# The Patterns and Relations Strand: Outcome P4.1

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| **Outcome** | **Indicators** |
| P4.1. Demonstrate an understanding of patterns and relations by:* identifying and describing patterns and relations in a chart, table, or diagram
* reproducing patterns and relations in a chart, table, or diagram using manipulatives
* creating charts, tables, or diagrams to represent patterns and relations
* solving problems involving patterns and relations

[C, CN, PS, R]*In support of the K-12 Mathematics goals of Number Sense, Logical Thinking, Mathematical Attitude, and Spatial Sense.* | 1. Identify and describe a variety of patterns in a multiplication chart.
2. Determine the missing element(s) in a table or chart and explain the strategies used.
3. Identify and correct error(s) in a table or chart.
4. Describe the pattern found in a table or chart.
5. Create a concrete representation of a pattern displayed in a table or chart.
6. Explain why the same relationship exists between the pattern in a table and its concrete representation.
7. Extend patterns found in a table or chart to solve a problem.
8. Translate the information provided in a problem into a table or chart.
9. Identify and extend the patterns in a table or chart to solve a problem.
10. Solve a problem by completing a Carroll diagram using given data.
11. Determine where new data belong in a Carroll diagram.
12. Identify a sorting rule for a Venn diagram.
13. Describe the relationship shown in a given Venn diagram when the circles intersect, when one circle is contained in the other, and when the circles are separate.
14. Determine where new data belong in a Venn diagram.
15. Solve a problem by using a chart or diagram to identify mathematical relationships.
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| **Learning Space:** [**Top**](#top) |
| Prior to this outcome, students have been studying patterns involved in sequences and in their other mathematical experiences, such as the hundred chart. It is in this outcome that the students begin to make the connection between different formats for representing and working with patterns and connecting the patterns to relationships between two different attributes. This outcome is the establishment of the concept of a “relation”. That is, for the students to explore and become comfortable with the notion of considering how one factor influences, relates to, or can be used to determine a second factor. The students’ depth of understanding of this concept will develop over time and is one of the big ideas that mathematics relies upon. Understanding relations is key to understanding functions, equations, and inequalities.When beginning their study of the concept of relations, students need a lot of hands-on experience with manipulatives, charts and diagrams used within contexts that are engaging and meaningful to the students. This learning outcome supports and is supported by *P4.2 Demonstrate an understanding of equations involving symbols to represent an unknown value,* in which students look for the relationships defined by a problem situation, and seek to determine specific situations in which a defined relationship is true. Students may encounter situations in Physical Education where they can collect data and record it in a table or chart and describe any/all patterns that they see in that data. Students can also look for patterns in data related to their study of light and sound. Also, in Health Education, students can use tables and charts to analyze data that they collect regarding food intake, exercise, and food analysis.  |
| **What Students Should…** [**Top**](#top) |
| **Know*** the word relation
* what a Venn diagram looks like
* what a Carroll diagram looks like
 | **Understand*** what each cell in a Carroll diagram represents
* what each region in a Venn diagram represents
* what each element in a table represents
* how patterns and relations are related to each other
* what a relation is and what it tells us
 | **Be Able to Do*** identify patterns
* identify relations in given data in a variety of formats
* create and interpret Carroll diagrams
* create and interpret Venn diagrams
* solve problems using Carroll or Venn diagrams
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| **Key Questions:** [**Top**](#top) |
| * What type of reasoning is being used to extend a pattern? (inductive)
* What type of reasoning is being used to find new entries in a table? (inductive)
* When or why would you use a Venn diagram?
* When or why would you use a Carroll diagram?
* What do the values in a table tell you?
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| **Suggestions for assessment:** [**Top**](#top) |
| **Big Idea:**Ways to represent patterns and relationships.**Suggestions for assessment tasks:**1. Provide the students with a concrete or pictorial pattern and ask them to represent it using a Carroll diagram, Venn diagram, or table and ask the students to explain their reasoning.
2. Provide students with a problem that involves a pattern and ask them to represent the pattern in at least two different ways and to explain their reasoning.
3. Have the students compare representations of patterns and explain what relationships each representation emphasizes.

**What to look for:*** See [*Representing Patterns and Relationships Rubric*](file:///C%3A%5CUsers%5Cru593%5CAppData%5CLocal%5CTemp%5CRepresenting%20Patterns%20and%20Relationships%20Rubric.doc)*.*

**Big Idea:**Identifying and applying relationships related to patterns.**Suggestions for assessment tasks:**1. Provide the students with a Carroll diagram, Venn diagram, or table and ask them to describe any patterns and relationships that they can find.
2. Provide the students with a table with missing values and ask the students to determine the missing values and explain their reasoning.
3. Ask the students to explain what the values in a given Carroll diagram, Venn diagram, or table mean or describe.
4. Describe patterns and relationships found in a multiplication table.

**What to look for:*** See [*Identifying and Applying Relationships Related to Patterns Rubric*](file:///C%3A%5CUsers%5Cru593%5CAppData%5CLocal%5CTemp%5CRelationships%20Related%20to%20Patterns%20Rubric.doc)*.*
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| **Suggestions for instruction:** [**Top**](#top) |
| **Big Idea:**Identifying and applying relationships related to patterns.**Suggestions for instructional activities:**1. Because of their focus in the number strand on multiplication, a good place to start the students’ study of patterns and relations in grade four is by having the students look for patterns in a multiplication chart (up to 10 x 10). The patterns that they identify will also contribute to the strategies they have for multiplication. Begin by having the students consider a multiplication chart and look for patterns in the numbers that they see. For example, they might look at numbers that end in a particular number. Allow the students time to explore these ideas on their own first, then in pairs or small groups, and finally as a whole class. When the patterns are shared in the class, have the students consider the questions of “is there a reason for this pattern?” and “is there a common relationship for all of the numbers in the pattern?” Draw their attention back to the factors of the products in the pattern. Help the students to come to making statements such as “all of the numbers in this pattern are related to multiples of five” and so on. Also work in the reverse direction. For example, ask the students to identify those numbers that are divisible by both 2 and 3. Ask the students if they can make another statement about those numbers based on the pattern that they see in the multiplication table. (Note: When working with patterns tables and charts like the multiplication table, it is often useful to have clear coloured markers for the students to use to mark the numbers in the pattern. Crayons also can be useful or small coloured beads.)
2. Use concrete patterns, such as ones made with pattern blocks to help establish relationships. Students have been asked to extend the pattern, now have them make the connections between where in the pattern they look and what they would expect to see. For example, if the pattern is square, triangle, triangle, square, triangle, triangle… the students should be able to explain how they would expect the 9th term to be a triangle because every third term is a triangle, where every third term after the first is square and so on.
3. Provide the students with Carroll diagrams, Venn diagrams, and tables and ask them to explain what the diagrams tell them. Try to use data that the students can relate to – information about the class, statistics for the school noon-hour sports, or factors of whole numbers. Give the students new pieces of data and ask them where they would put that data and why. In a table, ask the students what they believe the missing pieces of data to be and why. Continue to have the students provide their reasoning and encourage them to describe their thinking in terms of the relationships that they are seeing in the tables and graphs. Remember that the important idea coming out of their learning is an understanding of the meaning of a relation.
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| **Big Idea:**Ways to represent relationships.**Suggestions for instructional activities:**1. As the students engage in the above learning activities related to determining relation, and as they become familiar with the different forms of representation possible, encourage the students to try showing the relationships that they are finding in different ways. For example, if they are given a concrete pattern, ask the students to try to capture the relationship that they discover in a table. Or, if the students are given a pattern in a multiplication table, can they create a Venn diagram showing a relationship within that pattern? As the students create new representations of the patterns that they are exploring, be sure to continue to ask them to describe the relationships that they are seeing and how those relationships are helping them define their new representations.
2. Have the students explore problems and contexts in which there are patterns and relationships for which they can create representations. Have the students use these representations to answer questions related to the problems or contexts.
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