GRADE 1 MATHEMATICS

Patterns and Relations

Grade 1: Patterns and Relations

Mathematics is the study of patterns and relationships. Recognizing and exploring the inherent patterns in mathematics make it easier for children to see relationships and understand concepts.

Children first learn about patterns by discriminating similarities and differences as they sort. As they begin to understand the relationships between objects, they can start to make predictions. They then proceed to the recognition of visual, kinesthetic, and auditory patterns in their environment. From recognition, they progress to extension of patterns, translation of a given pattern to other modes, and finally to the creation of their own.

Teachers should be mindful of the needs of all students in the classroom including EAL, (English as an Additional Language) students. Manitoba's schools include young people of varied backgrounds and who have varying degrees of fluency in a number of different languages. When selecting activities and resources to support sorting and patterning, teachers are encouraged to ensure these choices support inclusion of all students that is respectful to the culture of the students.

Cultural background and language can influence the way children identify, translate, and create a pattern. For example, the patterns created by Aboriginal students may not fit English language criteria for patterns, but may make perfect sense to an Aboriginal language speaker. One of the reasons for this is that Aboriginal languages, such as Ojibwe, categorize things differently than they are categorized in English. Some Aboriginal language speakers categorize nouns, pronouns, and even verbs into animate or inanimate. Yet some things, such as rocks, would be classified as animate by an Aboriginal language speaker and inanimate or non-living by an English speaker depending on the circumstance of the situation.

Aboriginal languages do not follow a universal form and are diverse among the First Nation communities in Manitoba. Teachers are encouraged to seek support from within the community to ensure that classroom instruction and resources used are accurate and authentic and reflect sensitivity of the Aboriginal peoples of the community.

It is important to interview, in a non-judgmental manner, the students who appear not to have the concept of patterns. Children must feel comfortable communicating verbally about why a particular combination of objects, sounds, shapes, actions, or colours form a pattern. An interview will help clarify if the misunderstanding is culturally based or not. Further investigation into cultural background, either through reading or talking to the parents, may be necessary to verify the assessment made. Teachers should provide a wide variety of work and play with patterns of all kinds, including those from different cultures. Language and cultural activities should be carefully organized and incorporated into lesson plans to enrich the teaching content.

NOTES

Grade 1: Patterns and Relations (Patterns) (1.PR.1, 1.PR.2)

Enduring Understandings:

Patterns show order in the world.

Patterns can be found in many different forms.

Essential Questions:

What is the repeating unit (core) in the pattern?

Where are patterns found?

Specific Learning Outcome(s):	**Achievement Indicators:**
1.PR.1 Demonstrate an understanding of repeating patterns (two to four elements) by ■ describing ■ reproducing ■ extending ■ creating patterns using manipulatives, diagrams, sounds, and actions. [C, PS, R, V]	➛ Describe a repeating pattern containing two to four elements in its core. ➛ Identify errors in a repeating pattern. ➛ Identify the missing element(s) in a repeating pattern. ➛ Create and describe a repeating pattern using a variety of manipulatives, musical instruments, and actions. ➛ Reproduce and extend a repeating pattern using manipulatives, diagrams, sounds, and actions. ➛ Identify and describe, using everyday language, a repeating pattern in the environment (e.g., classroom, outdoors). ➛ Identify repeating events (e.g., days of the week, birthdays, seasons).
1.PR.2 Translate repeating patterns from one representation to another. [C, R, V]	➛ Represent a repeating pattern using another mode (e.g., actions to sound, colour to shape, ABC ABC to blue yellow green blue yellow green). ➛ Describe a repeating pattern using a letter code (e.g., ABC ABC…).

Prior Knowledge

Students may have had experience

- sorting objects using a single attribute
- copying, extending, describing, and creating a repeating pattern with a core of two or three elements using a variety of materials and modalities
- identifying the pattern core

Background Information

Patterns are everywhere. Children are surrounded by patterns in nature, in their homes, and in everything they do. Pattern, an ongoing theme in mathematics, can be explored in all the strands. Patterns and relationships also can be developed through connections with other areas, such as science, social studies, language arts, physical education, and music.

Activities, at this level, overlap and extend those addressed during Kindergarten.

Note: Repeating patterns can be extended in both directions.

It is difficult to identify a pattern from a small part of the pattern. Therefore, the pattern core should be repeated more than twice.

The teacher's role involves posing questions that alert students to patterns which occur naturally in the sequence of the day, such as in the songs sung, the books read, and the games played in gym. This is an ongoing and natural process. Activities should highlight patterns that are visual, kinesthetic, and auditory.

Mathematical Language

repeating pattern

core (the shortest string of elements that repeats in a repeating pattern is the core)

positional language (after, between, beside, before, next)

attribute vocabulary (colour, size, shape)

element

extend

translate

Learning Experiences

Assessing Prior Knowledge: Student or Small-Group Interview

1. Make an AB pattern with the cubes (e.g., red, blue, red, blue, red, blue).

   Ask the students to

   - copy the pattern
   - extend the pattern
   - describe the pattern
   - identify the core of the pattern

2. Make an ABC pattern with the cubes (e.g., green, yellow, blue, green, yellow, blue, green, yellow, blue).

   Ask the students to

   - extend the pattern
   - describe the pattern
   - identify the core of the pattern

3. Have the students create their own pattern.

Recording Checklist

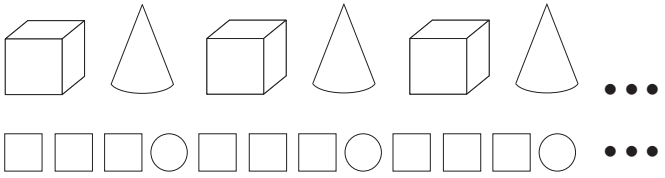
1. Copies the pattern ❒ Extends the pattern ❒
   Describes the pattern ❒ Identifies the pattern core ❒
2. Extends the pattern ❒ Describes the pattern ❒
   Identifies the core ❒
3. Creates an AB pattern ❒ Creates an ABC pattern ❒
   Other _____

BLM
1.PR.1&
2.1

- **Describe a repeating pattern containing two to four elements in its core.**
- **Create and describe a repeating pattern using a variety of manipulatives, musical instruments, and actions.**
- **Reproduce and extend a repeating pattern using manipulatives, diagrams, sounds, and actions.**

Students should have opportunities to reproduce (concretely and in drawings), describe, extend, and create repeating patterns (up to 4 elements in the core) in a variety of forms and contexts, such as

- people patterns (e.g., 1 stands, 1 sits, 1 stands...; hand up, hand down, hand up...)
- geometric patterns, for example



Teacher's questions should focus students' attention on the underlying mathematical skills or concepts elicited by the learning experience(s).

BLM 1.PR.1& 2.2

- object patterns (e.g., leaf, stone, stick, leaf, stone...)
- action patterns (e.g., clap, snap, clap, snap...)
- music patterns (e.g., beat, beat, beat, pause, beat, beat, beat, pause...)

During these experiences ask questions such as:

- What comes next/before/after? How do you know?
- Can you extend the pattern to the left? to the right?
- Which part of the pattern repeats? What is the pattern core?
- Can you make a new pattern using the same materials?
- What other materials could you use to make the same pattern?
- Are these patterns the same?
- How is this pattern different from that pattern?

Observation Checklist

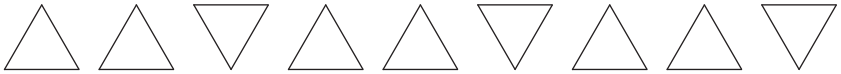
Students are able to

- ❑ reproduce and describe a pattern with a three element core
- ❑ reproduce and describe a pattern with a four element core
- ❑ extend a pattern with a three element core
- ❑ extend a pattern with a four element core
- ❑ create a pattern with a three element core
- ❑ create a pattern with a four element core

in a variety of contexts.

- **Identify errors in a repeating pattern.**
- **Identify the missing element(s) in a repeating pattern.**

- Seat students in a circle. Use pattern blocks or triangle cut-outs to make the following pattern.



Have students describe the pattern.

Ask:

What is happening to the triangle?

What will the next triangle in the pattern look like?

What part of the pattern is repeating?

What is the pattern core?

Note: Although these achievement indicators are dealt with separately, they should be incorporated into all work with patterns.

Have students add the next four elements to the pattern.

Ask students to close their eyes while you remove a shape from the pattern.

Give students an opportunity to look at the pattern before asking them to identify the missing element. Have students explain how they made their choice.

Extend the activity by removing more than one pattern element.

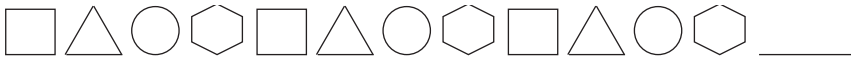
- Have several students form a line in the front of the class. Arrange them in a pattern (e.g., arms up, arms down, arms folded …) but have one student pose out of sequence. Ask the students who are observing if this is a pattern. Have them explain their thinking. Listen for the use of pattern language such as repeat, core, and positional language such as next, before, between, after, etc.

- Pattern Detective Centre

BLM 1.PR.1& 2.3

Prepare a set of pattern cards containing missing elements. Note: Cards with manipulative material representations (cubes, colour tiles, pattern block shapes) will allow students to fill in the missing elements with the actual material. The level of difficulty can be adjusted in order to meet the needs of all students. For example: Create cards that

  - limit the size of the pattern core to less than four elements
  - have the missing element(s) as an extension of the pattern on one end



  - have the missing element(s) as an extension on either or both ends

  - have one element missing in the middle of the pattern

  - have more than one element missing

- Prepare a second set of pattern cards containing errors. Students find the error(s) and make the correction. Cards with manipulative representations will allow students to correct the error(s) with the actual objects. Adjust the level of difficulty by increasing the number and position of the error(s).

Observation Checklist

Students are able to

- ❑ identify missing element(s) in a repeating pattern
- ❑ identify and correct errors in a repeating pattern

- **Identify and describe, using everyday language, a repeating pattern in the environment (e.g., classroom, outdoors).**

- **Pattern Walk:** Go for a walk in the playground or neighbourhood. Have students identify the patterns they see.
- Use a video or digital camera to take pictures of patterns in the environment. Students can describe the patterns orally on the video. Digital pictures can be compiled into a class book and students can write the pattern descriptions. (Literacy with ICT connection.)

- **Identify repeating events (e.g., days of the week, birthdays, seasons).**

- Connect to cluster 4, "Daily and Seasonal Changes" in the science curriculum (day/night, seasons, etc).
- Read books that are patterned after the days of the week (e.g., *The Very Hungry Caterpillar* and *Today is Monday* by Eric Carle; *Cookie's Week* by Cindy Ward) and the seasons (e.g., *The Seasons of Arnold's Apple Tree* by Gail Gibbons).

  Have students write their own pattern books.

Journal Entry

In your journal or math learning log tell about patterns that you see in the classroom.

- **Represent a repeating pattern using another mode (e.g., actions to sound, colour to shape, ABC ABC to blue yellow green blue yellow green).**
- **Describe a repeating pattern using a letter code (e.g., ABC ABC…).**

- Model how patterns can be translated from one medium to another, using objects, pictures, sounds, actions, or letters. Have students create their own patterns and translate them to a different medium, for example
  - concrete to action, to pictorial, or to auditory
    Example of concrete to action

  - action to pictorial, to concrete, to auditory
  - pictorial to concrete, to action, to auditory
    Example of pictorial to auditory, to letters

- Prepare a set of pictorial patterns and their letter descriptions. Have students match the picture to the correct letter description.

  During these learning experiences ask questions such as
  - Can you make a new pattern using the same materials?
  - What other materials could you use to make the same pattern?
  - Can you make a sound pattern to match this pattern?
  - Are these patterns the same?
  - How is this pattern different from this pattern?

Observation Checklist

Students are able to

- ❑ translate an action or sound pattern to a concrete or pictorial pattern
- ❑ translate a concrete pattern to a pictorial pattern
- ❑ translate a given pattern to letters
- ❑ justify why one pattern is the same or different from another
- ❑ apply their knowledge if pattern in different contexts
- ❑ demonstrate an interest in finding and creating patterns

PUTTING THE PIECES TOGETHER

Performance Task: Patterns

BLM 1.PR.1&2.4

Materials: one pattern strip per group
paper
crayons, markers, or pencil crayons
stamps, stickers, cut out shapes, etc.
BLM 1.PR.1&2.4 Putting the Pieces Together: Representing Patterns
BLM 1.PR.1&2.5 Representing Patterns Group Assignment

Have students work with a partner. Give each group a pattern strip.

Directions:

BLM 1.PR.1&2.5

Use the pattern on your pattern strip.

Represent this pattern in as many different ways as you can.

Present your work to the class.

Think about: sounds, actions, materials, pictures, shapes, letters

NOTES

Grade 1: Patterns and Relations (Variables and Equations) (1.PR.3, 1.PR.4)

Enduring Understandings:

"Equals" indicates equivalent sets.

Unknown quantities can be found by using the balance strategy.

Essential Questions:

How do you know the sets are equal?

How do you know the sets are not equal?

How is a number sentence like a balance scale?

Specific Learning Outcome(s):	Achievement Indicators:
1.PR.3 Describe equality as a balance and inequality as an imbalance, concretely and pictorially (0 to 20). [C, CN, R, V]	➛ Construct two equal sets using the same objects (same shape and mass), and demonstrate their equality of number using a balance scale. ➛ Construct two unequal sets using the same objects (same shape and mass), and demonstrate their inequality of number using a balance scale. ➛ Determine if two concrete sets are equal or unequal, and explain the process used.
1.PR.4 Record equalities using the equal symbol (0 to 20). [C, CN, PS, V]	➛ Represent an equality using manipulatives or pictures. ➛ Represent a pictorial or concrete equality in symbolic form. ➛ Provide examples of equalities where the sum or difference is on either the left or right side of the equal symbol (=). ➛ Record different representations of the same quantity (0 to 20) as equalities.

Prior Knowledge

Students may have had experience

- making sets that are equal to a given quantity using one-to-one matching
- knowing that a number can be decomposed into two or more parts

The operation and equal symbols may not have been introduced.

Background Information

The equal symbol represents a relation between two equal quantities.

Many students may have misconceptions about the equal symbol. Many think that the equal symbol means "give answer." As a result they have difficulty, for example

- 4 + ___ = 7
  Students will add across the equal sign and fill the blank with 11.
- ___ = 2 + 5
  Students will say that the question itself is incorrect because the blank is on the wrong side.
- 3 + 4 = 5 + ____
  Students will add all the numbers and put 12 in the blank.
- 5 = 5
  Students will not identify this as a true statement.

Mathematical Language

same

more

less

equal

not equal

balance

match

equal sign/symbol

Learning Experiences

Assessing Prior Knowledge: Student or Small-Group Interview

1. Give students a set (between 5 and 10) of counters. Ask them to make a set that is the same.
2. Make a duplicate set of dot cards. Have students match the ones that are the same or equal. Ask them to explain how they know they are equal or the same.

Observation Checklist

Students are able to

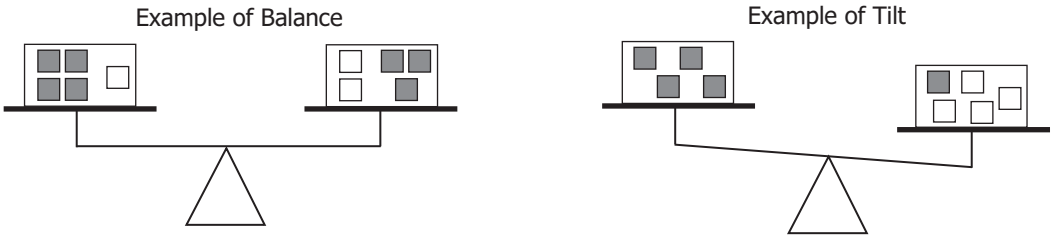
- ❑ reproduce an equivalent set
- ❑ match equal sets
- ❑ explain how they know they are equal

- **Construct two equal sets using the same objects (same shape and mass), and demonstrate their equality of number using a balance scale.**
- **Construct two unequal sets using the same objects (same shape and mass), and demonstrate their inequality of number using a balance scale.**
- **Determine if two concrete sets are equal or unequal, and explain the process used.**

- Use a 2-pan balance scale. Explain how the scale works. When the scale is balanced the sets are equal (equivalent). Have students use equal weight objects (e.g., unifix or coloured cubes to practise making equivalent and non-equivalent sets). Sets can be described using colours (e.g., 2 red and 3 green on the left side is the same as 5 blue on the right side or 4 blue is not the same as 3 red).

  Example of balance

Some students may have difficulty with the conservation of weight. These students will need experiences beyond the balance scales.



Checking for Understanding

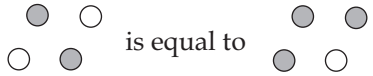
Use two sets of counters. Ask the student to determine whether they are equal or not equal. Have them explain/show how they found their answer.

Do students

- ❑ correctly identify the sets as equal or not equal
- ❑ explain using one-to-one matching/correspondence
- ❑ count each set and then use the numbers only to explain

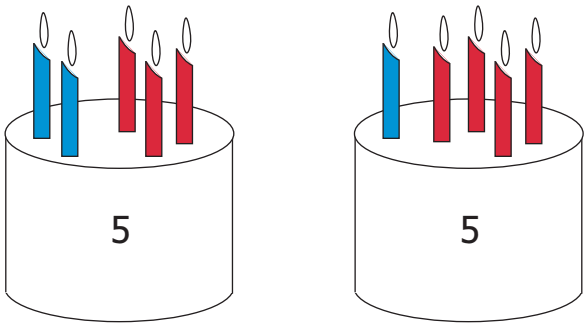
- **Represent an equality using manipulatives or pictures.**
- **Represent a pictorial or concrete equality in symbolic form.**

- Have students use materials and pictures to show an equality and then write the matching number sentence, for example



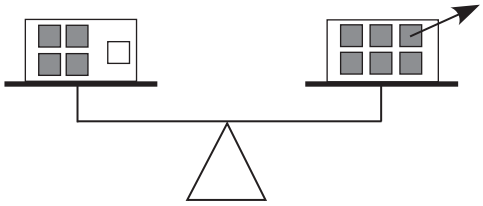
2 + 2 = 3 + 1

Example of birthday cakes and 2 colours of candles to represent the same age



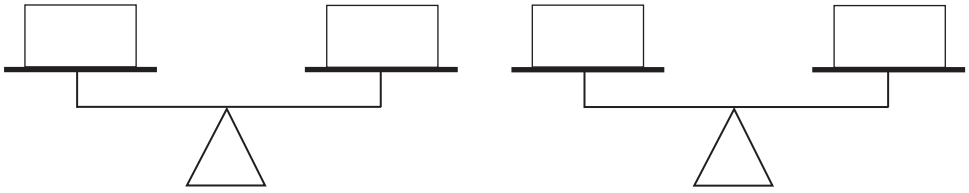
2 + 3 = 1 + 4

- Use a balance scale representation and have students write a number sentence to represent the equality.



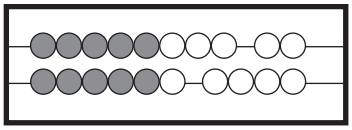
4 + 1 = 6 − 1

Have students fill in the missing objects on the balance scale.



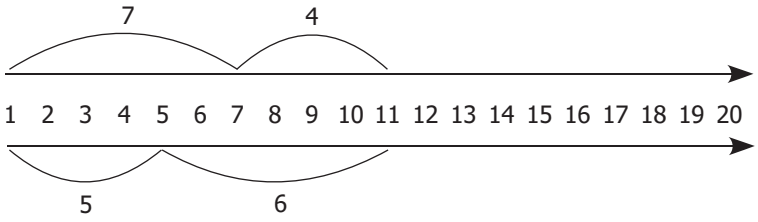
3 + 4 = 5 + 2 3 + 3 = 10 − 4

- Use a 20 bead frame to demonstrate equality with combinations to 10.



8 + 2 = 10
6 + 4 = 10
Therefore, 8 + 2 = 6 + 4.

- Use a double number line (e.g., show that 7 + 4 = 5 + 6).



- **Provide examples of equalities where the sum or difference is on either the left or right side of the equal symbol (=).**

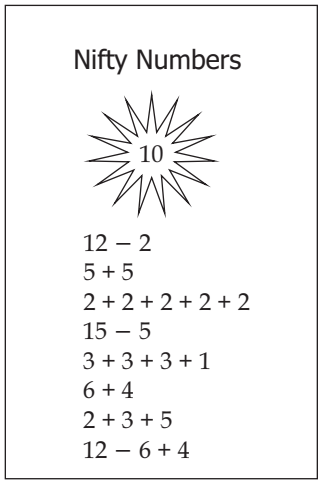
- Have students create number sentences to match given templates, for example

_____ + _____ = _____ and _____ + _____ = _____ + _____

_____ − _____ = _____ and _____ – _____ = _____ – _____

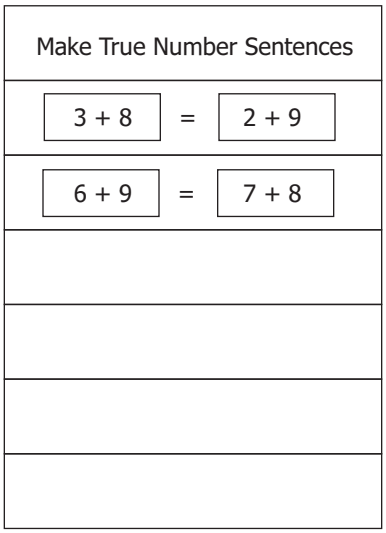
- **Record different representations of the same quantity (0 to 20) as equalities.**

- **Classroom routine: "Nifty Number Sentences":** Use a laminated chart or white chalkboard. Write a number between 0 and 20 at the top of the chart each day. Students take turns writing a number sentence to equal the number on the chart. Encourage students to try to write a sentence that is different from the ones already on the chart.



- **Pocket Chart:** Copy some of the expressions (the part of the number sentence without the equal sign, e.g., 3 + 8 or 16 - 9) from the Nifty Number Sentences chart each day onto cards.

  Note: Use the same colour of marker for all of them. Mix the expressions up. Place equal signs down the centre of a pocket chart. Have students make true number sentences by placing equivalent expressions on the either side of each equal sign.



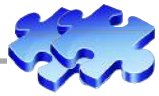
Assessing Understanding

True or False: Prepare a classroom set of cards with the word "True" on one side and the word "False" on the other. Present the following equations one at a time. Have students hold up their True/False card to indicate whether the equation is true or false. Ask students to justify their answer using materials, pictures, number lines, numbers, etc.

- ❑ 4 + 3 = 7
- ❑ 7 + 1 = 4 + 4
- ❑ 7 = 7
- ❑ 4 + 4 = 3 + 4
- ❑ 6 + 4 = 5 + 5
- ❑ 4 + 5 = 6 + 2
- ❑ 9 = 5 + 4

This assessment could be done with a small group or individual students.

Putting the Pieces Together



Performance Task: True or False Game

BLM 1.PR.3& 4.1

Materials: game board
true or false game cards
game pieces

Directions:

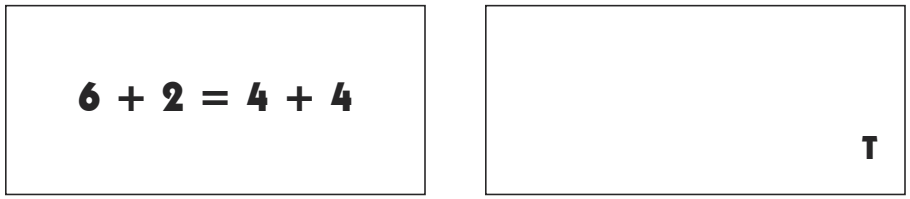
Game cards are placed face down on the table.

Players take turns drawing a card, stating whether the number sentence/equation is true or false. If correct, the players move their game marker two spaces for a true statement and one space for a false statement.

Scenario:

We have been asked to help design a True or False game for Grade 1 students. We already have the game board but we don't have the game cards. I need each of you to make five cards for the game. Each card needs to have a number sentence. The number sentence can be either true or false. The answer needs to be on the back of the card. Put a "T" for true or an "F" for false in the bottom right hand corner.

Sample:



Front Back

Addressing student needs:

- Vary the number range assigned to each student
  - combinations to 10
  - combinations to 20
- Vary the operations used
  - use only addition
  - use only subtraction
  - use a combination of both operations
- Colour code the cards based on the complexity of the equation.