use to multiply by 6? (e.g., *I could multiply by 5 and add the number, or I could figure out the answer for multiplying by 3 and double it.*)
- ▸ What are some different strategies you can use to multiply by 9? (e.g., *I could multiply by 5, double the product, and then subtract the number, or I could double the double of the double and then add the number.*)
- ▸ Why did you decide to use 4 and 5 in the second part? (e.g., *I knew that if you could multiply by 4, you just take half to multiply by 2, so it would have to work if 2 and 5 work.*)

Multiplication Fact Strategies

Pathway 3 GUIDED

Guided Intervention

You will need

- counters (about 50)
- Student Resource pages 66–69

Before Using the Guided Intervention

Provide counters and ask:

- Arrange your counters to show what 5 × 4 means. How does it show that? (e.g., *5 × 4 means 5 groups of 4, and that is what I showed.*)
- How would 4 × 5 look different? (e.g., *It would be 4 groups of 5 instead.*)

Have students arrange the 4 groups of 5 in an array if they are not already arranged that way and split the array in 2. Ask:

- How does this show that 4 × 5 is double 2 × 5? (e.g., *There are 2 sets of 2 × 5.*)
- How could you split the original array to show that 4 × 5 = 4 × 3 + 4 × 2? (e.g., *Split each 5 into 3 + 2.*)

Using the Guided Intervention (Student Resource pages 66–69)

Work through the instructional section on student pages 66 and 67 together as students model the strategies using counters. Make sure students have a sense of all 3 strategies—doubling, skip counting, and multiplying in parts.

Have students work through the **Try These** questions in pairs or individually.

Observe whether students

- use a doubling strategy (Questions 1, 4)
- use the distributive principle (multiplying in parts) (Questions 1, 2, 4)
- use a halving strategy (Question 2)
- are familiar with multiplication facts (Question 3)
- can explain strategies (Questions 5, 6)

Consolidating and Reflecting

Ensure understanding by asking questions such as these based on students' work:

- How is multiplying by 3 related to multiplying by 2? (*Just add the number you are multiplying by to the double.*)
- What are some different strategies you can use to multiply by 6? (e.g., *I could multiply by 5 and add the number, or I could figure out the answer for multiplying by 3 and double it.*)
- What are some different strategies you can use to multiply by 9? (e.g., *I could multiply by 5, double the product, and then subtract the number, or I could double the double of the double and then add the number.*)
- How was drawing the pictures in Question 5 useful? (e.g., *It sort of explains the way to think when you see the picture.*)
- What was the first answer you thought of for Question 6? (e.g., *I thought of multiplying by 4 being easy if you know how to double since you just double the double.*)

Strand: Number

Dividing Whole Numbers

Planning For This Topic

Materials for assisting students with dividing whole numbers consist of a diagnostic tool and 3 intervention pathways. The pathways differ based on the size of the dividend used.

Each pathway has an open-ended intervention and a guided intervention. Choose the type of intervention more suitable for your students' needs and your particular circumstances.

Curriculum Connections

Grades 3 to 6 curriculum connections for this topic are provided online. See www.nelson.com/leapsandbounds. There are no significant differences between the work in division of whole numbers across the country in Grades 3 to 5.

Why might students struggle with dividing whole numbers?

Students might struggle with dividing whole numbers for any of the following reasons:

- They might not correctly interpret $a \div b$ as a sharing situation.
- They might not recognize division as the inverse operation to multiplication (e.g., that answering $45 \div 5$ is the same as asking what $5 \times \blacksquare = 45$ is).
- They might have difficulty relating division of multiples of 10 or 100 to related facts (e.g., they may not realize that $60 \div 2$ is simply based on $6 \div 2$).
- They might not know how to handle remainders (e.g., they might be able to solve $36 \div 4$ but not $38 \div 4$, or, if using a more traditional algorithm, they might write $\begin{array}{r} 51 \\ 4\overline{)215} \end{array}$ instead of $\begin{array}{r} 53 \\ 4\overline{)215} \end{array}$ Remainder 3, since in their second step they divided 5 by 4 instead of 15 by 4).
- They might not know all of the multiplication facts and therefore not know the division facts.
- They might not understand how to separate the dividend into convenient parts for dividing (e.g., they may not realize that to divide 120 by 9, it might be convenient to think of it as $90 \div 9 + 30 \div 9$).
- They might ignore internal 0s when dividing (e.g., dividing 6003 by 3 and getting 21).

Professional Learning Connections

PRIME: Number and Operations, Background and Strategies (Nelson Education Ltd., 2005), pages 51–62, 84, 90–97

Making Math Meaningful to Canadian Students K–8 (Nelson Education Ltd., 2008), pages 175–177, 182–189

Big Ideas from Dr. Small Grades K–3 (Nelson Education Ltd., 2010), pages 44–48

Big Ideas from Dr. Small Grades 4–8 (Nelson Education Ltd., 2009), pages 25–34, 38–41

Good Questions (dist. by Nelson Education Ltd., 2009), page 50

Diagnostic Tool: Dividing Whole Numbers

Use the diagnostic tool to determine the most suitable intervention pathway for dividing whole numbers. Provide Diagnostic Tool: Dividing Whole Numbers, Teacher's Resource pages 62 and 63, and have students complete it in writing or orally. Have base ten blocks, counters, and 10-frames available for students to use.

See solutions on Teacher's Resource pages 64 and 65.

Intervention Pathways

The purpose of the intervention pathways is to help students divide. The focus is to prepare them for working with a broader range of quotients and, eventually, decimal quotients as well.

There are 3 pathways:
- Pathway 1: Dividing Three-Digit Numbers
- Pathway 2: Dividing Two-Digit Numbers
- Pathway 3: Division Fact Strategies

Use the chart below (or the Key to Pathways on Teacher's Resource pages 64 and 65) to determine which pathway is most suitable for each student or group of students.

Diagnostic Tool Results	Intervention Pathway
If students struggle with Questions 6 to 8	use Pathway 1: Dividing Three-Digit Numbers *Teacher's Resource pages 66–67* *Student Resource pages 70–74*
If students struggle with Questions 4 to 5	use Pathway 2: Dividing Two-Digit Numbers *Teacher's Resource pages 68–69* *Student Resource pages 75–79*
If students struggle with Questions 1 to 3	use Pathway 3: Division Fact Strategies *Teacher's Resource pages 70–71* *Student Resource pages 80–84*

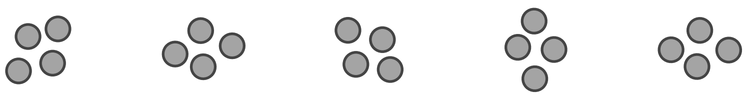
If students successfully complete Pathway 3 (or 2), they may or may not need the additional intervention provided by Pathway 2 (or 1). Either re-administer Pathway 2 (or 1) questions from the diagnostic tool or encourage students to do a portion of the open-ended intervention for Pathway 2 (or 1) to decide if more work in that pathway would be beneficial.

Name:________________________ Date:______________

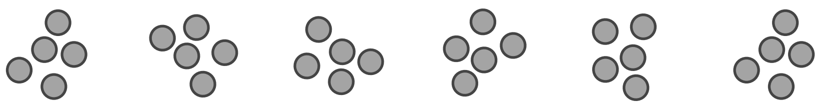
Dividing Whole Numbers

Diagnostic Tool

1. What multiplication does each picture show?
What division does each picture show?

a) 

multiplication: ____________ division: ____________

b) 

multiplication: ____________ division: ____________

c) 

multiplication: ____________ division: ____________

2. Draw a picture to show each division sentence.
Record the value of ■.

a) 25 ÷ 5 = ■

b) 18 ÷ 3 = ■

c) 56 ÷ 8 = ■

Name:____________________ Date:____________

3. Suppose you know that $4 \times 7 = 28$.
What division facts would that help you with?

____

4. a) How much more is $66 \div 3$ than $60 \div 3$?

________ more

b) How much more is $76 \div 4$ than $36 \div 4$?

________ more

5. Calculate.

a) $42 \div 2 =$ ________

b) $96 \div 8 =$ ________

c) $78 \div 7 =$ ________

d) $79 \div 3 =$ ________

6. Use words or draw a picture to show that
$315 \div 3 = 300 \div 3 + 15 \div 3$.

7. Circle the division expressions with answers close to 60.

$357 \div 6$ $134 \div 3$ $211 \div 3$ $548 \div 9$

8. Calculate.

a) $262 \div 2 =$ ________

b) $424 \div 8 =$ ________

c) $142 \div 5 =$ ________

d) $651 \div 9 =$ ________

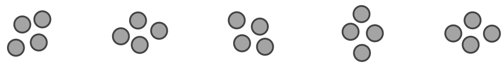
Name:________________________ Date:________________

Dividing Whole Numbers

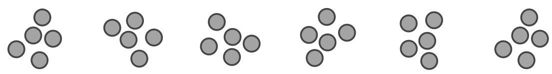
Diagnostic Tool

Pathway 3

1. What multiplication does each picture show?
   What division does each picture show?

   a) 

   multiplication: e.g., $5 \times 4 = 20$ division: e.g., $20 \div 5 = 4$

   b) 

   multiplication: e.g., $6 \times 5 = 30$ division: e.g., $30 \div 6 = 5$

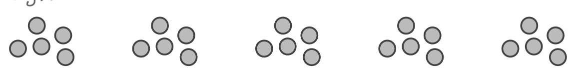
   c) 

   multiplication: e.g., $2 \times 9 = 18$ division: e.g., $18 \div 9 = 2$

2. Draw a picture to show each division sentence.
   Record the value of ■.

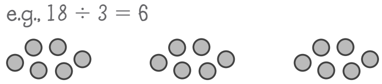
   a) $25 \div 5 =$ ■

   e.g., $25 \div 5 = 5$

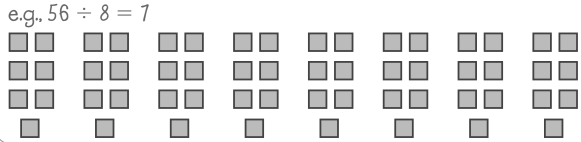
   b) $18 \div 3 =$ ■

   e.g., $18 \div 3 = 6$

   c) $56 \div 8 =$ ■

   e.g., $56 \div 8 = 7$

62 Dividing Whole Numbers, Diagnostic Tool *Leaps and Bounds* Copyright © 2011 by Nelson Education Ltd.

Name:______________________ Date:______________

Pathway 3

3. Suppose you know that $4 \times 7 = 28$.
What division facts would that help you with?

e.g., $28 \div 4$ or $28 \div 7$

Pathway 2

4. a) How much more is $66 \div 3$ than $60 \div 3$?

2, or $6 \div 3$ more

b) How much more is $76 \div 4$ than $36 \div 4$?

10, or $40 \div 4$ more

5. Calculate.

a) $42 \div 2 =$ 21

c) $78 \div 7 =$ 11 R1

b) $96 \div 8 =$ 12

d) $79 \div 3 =$ 26 R1

Pathway 1

6. Use words or draw a picture to show that
$315 \div 3 = 300 \div 3 + 15 \div 3$.

e.g., To share 315 among 3 people, you could share the first 300 and then the other 15.

7. Circle the division expressions with answers close to 60.

$357 \div 6$ $134 \div 3$ $211 \div 3$ $548 \div 9$

8. Calculate.

a) $262 \div 2 =$ 131

c) $142 \div 5 =$ 28 R2

b) $424 \div 8 =$ 53

d) $651 \div 9 =$ 72 R3

Dividing Three-Digit Numbers

You will need

- base ten blocks
- Student Resource page 70

Open-Ended Intervention

Before Using the Open-Ended Intervention

Have students model 412 with base ten blocks and ask:

- Suppose you had to divide that amount into 3 piles so that each pile had exactly the same amount in it. How do you know each pile would have more than 100 in it? (e.g., *3 × 100 is only 300, and that's too low*)
- How could you share the 412?
  (e.g., *I would put 1 hundreds block in each pile. I would trade the other hundreds block for 10 tens blocks. Then I could put 3 tens blocks in each pile. I would have 2 tens blocks left, so I would trade them for ones blocks. I could put 7 ones blocks in each pile. I would have 1 ones block left.*)
- Why might it make sense to write 412 ÷ 3 = 137 Remainder 1?
  (e.g., *You write division when you are sharing, and there were 412 to start with; there are 3 piles, and each pile has 137 in it, and there is 1 left over*.)

Using the Open-Ended Intervention Student Resource page 70

Read through the tasks on the student page together. Make sure students realize they should select different total numbers of comic books and that they must use 3 different numbers of piles for each total number of comic books. Provide base ten blocks and give students time to work, ideally in pairs.

Observe whether students

- use reasonable estimates to make predictions
- divide, or share, in parts
- use convenient parts (or easy numbers) to divide
- recognize that the number in a pile must be less if there are more piles for the same number of comics
- use multiplication knowledge to solve division (e.g., think about a number that might lead to 5 × ■ = a given number of comic books)

Consolidating and Reflecting

Ensure understanding by asking questions such as these based on students' work:

- How did you predict the number of comic books in a pile when there were 516 comic books in 5 piles?
  (e.g., *I know it's just a bit more than 100, since 5 × 100 = 500.*)
- Why might it be useful to realize that 600 = 500 + 100 to divide 600 comic books into 5 piles? (e.g., *because it's easy to split 500 into 5 piles, and then you just split 50 more and 50 more into the 5 piles*)
- How does knowing that 5 × 80 = 400 help you figure out the number of comic books in a pile if there were 408 comics in 5 piles? (e.g., *I would know that 400 ÷ 5 = 80, and then I would just divide up the last 8 and add to 80.*)

Dividing Three-Digit Numbers

Guided Intervention

You will need

- base ten blocks
- Student Resource pages 71–74

Before Using the Guided Intervention

Present the situation that 3 people were sharing $412. Ask:

- ▸ How do you know each person will get more than $100?
  (e.g., *If each person got $100, that would be only $300.*)
- ▸ How do you know they would get more than $130 each?
  (e.g., *because that would be $390, and $412 is still more than $390*)
- ▸ Why might you represent the question as 412 ÷ 3?
  (e.g., *You use division when you share.*)

Using the Guided Intervention **Student Resource pages 71–74**

Work through the instructional section on the student pages together as students do the calculations and model using base ten blocks. Make sure students understand all 3 strategies—estimating and adjusting, breaking up a number into "friendly" components, and sharing using base ten materials. For the last strategy, make sure students realize that it is not required but is much more efficient to start by sharing the largest blocks first. Point out how the recordings describe the actions.

Have students work through the **Try These** questions in pairs or individually.

Observe whether students

- relate a concrete model to a division situation (Question 1)
- relate the division of a three-digit number by a one-digit number to the separate division of its parts (Question 2)
- estimate quotients (Question 3)
- explain division strategies (Question 4)
- calculate quotients (Questions 4, 5, 6, 7)

Consolidating and Reflecting

Ensure understanding by asking questions such as these based on students' work:

- ▸ How did you estimate Question 3d)?
  (e.g., *I realized it was close to 720 ÷ 9 and knew that it was 80.*)
- ▸ What if you had divided 708 by 8? Would it be more or less than 708 ÷ 9? Explain.
  (e.g., *More, there is the same amount to share, but fewer people are sharing it.*)
- ▸ Why might it be useful to realize that 520 = 400 + 100 + 20 to figure out Question 4a)?
  (e.g., *because it's easy to split 400, 100, and 20 into 4*)
- ▸ How does knowing that 8 × 6 = 48 help you figure out Question 4c)?
  (e.g., *I would know that 8 × 60 = 480, and then I would just need to share the last 14 cookies.*)

Dividing Two-Digit Numbers

You will need

- base ten blocks or counters and 10-Frames (BLM 5)
- Student Resource page 75

Open-Ended Intervention

Before Using the Open-Ended Intervention

Provide either base ten blocks or counters and 10-Frames. Ask:

- How would you model 43? (e.g., *4 tens blocks and 3 ones blocks, or 4 full 10-frames and a 10-frame with only 3 counters in it.*)
- Suppose you had to divide that amount into 3 piles so that each pile had exactly the same amount in it. How do you know each pile would have more than 10 in it? (e.g., *3×10 is only 30, and that's too low.*)
- How could you share the 43? (e.g., *I would put 1 tens block in each pile. I could trade the other tens for 10 ones—then I could put 4 ones in each pile. I would still have 1 ones block left.*)
- Why might it make sense to write $43 \div 3 = 14$ Remainder 1? (e.g., *You write division when you are sharing and there were 43 to start with; there are 3 piles, and each pile has 14 in it and there is 1 left over.*)

Using the Open-Ended Intervention Student Resource page 75

Read through the tasks on the student page together. Make sure students realize they should select a few different total numbers of papers and that they must use 3 different numbers of friends for each number of papers selected. Remind students that they need to count Evan in the number of people delivering papers.

Provide the materials and give students time to work, ideally in pairs.

Observe whether students

- use reasonable estimates to make predictions
- divide, or share, in parts
- use convenient parts (or easy numbers) to divide
- use multiplication knowledge to help them get an answer (e.g., think about a number that might lead to $5 \times ■ =$ a given number of papers)

Consolidating and Reflecting

Ensure understanding by asking questions like these based on students' work:

- How did you predict the number of papers each person would deliver when there were 51 papers and 3 people delivering? (e.g., *I know there would be 3 people delivering. It's fewer than 20, since $3 \times 20 = 60$.*)
- What if there had been 2 people delivering instead of 3—would there be more or fewer papers for each person to deliver? Explain. (*more;* e.g., *If each person delivered the same number as with 3 people delivering, there would have been 1 pile that was not delivered.*)
- How does knowing that $5 \times 8 = 40$ help you figure out how many papers each of 5 people delivers if there were 42 papers to deliver? (e.g., *I would know that $40 \div 5 = 8$, and then one person would deliver an extra 2 papers*)

Dividing Two-Digit Numbers

Pathway 2 GUIDED

Guided Intervention

Before Using the Guided Intervention

Present the situation that 3 people were sharing \$82. Ask:

- ▸ How do you know each person will get more than \$20?
  (e.g., *because* $3 \times \$20 = \$60$*, so that would only use \$60*)
- ▸ How do you know that it makes sense that each person would get \$27?
  (e.g., *3 groups of 27 is* 3×27*, and that's 81 and really close to 82.*)
- ▸ Why might you represent the question as $82 \div 3$?
  (e.g., *You use division when you share.*)

Using the Guided Intervention **Student Resource pages 76–79**

Work through the instructional section on the student pages together as students model the division with base ten blocks or 10-frames and counters. Make sure students understand all 3 strategies—estimating and adjusting, breaking up a number into "friendly" components, and sharing using base ten materials or 10-frames and counters. For the last strategy, make sure students realize that it is not required but is much more efficient to start by sharing the tens blocks or full 10-frames first.

Have students work through the **Try These** questions in pairs or individually.

Observe whether students

- relate a concrete model to a division situation (Questions 1, 6)
- relate the division of a two-digit number by a one-digit number to the separate division of its parts (Question 2)
- estimate quotients (Question 3)
- explain division strategies (Question 4)
- calculate quotients (Questions 4, 5, 7, 8)

Consolidating and Reflecting

Ensure understanding by asking questions such as these, based on students' work:

- ▸ How did you estimate Question 3c)?
  (e.g., *I realized it was close to* $90 \div 3$ *and knew that it was 30.*)
- ▸ What if you had divided 98 by 8 in Question 3d)? Would the answer be more or less? Explain.
  (*more*, e.g., *There is the same amount to share, but fewer people are sharing it.*)
- ▸ Why might it be useful to realize that $80 = 60 + 18 + 2$ to figure out Question 4b)? (e.g., *It's easy to divide 60 and 18 by 6.*)
- ▸ How would you figure out how to share \$52 among 3 people?
  (e.g., *I know it would be \$10 if there were \$30, so I just need to share the last \$22. Each person gets \$7 more, and there is a remainder of \$1.*)

You will need

- base ten blocks or counters and 10-Frames (BLM 5)
- Student Resource pages 76–79

Division Fact Strategies

You will need

- multiplication tables
- counters (about 50)
- Student Resource page 80

Open-Ended Intervention

Before Using the Open-Ended Intervention

Provide multiplication tables. Ask:

- ▸ Look at the number in the row beginning with 2 and the column beginning with 8. What does the 16 mean?
  (e.g., *It's 2 × 8, since there are 2 groups of 8.*)
- ▸ How would that help you figure out 16 ÷ 2?
  (e.g., *It would have to be 8, since 16 ÷ 2 means how much is in each of 2 groups if there are 16 altogether, and that's what you have with 2 groups of 8.*)
- ▸ What division does the number in the row beginning with 4 and the columns beginning with 9 help you solve? (*36 ÷ 4 or 36 ÷ 9*)

Using the Open-Ended Intervention Student Resource page 80

Read through the tasks on the student page together. Make sure students realize they have 3 tasks—one dealing with 24, one with 26, and the last one requiring them to consider as many divisions as possible. Provide counters and multiplication tables and give students time to work, ideally in pairs.

Observe whether students

- recognize the relationship between multiplication and division
- consider all possible factor pairs for a given product
- look for alternative nearby numbers (e.g., realize that for 35 ÷ 4, they could look for 32 ÷ 4 or 36 ÷ 4 to help them)
- recognize when the table won't help them calculate a quotient because the quotient is too great (and, therefore, not close to numbers in the table for the given factor)
- persevere in finding quotients both with and without remainders, based on the multiplication table

Consolidating and Reflecting

Ensure understanding by asking questions such as these based on students' work:

- ▸ How does knowing that 4 × 6 = 24 help you figure out 24 ÷ 4? Use a picture to explain. (e.g., *I know that a picture with 4 groups of 24 shows 24 being shared 4 ways, but it also shows that 4 groups of 6 makes 24.*)
- ▸ Suppose you wanted to figure out 57 ÷ 7. What row in the table would you look at? (*the 7 row*)
- ▸ What could you do when you don't see 57? (e.g., *I look for a number close to it, like 56.*) Then what? (e.g., *If 7 × 8 = 56, then I know 56 ÷ 7 = 8, so 57 ÷ 7 is 8 R1.*)
- ▸ Why does the table not help you solve 96 ÷ 2?
  (e.g., *because there is nothing even close to 96 in the 2 row*)

Division Fact Strategies

Pathway 3 GUIDED

Guided Intervention

Before Using the Guided Intervention

Create an array with 2 rows of 8 counters. Ask:

- What multiplication fact does this model? (e.g., *2 × 8 = 16*)
- How do you know that?
  (e.g., *because there are 2 groups of 8*)
- How would that help you figure out 16 ÷ 2?
  (e.g., *It would have to be 8, since 16 ÷ 2 means how much is in each of 2 groups if there are 16 altogether, and that's what you have with 2 rows of 8.*)
- How would you show 36 ÷ 4?
  (e.g., *I would put 36 counters in 4 rows and see how many there are in each row.*)

Using the Guided Intervention Student Resource pages 81–84

Work through the instructional section on the student pages together as students model the division with counters. Make sure students have an understanding of all 3 strategies—using counters, estimating and then adjusting, and backwards multiplication.

Provide multiplication tables. Have students work through the **Try These** questions in pairs or individually.

Observe whether students

- model division situations (Questions 1, 2, 5)
- relate multiplication facts to division situations (Question 3)
- calculate quotients with and without remainders (Questions 1, 2, 4)
- explain the relationship between various division situations (Questions 5, 6)

Consolidating and Reflecting

Ensure understanding by asking questions such as these based on students' work:

- Suppose you had decided to draw a picture to solve Question 1c)—what would it look like?
  (*45 divided into 9 groups of 5*)
- What multiplication does Question 1c) relate to? (*9 × 5 = 45*)
- How could knowing that 9 × 4 = 36 help you figure out the answer to Question 2a)?
  (e.g., *I know that a picture with 9 groups of 4 shows 36 being shared 9 ways, but it also shows that 9 groups of 4 makes 36.*)
- What was different about solving 59 ÷ 8 in Question 2c)?
  (e.g., *The groups could not all be equal so I had a remainder.*)
- What might be some different ways you could have calculated 63 ÷ 9 in Question 4b)?
  (e.g., *I could have just remembered that 9 × 7 = 63; I could have put 63 counters into 7 equal piles; I could have figured out 45 ÷ 9 and added it to 18 ÷ 9.*)

You will need

- counters (about 50)
- multiplication tables
- Student Resource pages 81–84

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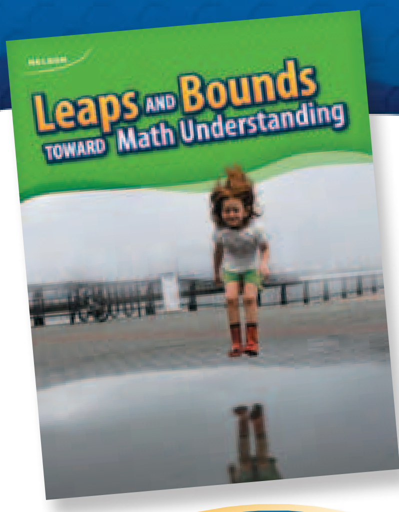

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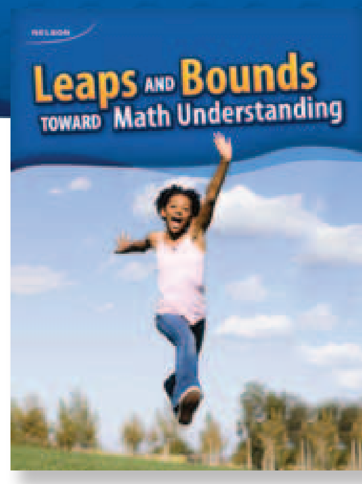

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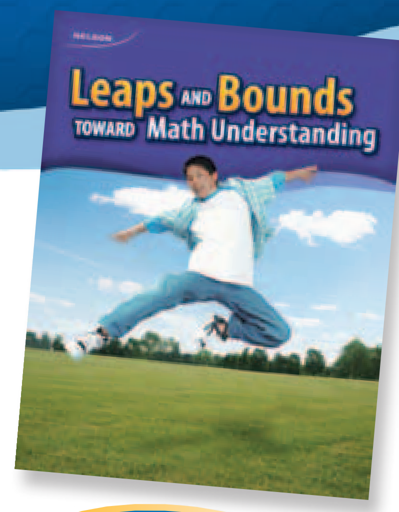

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