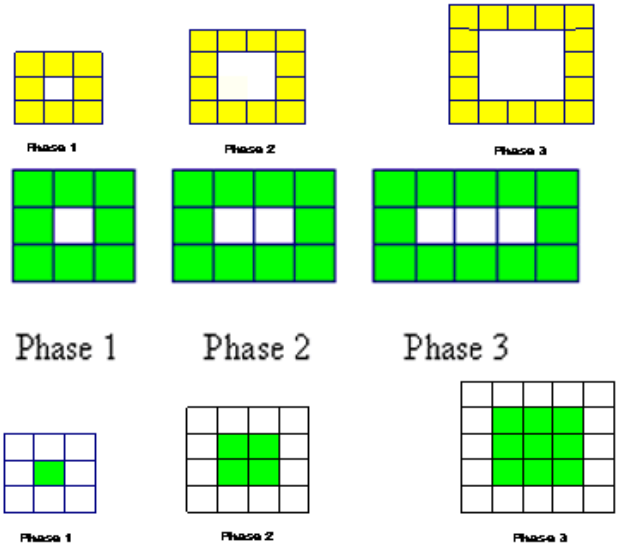
Patterning and Algebra Learning Activities – Grade 4

Picnic Partners

Strand: Patterning and Algebra, Grade 4

Big Ideas: Patterns and relationships

Overview



This learning activity can be used to introduce students to the exploration of growing patterns (sequences). The context is the seating around a picnic table. Students learn about or review the use of T-charts and are introduced to the concept of pattern rules. By solving the problem students will represent their thinking about patterns in a variety of ways including: concrete materials (manipulatives), numbers, words, tables, diagrams, and graphs. As students model and explain their representations of the patterns, they will build connections from concrete experiences toward generalizations of their findings using mathematical language.

Prior to this learning activity, students should have had some experience with extending simple number patterns, using charts to display data, using concrete materials to represent patterns, and representing simple geometric patterns with the aid of a number sequence, a number line, or a bar graph.

Curriculum Expectations

Overall Expectation

- describe, extend, and create a variety of numeric and geometric patterns, make predictions related to the patterns, and investigate repeating patterns involving reflections.

Specific Expectations

- extend, describe, and create repeating, growing, and shrinking number patterns (e.g., “I created the pattern 1, 3, 4, 6, 7, 9, …. I started at 1, then added 2, then added 1, then added 2, then added 1, and I kept repeating this.”);
- connect each term in a growing or shrinking pattern with its term number (e.g., in the sequence 1, 4, 7, 10, …, the first term is 1, the second term is 4, the third term is 7, and so on), and record the patterns in a table of values that shows the term number and the term;
- create a number pattern involving addition, subtraction, or multiplication, given a pattern rule expressed in words (e.g., the pattern rule “start at 1 and multiply each term by 2 to get the next term” generates the sequence 1, 2, 4, 8, 16, 32, 64,…);
- make predictions related to repeating geometric and numeric patterns.

About the Learning Activity

Length: 120 minutes

Materials

- **PA.BLM4a.1: Space Station Challenge**
- **PA.BLM4a.2: Home Connection**
- interlocking cubes or two-coloured tiles (about 80 per pair of students)
- graph paper
- grid chart paper, markers
- calculators

Math Language

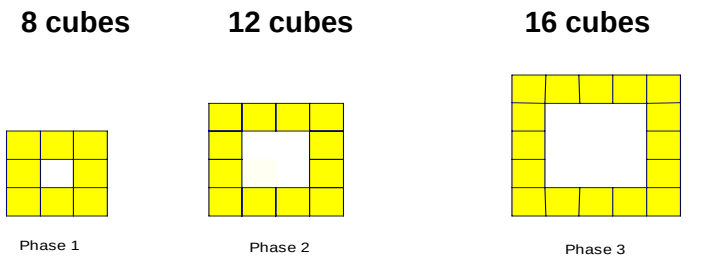
- growing pattern, sequence, border, perimeter area, T-chart

Instructional Grouping: whole group, pairs/small group

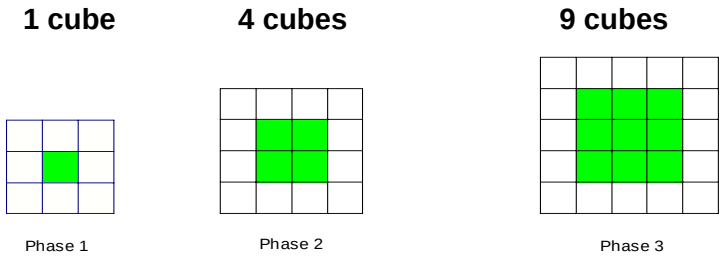
About the Math

Different growth patterns

Observe the difference between the two growth patterns. The first pattern grows when the same number is added to each term – that is, the pattern grows at a constant rate of 4. The second pattern grows when an increasing amount is added to each term – that is, the growth rate of the pattern is not constant.



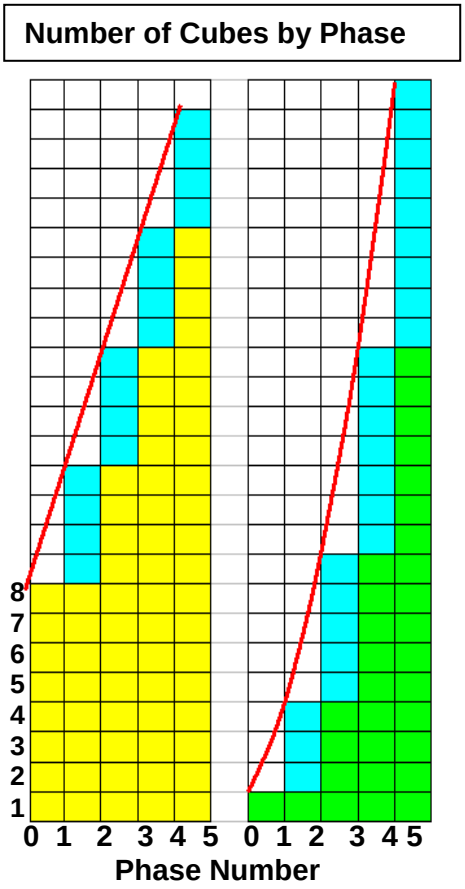
Same number added to each term



Increasing number added to each term

The bar graphs on the right show the number of shaded squares in the patterns. Notice that the bars that grow by adding the same number form a straight line pattern while the bars that grow by adding an increasing amount form a curve.

Legend
- = 1 cube in the border
- = 1 cube inside the border
- = 1 cube added for the term



The growth patterns

The table below shows how the two types of pattern grow.

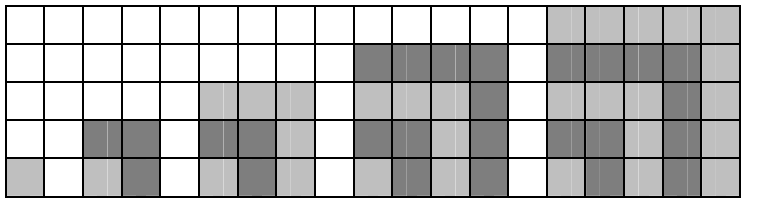
Dimensions of the Phases	Number of Border Squares	Border Growth	Number of Inner Squares	Inner Growth
3 x 3	8	+4	1	
4 x 4	12	+4	4	+3
5 x 5	16	+4	9	+5
6 x 6	20	+4	16	+7
7 x 7	24	+4	25	+9

Notice that the border-squares pattern grows at a constant rate (4 squares each time), while the inner-squares pattern does not. The inner-squares pattern starts with 1 square, then 3 more are added, then 5 more are added, then 7 more, and so on. The inner-squares growth is represented by odd numbers, but notice that when consecutive odd numbers are added together, the sum is a square number.

Examples: 1 + 3 = 4, 1 + 3 + 5 = 9, 1 + 3 + 5 + 7 = 16.

The diagram below offers a visual representation of the growth pattern of the inner squares.

Growth Pattern of Inner Squares



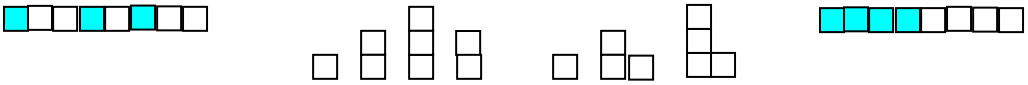
Phase:	1	2	3	4	5
	1	1+3=4	1+3+5=9	1+3+5+7=16	1+3+5+7+9=25

Getting Started – Warm Up (Part 1 of the 3 part lesson)

The Getting Started or Warm Up part of the lesson provides an opportunity for students to activate their prior knowledge about exploring and generating patterns. Distribute 8 cubes or colour tiles to each student. Ask students:

What pattern can you create with coloured tiles? When you have finished, turn to your learning partner and ask them to analyse your pattern to discover the rule for your pattern.

Some anticipated student responses might include:



By observing the students' patterns and the questions they ask each other to determine the rule, the teacher assesses the range of thinking about patterns. The teacher can think about which students are using colour only as their pattern, which students show growth patterns in their work, and which students selected repeating patterns in their work. Creating the patterns activates the students' knowledge about patterns before engaging in the focus problem of the lesson, and it provides the teacher an opportunity to think about how the lesson will engage each learner in further development of their understanding.

Working on It – (Part 2 of the 3 part lesson)

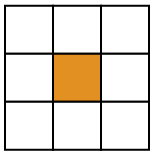
Distribute **PA.BLM4a.1** (one copy to each student) and read the scenario together:

Organize students for whole group discussion (e.g., sitting in a circle at their desks or on the floor). Pose this problem for the students:

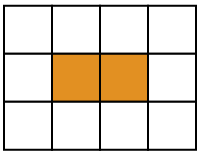
The Grade 1 teacher has asked our class to help her with a problem. She is planning a picnic for her class, and each student is going to bring one visitor. She started planning the seating by drawing a picture of the picnic table. (Draw Table 1 on the board.)

She thinks that 8 people can sit at one table, but that won't be enough seating for every student and every guest. She wants everyone to be able to sit at the same table.

If she pushed two tables together, 10 people could sit down.



1 Table



2 Tables

How many picnic tables will the Grade 1 class need to seat 30 people?

Working on It

Part 1: Understanding the Problem

Whole Group: Ask the students to turn to a partner and describe what they think the problem is asking them to do? Ask for a volunteer who feels able to explain to the class what the problem is asking? After the student provides the explanation, ask the class, "I'm still not sure; is there anyone else who can explain it to me?" This exchange allows students to think about and articulate the problem. Ask students, "If you understand the problem, show me a "thumbs up" (students make a fist and point their thumb toward the ceiling); if you do not understand the problem show me a "thumbs down" (students make a fist and point their thumb toward the floor). The teacher is able to quickly assess who understands the problem and is ready to work. Continue the conversation until all the students fully understand the problem.

Part 2: Make a Plan

Small Group: Provide each small group (3 or 4 students) with grid chart paper, markers, interlocking cubes, and colour tiles. Remind students that they may use any tools (manipulatives, calculators, or found materials) they want in order to solve the problem.

Allow students time to organize themselves and to discuss their thinking about how their group will solve the problem.

Part 3: Carry Out the Plan – Solve the Problem

Small Group: Students continue to work on solving the problem in their small groups. As students work, the teacher observes the groups and asks them questions to help them focus their thinking. It is critical that the teacher refrain from telling students how to solve the problem or from providing hints, as this will interfere with the students' construction of their own understanding. The teacher may ask questions such as:

Tell me what you are doing?

I don't understand that; can you explain it to me again?

What are you noticing about the number of tables and the number of guests?

Why did you choose to use the table of values to work on the problem?

I'm still not sure if I understand how many picnic tables you think you will need. Can you tell me again?

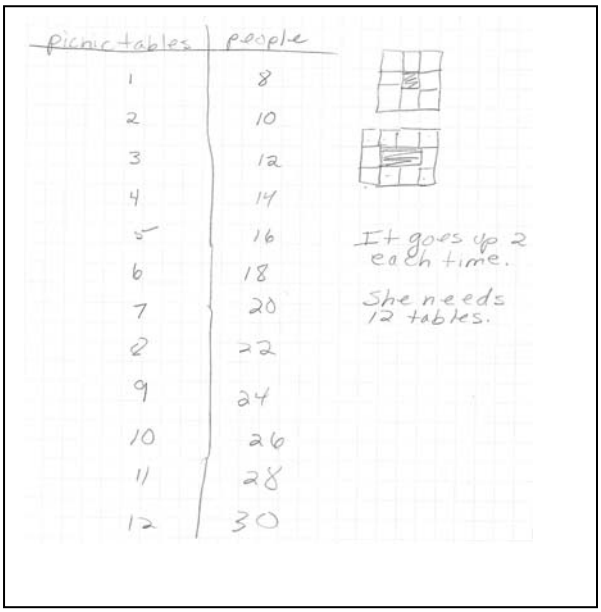
Part 4: Look Back and Reflect

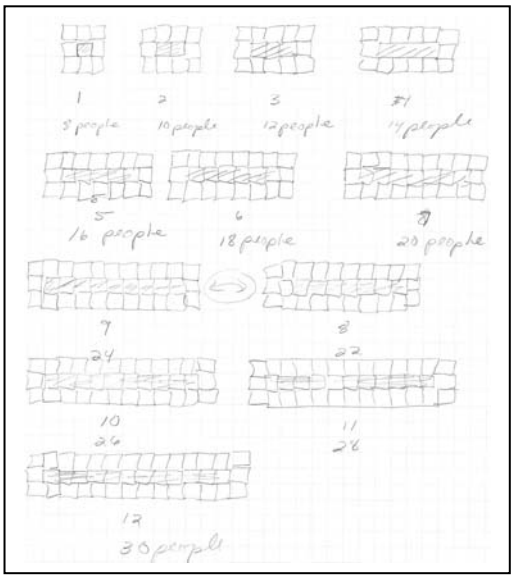
Small Group: Ask each group of students to hang their solution on the board or wall. Provide students with sticky notes and direct them to take a gallery walk around the room to view each solution. While they are viewing the solutions, ask them to put any questions they have about the solutions on sticky notes and attach them to the group's solution.

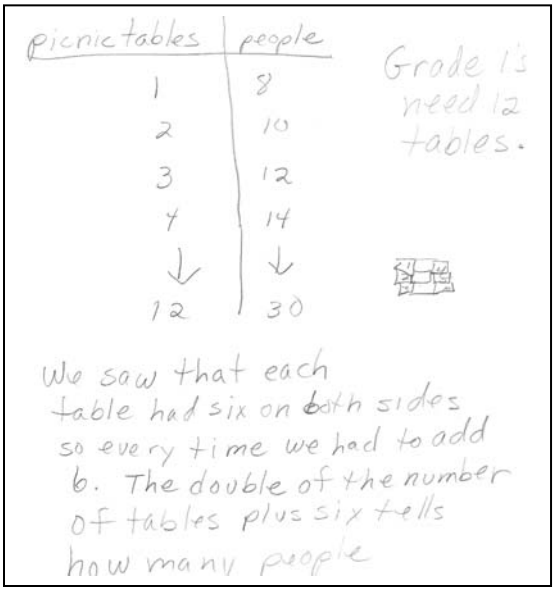
Whole Group: Provide opportunities for the students to meet with their groups to discuss the questions on the sticky notes. Ask each group to answer the sticky note questions in front of the whole group.

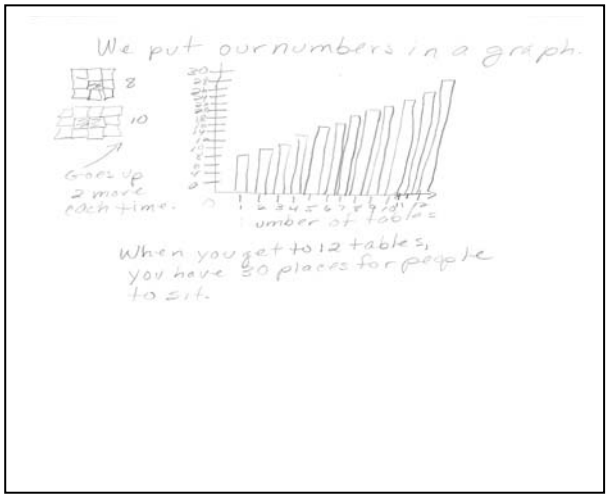
Reflecting and Connecting – (Part 3 of the 3 Part Lesson)

At this point in the lesson, students have had ample opportunity to solve the problem and record their thinking and representations on chart paper. At this point in the lesson, the teacher selects 3 or 4 samples to use for the consolidation of the lesson. Different representations of the problem and the solution should be chosen to provide opportunities for rich discussion and dialogue about the mathematics. Anticipated student responses may include:









Provide time for each group of students to describe their solution. Ask them how they decided to represent their thinking. As students talk about their thinking, place strips of paper over the samples to notate their work (e.g., Table of Values, Graphics, Graphs, Number Sentence). Allow the students in the class to ask the group any clarifying questions after they have explained their solution. Then ask a student from the class to repeat in his or her own words what the group explained about their solution.

To demonstrate their understanding, students may have selected to:

- construct the table shapes with manipulatives;
- draw/shade a grid;
- complete a T–chart;
- explain a pattern rule;
- extend the pattern to 12 tables.

Students may say that they were able to find the solution by counting desks and adding tables, by using a "T chart", by seeing a pattern. Students may say that the number of tables is doubled and then 6 is added to find out how many people can sit at the tables. As students describe this, the teacher can annotate on the board:

Scaffolding questions: Does your model match the diagram? How many pieces did you need for each part? How many more did you use each time? Was it always the same?

Student says: Double the number of tables and add six.
Teacher writes: # of tables + # of tables + six = number of people.

The teacher may ask students if they can think of another way to write the rule of the pattern from the problem. Student responses might include:
2 x the # of tables plus six.
2 x tables + 6 = # of people for the picnic.

Using three or four samples from the students' work to discuss solutions, strategies, and representations is referred to as a "math congress". This term was coined by Cathy Fosnot in her work with elementary students. Mathematicians meet at a congress to

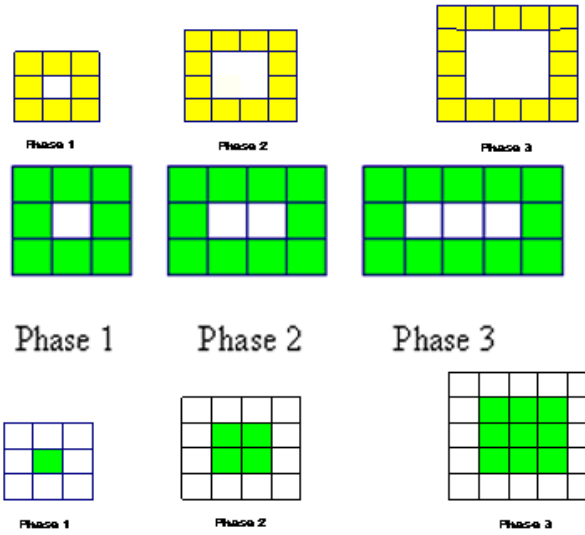
discuss their ideas, provide proofs, and dialogue about math. The “math congress” provides students with an opportunity to learn through problem solving, and the congress creates differentiated instruction for all students in the learning environment. The congress helps students to construct the meaning of the mathematics as opposed to rigidly following rules that they may not understand.

Tiered Instruction

Supports and extensions can be beneficial for all students. For any given activity, there will always be some students who require more or less support, or for whom extensions will increase interest and deepen understanding.

Extension

Students may want to consider the relationship discussed in the introduction to this activity. Students will be able to build on their experience with the middle row below to try and discover the rule for the first and third rows below.



Pattern: Row 1

Phase	Pieces
1	8
2	12
3	16
4	20
5	24

Multiply the phase number by 4, then add 4 to get the number of pieces.

Pattern: Row 2 (as in the problem solved by students)

Phase	Pieces
1	8
2	10
3	12
4	14
5	16

Multiply the phase number by 2, then add 6 to get the number of pieces.

Home Connection

Extend the activity further by providing students with a different but similar pattern to work on at home. Distribute **PA.BLM4a.2** to students. This activity follows a format similar to the activity completed in class. Ask students to share with their parents what they have learned, and demonstrate their understanding of the concept, using numbers, pictures and words.

Assessment

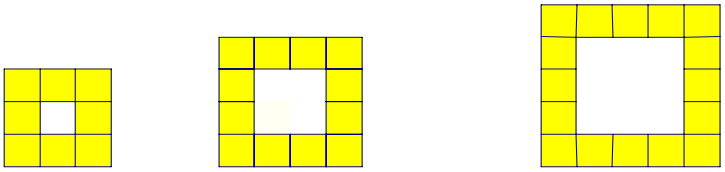
Use the students' discussions and representations to identify areas of focus for the next lesson. Assessment for learning uses observation and data collected by the teacher during the lesson to plan the next instructional focus. Assessment opportunities include:

- an interview or informal discussion during the activity;
- observation of progress as students move from one part of the lesson to the next;
- student responses to questions posed by fellow students at the math congress
- written representations of the math on the solution charts.

PA.BLM4a.1 Space Station Challenge

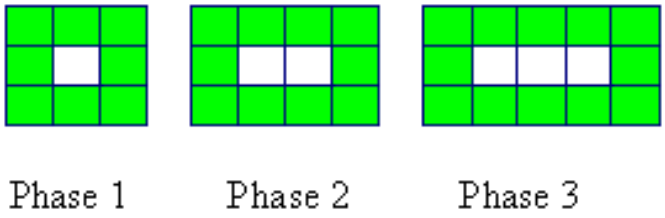
Part 1: Design #1

The Canadian government wants to build an expandable space station that could provide classrooms for students who are studying outer space. Here is the design proposed by one company. The company provided a model made of cubes to show how the station might grow. The diagram shows the first three phases of the project. If the space station were to grow 2 more times, what would it look like?



Part 2: Design #2 (Do not begin until Part 1 of the Project Status form is signed.)

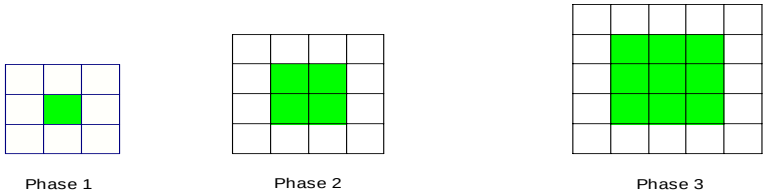
Another company has submitted a different proposal for the space station. The first phase is also made up of 8 cubes. The model and its growth in the first three phases are represented at right. Compare design #2 with design #1. At phase 8, which design will involve more cubes? How do you know?

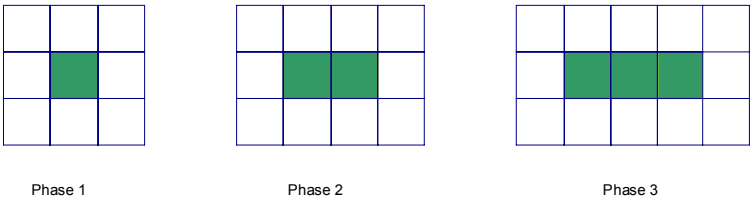


Part 3: Designs #3 and #4 (Do not begin until Part 2 of the Project Status form is signed.)

Each of the two companies also submitted a second design that is a variation on their first design (as shown below). Notice that in this second set of designs the space station is constructed in the central space of the first set of designs. Look at the central space created by design #1. Phase 1 is the size of 1 square, phase 2 is the size of 4 squares, and phase 3 is the size of nine squares. How large would the central space be for phase 5? Model the problem, record results on a T-chart, and develop a pattern rule.

Look at the central space of design #2. Phase 1 is the size of 1 square, phase 2 is the size of 2 squares, and phase 3 is the size of 3 squares. How large would the central space be for phase five? Model the problem, record results on a T-chart, and develop a pattern rule.





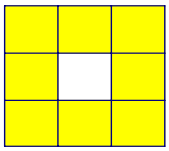
PA.BLM 4a.2 Home Connection
Space Station Challenge

Dear Parent/Guardian:

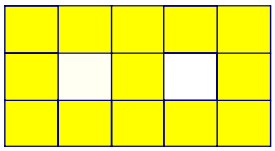
In math we are currently exploring many types of patterns. The class has already examined four possible designs for an expandable space station to provide classrooms for students who might one day study in outer space.

This home task builds on the activity by presenting a new design for consideration. Please ask you child to investigate the following problem:

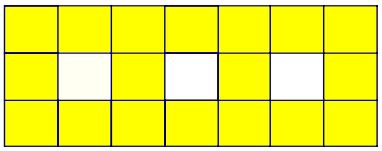
The Canadian government has just considered four proposals for the design of an expandable space station. A fifth design has been submitted, and as with the other designs, a model made of cubes demonstrates how this design would grow. The diagrams below show the first three phases of construction. If the space station were to grow 2 more times, what would it look like? How many cubes would there be in that phase (phase 5)? What is the pattern rule?



Phase 1



Phase 2



Phase 3

Your child could solve this problem by building a model, drawing a diagram, or using a T-chart (shown on the right).

Back in class, students will be asked to share their solutions with their classmates.

Phase	Pieces
1	8
2	
3	
4	
5	

What's My Rule?

Strand: Patterning and Algebra, Grade 4

Big Ideas: Expressions, variables, and equations

Overview

This learning activity provides an introduction to the use of variables and examines the inverse relationship between multiplication and division. Using a literature connection, students discover the relationship between input and output values, then plot points on a graph.

Prior to this learning activity, students should have had some experience with creating charts, making graphs, modelling patterns with concrete materials, and drawing diagrams on grid paper.

Input	Output
1	6
2	12
3	18
4	24
…	…
10	60

Curriculum Expectations

Overall Expectation

- demonstrate an understanding of equality between pairs of expressions, using addition, subtraction, and multiplication.

Specific Expectations

- Determine, through investigation, the inverse relationship between multiplication and division (e.g., since 4 x 5 = 20, then 20 ÷ 5 = 4; since 35 ÷ 5 = 7, then 7 x 5 = 35);
- Determine the missing number in equations involving multiplication of one- and two-digit numbers, using a variety of tools and strategies (e.g., modelling with concrete materials, using guess-and-check with and without the aid of a calculator);
- Identify, through investigation (e.g., by using sets of objects in arrays, by drawing area models), and use the commutative property of multiplication to facilitate computation with whole numbers (e.g., "I know that 15 x 7 x 2 equals 15 x 2 x 7. This is easier to multiply in my head because I get 30 x 7 = 210.").

About the Learning Activity

Time: 120 minutes

Materials

- **PA.BLM4b.1: Home Connection**
- interlocking cubes or coloured tiles
- graph paper
- chart paper

Math Language

- array, T-chart, equality, decompose, symbol (variable), input, output

Instructional Grouping: whole class, pairs

About the Math

Variable. In algebra terminology, a variable is a letter or symbol that is used to represent an unknown value (as in 5x = 15) or a varying quantity (such as the input and output values in P = 4s, where output is P and input is s). The symbols x and y are often used to represent variables. However, any letter (a or b or c…), any symbol ( or ) or any concrete material (such as a colour tile) may be used to represent a variable.

Getting Started

Start by reading *Six Dinner Sid,* a story about a clever cat who loves to eat dinner. If the book or video is not available, use the following text to explain the premise of the story:

"The story *Six Dinner Sid* is about a very clever and manipulative cat named Sid. He has convinced six people living on the same street that he belongs to them and to them alone. As a result, he is able to enjoy six dinners a day. Unfortunately, this also means that when he gets sick, he has to visit the vet six times and take six doses of medicine, which leads to a humorous predicament."

Discuss what else Sid might have access to in all six homes (e.g., how many people will he have to pet him? how many chairs will he have to sit on?).

Working on It: Part 1

Creating the T-chart

Tell the class that they are going to focus on Sid's dinners, and use this story to explore the pattern in the number of dinners that Sid consumes, and then plot the pattern on a graph. Set up a T-chart on the board showing days as the input and dinners as the output. Pose the question: "How many dinners would Sid eat in one day?" Write "1" in the input column and "6" in the output column. Say, "In one day Sid would eat 6 dinners."

 Input	 Output
1	6
2	12
3	18
4	24
…	…
10	60

Continue prompting the class with:

- How many dinners would Sid have in 2 days? Explain.
- How many dinners would Sid have in 3 days? Can you see a pattern?
- How many dinners would Sid have in 4 days?

Teacher note: Notice the symbols used for input and output. Let the class choose the symbols for the T-chart.

Typical student responses might include statements such as: "Every day he gets six more." "I added six more each day." "I see that you can multiply the days by six because he gets six more each day." "There is one more group of six each day." "It's like counting by sixes."

Teacher note: As the students respond, prompt them to say the same thing in different ways. Remind them that multiplication is the same as repeated addition.

Prompt the students to predict the output for 5 days, and then for a full week. You might then ask, "If Sid had 60 dinners, how many days would that have taken? How do you know?" Responses might include: "I put 60 cubes into six piles and there were 10 in each pile." "I put one cube down for dinner at each house and when I used all 60 cubes I had ten under each house." "I continued the pattern of adding six. I knew he ate 42 dinners in a week, so I added 3 groups of six to get 60. That meant 10 days." "I divided 60 into 6 groups, and 60 meals divided by 6 per day gives 10 days."

Teacher note: Encourage students to see that multiplying by 6 and dividing by 6 are related. If they know the input value they can multiply by 6 to determine the outcome, and if they know the output value they can divide by 6 to determine the input.

Developing a rule

Ask for suggestions on how to reword the rule to use terms such as input value and output value.

The chart should help students to see that the rule could be expressed in different ways:

- the input value x 6 = output value
- the input value + input value + input value + input value + input value + input value = output value
- the output value ÷ 6 = input value

Teacher Note: Have manipulatives available so that students can model the problem.

Look at the first rule: the input value x 6 = output value. Ask the class: "How could we represent the input value without having to write out the words each time? Is there a short form?" Brainstorm different ideas. Also, offer the suggestion that they could use the sun (or the input symbol the class has chosen) to represent the number of days.

Teacher prompts: The sun represents the input value, the number of days. What do we have to do to the input value to get the output value? We could write 6 x  or  x 6 to show this part of the rule**.** What does the dinner plate represent?

Now ask the class: "How could we represent the output value without having to write out the words each time? Is there a short cut?" Brainstorm ideas. One option is to use the dinner plate (or the output symbol the class has chosen).

The first rule (the input value multiplied by 6 = output value) could be written as:

6 x  =  or  x 6 = 

Checking the rule

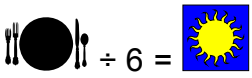
"Let's see if our rule works. What number do I put in for the sun? Let's start with 1. 1 x 6 is 6 and Sid does have six dinners in 1 day, so it works. Let's see if it works for two days. I put 2 in for the sun and 2 x 6 is 12. Yes, he has 12 dinners in two days. Work in your groups and see if the rule works for the whole week." Circulate and look at how the students are substituting numbers for symbols. Ask questions to see if everyone has a clear understanding.

Writing the rule a different way

Say: "Let's look at another way of writing the rule. Could we write the rule without using multiplication?" The rule could be written as:

Have students work in their groups to substitute values and see if the rule works for the week.

Continue: "Let's look at yet another way of writing the rule. Could we write the rule without using multiplication or addition?" The final rule (the output value divided by 6 = input value) could be written as:



Have students work in their groups to substitute values and see if the rule works for the whole week."

Teacher prompts: "If we start with the output, which is the number of dinners, and if we divide the output into 6 groups, it equals the input. If we put in the symbol for output, the dinner plate, and we divide the output into 6 groups, we should get the input, which is the sun."

Working on It: Part 2

Tell the story of *Four Meal Fred*: "Fred is a St. Bernard dog with a voracious appetite. He is not quite as clever as Sid but he is able to convince four different families that he belongs to them. They all feed him, of course, so Fred gets 4 meals a day. You will now work in pairs to determine how many meals Fred would receive in a week."

Input □	Output ▲
1	4
2	8
3	12
4	16
5	20
6	24
7	28

Make clear the scope of the task. Each pair needs to:

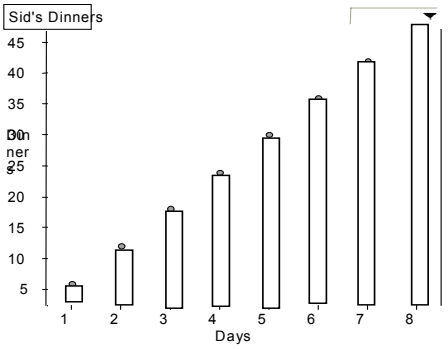
- create a T-chart with values;
- write at least one rule in words;
- represent the rule in symbols;
- check that the rule is correct.

Extend the problem:

- How many meals might Fred receive in a month?
- How many days would it take for Fred to have 56 meals?

Working on It: Part 3

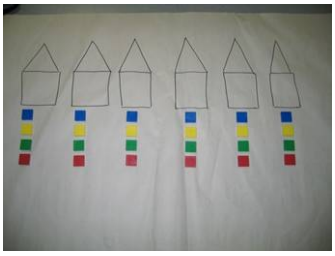
Graphing Sid's Dinners and Fred's Meals



Explain to students that they will be using the data they gathered on Sid's dinners and representing it as a bar graph, with the input numbers on the horizontal axis and the output numbers shown as bars.

Have students use the data from Fred's meals to create their own graph, using graph paper or graphing software. Have them create a variety of representations for Fred's meals. They could use the following template.

Diagram or manipulative



T-Chart

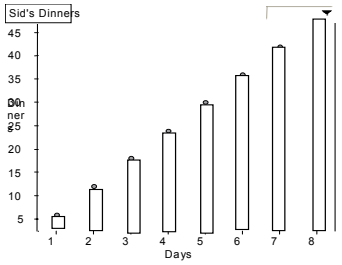
Input □	Output ▲
1	4
2	8
3	12
4	16

Fred's Meals

Multiply the input by 6 to get the output

6 x □ = ▲

Rule



Graph

Reflecting and Connecting

Draw the input/output chart for Fred's meals on the board or on an overhead transparency, and encourage students to fill it in. Prompt the class to give a rule for what's happening. Students will have to make up their own symbols (variables). For example:

□ x 4 = ▲, □ + □ + □ + □ = ▲, ▲ ÷ 4 = □, 4 x □ = ▲

Teacher note: Students may think that □ x 4 = ▲ and 4 x □ = ▲ are different. Use simple examples to show the *commutative property* of multiplication (e.g., 3 x 4 is equal to 4 x 3).

Tiered Instruction

Supports and extensions can be beneficial for all students. For any given activity, there will always be some students who require more or less support, or for whom extensions will increase interest and deepen understanding.

Supports for student learning

Scaffolding suggestions:

- For students who require a lower-level entry, provide a similar but simpler activity from the book *Two of Everything*, which uses a doubling pattern.
- Have students draw houses on chart paper and model houses with tiles.
- Leave examples of the Sid problem posted as a model.
- Do a "Gallery Walk" to see what other students are doing.
- Provide a checklist, with the following steps to be completed:
  - create a T-chart with headings
  - use manipulatives to model
  - check for a pattern
  - pair/share; orally describe the pattern
  - write the rule
  - use symbols to state the rule
  - check by substituting a number

Extensions

- Have students write a different problem based on Sid's experiences.
- Have students read *Anno's Mysterious Multiplying Jar* to find the rule for the jar.
- Have students read *Multiplying Menace* and look for the secret of the stick.

Other literature connections:

- *Two of Everything*, by Albert Whitman. ISBN 0807581577
- *100 Angry Ants*, by Elinor J. Pinczes. ISBN 0395971233
- *Spaghetti and Meatballs for All*, by Marilyn Burns, 1997. ISBN 0-590-94459-2
- *The Number Devil (the third night)*, by Hans Magnus Enzensberger, 1997. ISBN 0-8050-6299-8

Home Connection

See **PA.BLM4b.1**.

Assessment

Observe students in order to assess their use of:

- an efficient strategy;
- math language to explain the solution;
- appropriate symbols (variables) in pattern rules;
- appropriate diagrams/models.

Rubric

Assessment category	Level 1	Level 2	Level 3	Level 4
Knowledge and understanding				
– generates patterns	□ limited	□ some	□ considerable	□ thorough
– distinguishes between term number and term value	□ limited	□ some	□ considerable	□ thorough
– identifies similarities and differences in growing patterns	□ limited	□ some	□ considerable	□ thorough
– constructs tables, graphs, and diagrams	□ limited	□ some	□ considerable	□ thorough
Thinking				
– creates a plan of action for exploring patterns	□ limited	□ some	□ considerable	□ high degree
– identifies and extends growing patterns	□ limited	□ some	□ considerable	□ high degree
– makes predictions for pattern growth	□ limited	□ some	□ considerable	□ high degree
– creates a rule for describing pattern growth	□ limited	□ some	□ considerable	□ high degree
– explores alternative solutions	□ limited	□ some	□ considerable	□ high degree
Communication				
– explains mathematical thinking	□ limited	□ some	□ considerable	□ high degree
– communicates using a variety of modes (short answers, lengthy explanations, verbal and written reports)	□ limited	□ some	□ considerable	□ high degree
– uses appropriate vocabulary and terminology	□ limited	□ some	□ considerable	□ high degree
Application				
– applies patterning skills in familiar contexts	□ limited	□ some	□ considerable	□ high degree
– transfers knowledge and skills to new contexts	□ limited	□ some	□ considerable	□ high degree
– makes connections among patterns	□ limited	□ some	□ considerable	□ high degree

PA.BLM 4b.1

Home Connection
What's My Rule?

Dear Parent/Guardian:

In math, we have recently explored a pattern based on multiples of six (6, 12, 18, 24, etc.), introduced in a book called *Six Dinner Sid*. Sid, the cat, is very manipulative and very clever. He has convinced six people living on the same street that he belongs to them and to them alone. As a result, he is able to enjoy six dinners a day. Students recorded terms from this pattern on a T-chart and wrote rules to model the relationship, such as 6 x  =  . Ask your child to explain the chart and the rule.

 Input	 Output
1	6
2	12
3	18
4	24
…	…
10	60

Your child's new task is to create a new rule. For example, the rule 3 x  =  might represent the number of meals your child eats each day (breakfast, lunch, and dinner).

Or 10 x  =  might represent the number of hours your child sleeps each day. Encourage your child to develop his or her own rule. Ask your child to complete a table such as the one on the right, leaving 3 of the output spaces blank.

Input	Output
1	
2	
3	
4	
5	
…	…
10	

In class, your child will be asking other students to try to complete the table and to work out the rule. To prepare for that activity, your child should try to determine the rule and describe it to you (using words, diagrams, physical materials or mathematical symbols).