

**GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.**

**Outcomes**

KSCO: By the end of grade 3, students will be expected to

- i) recognize, describe, extend, and create patterns and sequences in a variety of mathematical and real-world contexts (e.g. geometric, numeric, and measurement)

SCO: By the end of grade 3, students will be expected to

- C1 recognize the pattern implicit in our place-value system
- C2 recognize and create geometric patterns

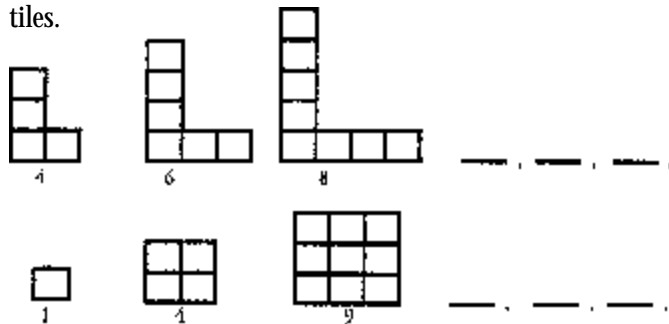
*Almost all patterning activities should involve some form of physical materials to make up the pattern. This is especially true of repeating patterns in grades K-4... (Elementary School Mathematics, p. 273)*

**Suggestions for Teaching and Learning**

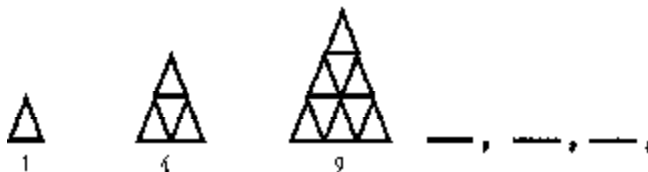
C1/C2 Students at this level have learned that the digit representing hundreds is to the left of the one representing tens in our place-value system, and it takes ten of one unit to be equivalent to one of the units to its left. Students can use this pattern to understand how we extend the place value system to decimals; that is, if 10 ones make 1 ten, 10 tens make 1 hundred, etc., and since 10 tenths make 1, the place to the right of the ones should be tenths.

- Students need opportunities to connect patterns to number ideas. Work with patterns found in the hundreds charts should be continued and expanded.

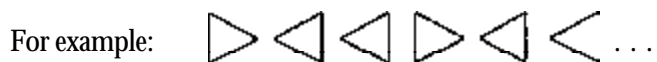
- Ask the students to respond orally in giving a number that is 100 more (100 less, 10 more, 10 less) than a 2- or 3-digit number that you provide.
- Invite students to use pattern blocks to begin a pattern for someone else to continue. The pattern should be related to the number of sides and vertices of the shapes.
- Have students create "L" numbers and square numbers, using tiles.



Ask students to create triangular numbers with pattern blocks.



- When studying slides and flips, it is natural for students to observe and create patterns with shapes based on these transformations.



## GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.

### Suggestions for Assessment

#### *Performance*

**C2.1** Give the student pattern-block pieces and ask him/her to create and describe a pattern showing flips.

**C2.2** Ask the student to find, in the classroom, examples of patterns created by slides, or flips, or a combination of the two.

**C2.3** Ask the student to use toothpicks to continue the pattern shown below:



**C2.4** Show a picture of the following pattern:



Ask the student to use the  $\triangle$  pattern blocks to recreate the pattern and use "slide flip" language to describe the pattern.

#### *Paper and Pencil*

**C1.1** Give problems such as those below and ask the student to complete to make a pattern.

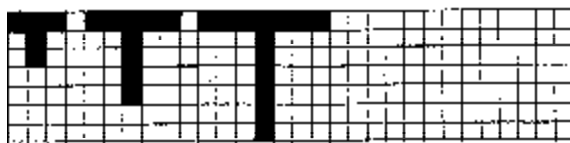
475, 575, \_\_\_\_\_, \_\_\_\_\_  
 233, \_\_\_\_\_, 253, \_\_\_\_\_  
 420, 440, \_\_\_\_\_, \_\_\_\_\_  
 556, \_\_\_\_\_, \_\_\_\_\_, 889

#### *Interview*

**C1.2** Ask the student to explain why hundreds come directly to the left of tens in our place-value system.

#### *Portfolio*

**C2.5** Provide  $\text{cm}^2$  paper for the students. Have them use coloured pencils to continue the pattern. Ask the students to create their own growing patterns.



### Resources

**GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.**

**Outcomes**

KSCO: By the end of grade 3, students will be expected to

*ii) use patterns to solve problems*

SCO: By the end of grade 3, students will be expected to

**C3** use and recognize the patterns in a multiplication table

**Suggestions for Teaching and Learning**

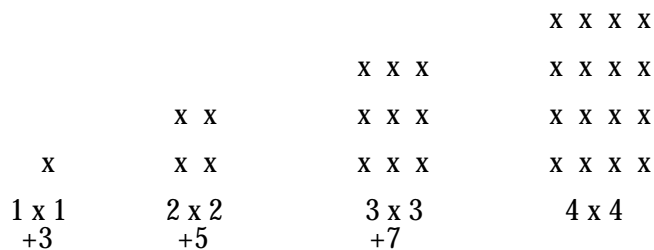
**C3** Students should be encouraged to find and explain patterns that occur in the multiplication grid. It is important that students understand they can use these patterns to determine unknown products or quotients.

Multiplication Grid

	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

For example, students might note that

- the numbers in each row and column increase by the same amount
- the numbers in each row increase by an amount one greater than the numbers in the previous row
- the square numbers are found on the left-right diagonal
- the numbers on the left-right diagonal increase by 1, 3, 5, 7,...



- row 4 is double row 2, row 6 is double row 3
- when you add the corresponding products of rows 2 and 3, you get the products in row 5; for example, 2 x 4 (8) plus 3 x 4 (12) is the same as 5 x 4 (20)

## GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.

### Suggestions for Assessment

#### *Paper and Pencil*

**C3.1** Ask the student to fill in the missing numbers, explaining the reason for each choice.

4, 8, \_\_\_\_, 16, 20  
 5, \_\_\_\_, 15, \_\_\_\_, 25  
 3, \_\_\_\_, \_\_\_\_, 12, 15

#### *Interview*

**C3.2** Provide the student with a multiplication grid. Ask him/her to describe some of the patterns he/she observes.

**C3.3** Ask the student to examine the 9 times table and tell what pattern(s) he/she notices.

**C3.4** Ask the student to show how one could use the multiplication grid to practise skip counting.

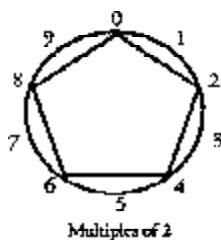
**C3.5** Ask the student to explain why some columns/rows have both even and odd numbers.

**C3.6** Ask the student to use the multiplication grid to explain why  $4 \times 5$  plus  $2 \times 5$  is the same as  $6 \times 5$ .

#### *Portfolio*

**C3.7** Have the student create a visual pattern of the final digits of the numbers in each of the multiplication tables. In each case, the final digit of one multiple is connected by a line to the final digit of the next.

For example:



The student should record any observations that he/she makes. Ask the student to create a visual pattern for another times table.

### Resources

**GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.**

**Outcomes**

KSCO: By the end of grade 3, students will be expected to

*ii) use patterns to solve problems*

SCO: By the end of grade 3, students will be expected to

**C3** use and recognize the patterns in a multiplication table (Cont'd)

KSCO: By the end of grade 3, students will be expected to

*iii) represent mathematical patterns and relationships in informal ways, including via open sentences (i.e., statements with missing addends)*

SCO: By the end of grade 3, students will be expected to

**C4** record a repeated addition pattern using multiplicative notation


**C5** recognize the meaning of open sentences of the forms:

$$\begin{aligned} \mathbf{a \times b} &= \square \\ \mathbf{a \times \square} &= \mathbf{c} \\ \mathbf{\square \times b} &= \mathbf{c} \end{aligned}$$

**Suggestions for Teaching and Learning**

**C3 (Cont'd)**

- when you "cross multiply" any 4 numbers that form a square on the grid, the product is always the same; for example,

$$2 \times 6 = 3 \times 4$$


- also, when you "cross add" these numbers and subtract the sums, you get 1
- the grid is symmetrical (i.e., numbers under the left-right diagonal are the same as the numbers above it)

- Ask students to look for the even and the odd numbers and see if they can find the pattern.
- Encourage students to examine a hundreds chart to find patterns.

**C4/C5** When faced with a situation involving repeated addition, students should recognize that the addition can be written as a multiplication in which the first factor normally tells how many times the addend is repeated and the second factor represents the addend. For example,  $5 + 5 + 5 + 5 + 5 + 5 + 5 + 5$  can be represented as  $7 \times 5$ .

- Give students questions such as the following: There were 3 muffins in each package and I bought 6 packages. How many muffins did I buy? Ask the students to model the question, to skip count to determine a response, and to write the repeated addition pattern as well as the corresponding multiplication notation:  $3 + 3 + 3 + 3 + 3 + 3$  or  $6 \times 3$ . (Even though  $6 \times 3 = 3 \times 6$ , it is important that 6 groups of 3 be written  $6 \times 3$ .)
- Provide opportunities for the students to look for patterns such as
 

4 packages	$3 + 3 + 3 + 3$	$4 \times 3$	12
5 packages	$3 + 3 + 3 + 3 + 3$	_____	_____
6 packages	_____	_____	_____
7 packages	_____	_____	_____

**GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.**

**Suggestions for Assessment**

*Paper and Pencil*

**C5.1** Ask the student to solve the following:

$$4 \times 3 = \square$$

$$7 \times \square = 21$$

$$\square \times 4 = 20$$

Have him/her show the meaning in a sketch or diagram.

**C4.1** Have the student write problems which show the difference between  $8 \times 4$  and  $4 \times 8$ . Ask him/her to explain why the answers (products) are the same.

**C4.2** Ask the student to fill in the missing sections of the chart on baseball.

There are 9 members on a baseball team.

	$9 + 9 + 9 + 9$	$4 \times 9$	
3 teams	$9 + 9 + 9$		
6 teams		$6 \times 9$	
			45

*Interview*

**C4.3** Ask the student to explain how to calculate  $6 + 6 + 6 + 6 + 6 + 6 + 6$  without doing the addition.

**C5.2** Ask the student to create three different open multiplication sentences for which the solution is 12.

**C5.3** Show the student the following equations and ask him/her to give the meaning for each.

$$6 \times \square = 18$$

$$\square \times 5 = 20$$

$$4 \times 4 = \square$$

**Resources**

## GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.

### Outcomes

KSCO: By the end of grade 3, students will be expected to

*iii) represent mathematical patterns and relationships in informal ways, including via open sentences (i.e., statements with missing addends)*

SCO: By the end of grade 3, students will be expected to

**C4** record a repeated addition pattern using multiplicative notation (**Cont'd**)

**C5** recognize the meaning of open sentences of the forms:

$$a \times b = \square$$

$$a \times \square = c$$

$$\square \times b = c \quad (\text{Cont'd})$$

### Suggestions for Teaching and Learning

**C4/C5 (Cont'd)** Although open multiplication sentences with missing factors, particularly with a missing first factor, are more challenging for students to solve than open sentences with the product missing, students need experience with both types. The following type of activity helps students to understand open multiplication sentences.

Provide practice in stating the meaning for equations.

$$4 \times \square = 24$$

Four sets of how many make 24?

$$\square \times 5 = 15$$

How many sets of 5 equal 15?

$$3 \times 6 = \square$$

3 sets of 6 is how many?

**GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.**

---

**Suggestions for Assessment**

**Resources**