

PATTERNS AND RELATIONS
GRADE 4

Western and Northern Canadian
Protocol (WNCP) Edition

hands-on
mathematics
Grade 4

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Introduction

A large part of mathematics is the study of patterns and relations. When students recognize and explore the patterns that are inherent in mathematics, it becomes easier for them to understand the relationships among different mathematical concepts, as well as to make generalizations and predictions. Students need opportunities to discover and explore both patterns that occur in everyday life as well as those revealed through technology.

Students are surrounded by patterns: they exist in their homes, in nature, and in many things they do. Patterning is also a unifying theme that weaves together many mathematical topics and is a basic skill for problem solving. Students should be provided with many opportunities to focus on the regularity in events, shapes, designs, and sets of numbers. *Regularity* refers to the continuous appearance of a shape or consistent change in a set of numbers.

In this module, students use real objects, mathematical materials, and numbers to identify, describe, reproduce, and represent patterns. They use patterns found in tables and charts to solve problems: first, they identify and describe a variety of patterns, including the multiplication table; then, they use concrete materials to reproduce patterns shown in a table or chart; next, they represent and describe patterns and relationships using charts and tables to solve problems; finally, they identify and explain mathematical relationships using charts and diagrams to solve problems.

Students also explore relations by expressing problems as equations with symbols representing unknown numbers; this leads them to solve one-step equations—equations that take only one step to solve for the unknown. For example, $7 + Z = 15$ or $40 = 8T$.

An understanding of patterns is essential to algebraic thinking. Observations of patterns that define how quantities are related allow students to embark on learning experiences with functions. *Functions* describe the relationship between two variables and may be represented as charts, equations, and graphs.

Key to students' learning about algebra is experience creating, recognizing, and extending patterns. Also essential is experience describing and representing symbolically, and in a variety of ways (for example, using tables), equations with variables (algebraically) and geometrically on graphs. Learning occurs when students connect new understandings to familiar experiences such as linking development of algebraic thinking to concepts in number.

Mathematical Vocabulary

Students must learn to recognize and understand the mathematical vocabulary related to the patterns and relations module. A mathematics word wall for displaying new vocabulary is a valuable reference for students. Dedicate a classroom bulletin board to your math word wall, and display the letters of the alphabet along the top. Use index cards to record math vocabulary introduced in each lesson, attaching these to the board under the appropriate letter. Encourage students to refer to the math word wall during classroom activities and assignments.

Throughout this unit, teachers should use, and encourage students to use, vocabulary such as:

Algebra: mathematics that uses variables (symbols) to represent numbers. For example:

$$5 + Y = 9$$

Algebra is used to solve problems and examine patterns.

4 Patterns in Calendars

Background Information for Teachers

Although students may have experience using calendars, they may not have explored the patterns inherent to arranging numbers into seven columns.

Materials

- old calendar pages (donated or saved from previous years, or printed from the computer/internet. You will need a one-month page for each student.)
- chart paper
- markers
- calculators (one for each student)
- coloured pencils

Activity: Part One

Review what students already know about calendars. Ask:

- What information do we find on a calendar?
- How are all monthly calendars the same?
- How are they different?
- How many days are there in a month?

Discuss the varying number of days in the 12 months of the year and the fact that months begin on different days of the week. Provide each student with a one-month page from an old calendar. Ask students to examine their calendar pages and then compare them with those of a partner. Have students identify similarities and differences between the two calendar pages.

Now, have students focus on the day-of-the-week pattern. Tell them to look at the first day of the month on their calendar page. Ask:

- What numbers do you notice going down that column?

On chart paper, record the number sequence going down the column that begins with the first day of the month: 1, 8, 15, and so on. Ask:

- What is the pattern? (+7)

Activity: Part Two

Distribute Activity Sheet A (1.4.1), and have students complete the calendar sheet for the current month.

As a class, examine other calendar patterns. Have students look at the diagonal number sequence on their calendar pages beginning with the first Sunday of the month and moving down to the right. Distribute coloured pencils, and have students use pencils to circle this number sequence. Ask:

- What number sequence is shown? (this will vary according to the calendar page)
- What is the pattern for this number sequence? (+8)

Now, have students look at the diagonal number sequence beginning from the first Saturday of the month and moving down to the left. Have students circle this number sequence with a different coloured pencil. Ask:

- What number sequence is shown? (this will vary according to the calendar page)
- What is the pattern for this number sequence? (+6)

Have students complete Activity Sheet A by answering the question at the bottom of the page.

Activity Sheet A

Directions to students:

Complete the calendar sheet for the current month, and answer the question at the bottom of the page. Use the completed calendar month page to explore patterns on the calendar (1.4.1).

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Activity: Part Three: Date Sum Patterns

Distribute Activity Sheet B (1.4.2) to students. Ask students to find the sum of all the dates in the first full week (Sunday through Saturday) of the month, and then divide that sum by the date on Wednesday of that week.

Note: Students may choose to use calculators to assist them with this task.

Once students have all completed the problem, have them compare their answers. Ask:

- If we do the same operations (adding and then multiplication) with the second full week of dates (Sunday through Saturday), what do you think the answer will be?

Have students discuss their predictions and reasoning. Then, tell them to test their predictions by adding the dates in the second week and dividing by Wednesday's date. Ask:

- What do you notice about the answers? (both = 7)
- Do you think there is a pattern?
- Why do you think this occurs?

Now, have students shade in or outline any four adjacent squares on the activity sheet calendar to form a larger two-by-two square. Have them find the sum of each of the two numbers on the diagonal. Ask:

- What do you notice about the two sums?

Ask students to shade a different two-by-two square on the calendar. Ask:

- What is the sum of each of the two numbers on the diagonal?

Have one student find the sum of all four numbers in a two-by-two square and share the sum with the rest of the class. Ask:

- Can you use this sum to determine what the two-by-two square is?
- What strategy did you use?

Divide the class into pairs of students, and have the pairs repeat the preceding task: Have one student share with the other the sum of four numbers that form a square on the calendar, and have the other student use the sum to figure out what the two-by-two square is.

As a final challenge, have students select any three-by-three square of nine dates on their activity sheet calendar. Ask them to find the sums of the numbers in the two diagonals as well as the sums of the numbers in the centre column and the centre row. Ask:

- What do you notice about the four sums?
- Try another three-by-three square. Do you notice the same thing?

Have students complete Activity Sheet B.

Activity Sheet B**Directions to students:**

Explore date sum patterns on the monthly calendar page, and complete the activity sheet by following the directions at the bottom of the page (1.4.2).

Problem Solving

What is the date of your birthday? If you can have a party only when your birthday falls on a Saturday or Sunday, how many chances will you have in the next 10 years to have a party? In which years will you have a party? Check online calendars to determine the pattern of dates for your birthday for the next 10 years (that is, to find out on which day your birthday will fall for each of the next 10 years). Use your data to make a chart and find your solution.

Note: A reproducible master for this problem can be found on page 175.

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Extension

Examine calendar patterns on a regular basis as part of daily classroom routines. Many different concepts can be explored as the monthly calendar changes. More challenging ideas, including forward and backward horizontal, vertical, and diagonal patterns, as well as skip counting patterns, can be explored as a class or by individual students.

Date: _____ Pages _____

Name: _____

Month: _____

Sunday Monday Tuesday Wednesday Thursday Friday Saturday

Observations of patterns on the calendar:

1. _____

2. _____

3. _____

Date: _____ Pages _____

Name: _____

JUNE 2008

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Record three things you observed about the date sum patterns on the calendar.

1. _____

2. _____

3. _____