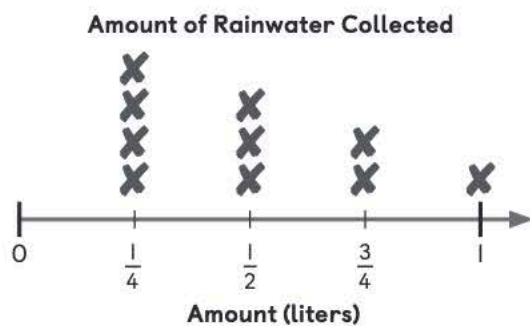


# LINE PLOTS AND THE COORDINATE PLANE

## Chapter Overview

In this chapter, your student's knowledge of line plots and picture and bar graphs from the earlier grades will be extended to understanding line graphs and solving problems involving the four operations of fractions. Your student will:

- **interpret data from a line plot** and solve problems involving the four operations with fractions and mixed numbers.



Key: Each X represents 1 beaker.

$$(4 \times \frac{1}{4}) + (3 \times \frac{1}{2}) + (2 \times \frac{3}{4}) + (1 \times 1)$$

$$= 1 + \frac{3}{2} + \frac{3}{2} + 1$$

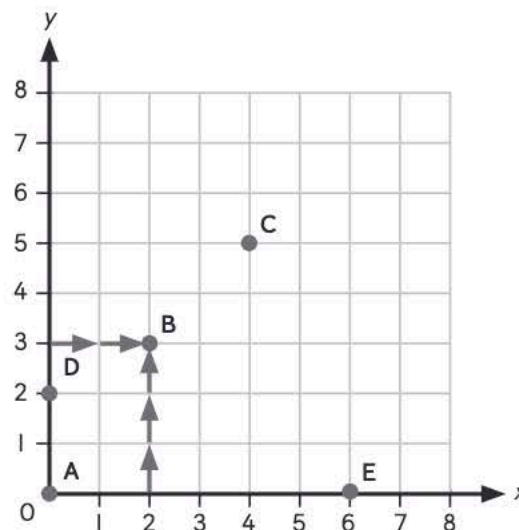
$$= 5$$

There are 5 liters of rainwater in 10 beakers.

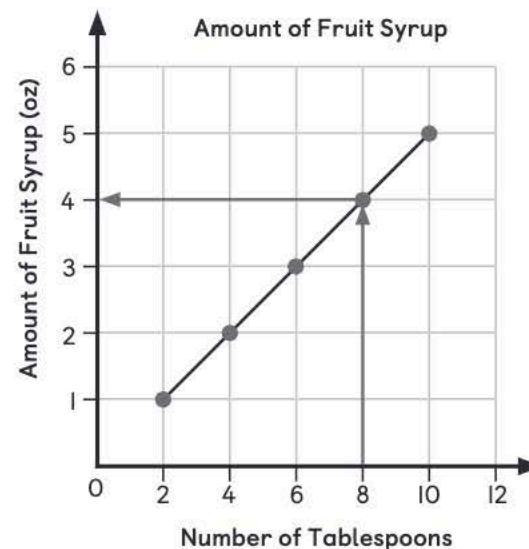
$$\frac{5}{10} = \frac{1}{2}$$

There would be  $\frac{1}{2}$  liter of rainwater in each beaker.

- **plot points on a coordinate plane** using ordered pairs.



- **plot points on a coordinate plane to create line graphs** and interpret data represented from line graphs.



### Teaching Tip

Encourage your student to collect real data that could be represented in a line plot and a line graph. Look for line plots and line graphs on the Internet, in newspapers, and in magazines. Invite your student to explain how he/she represents the data.

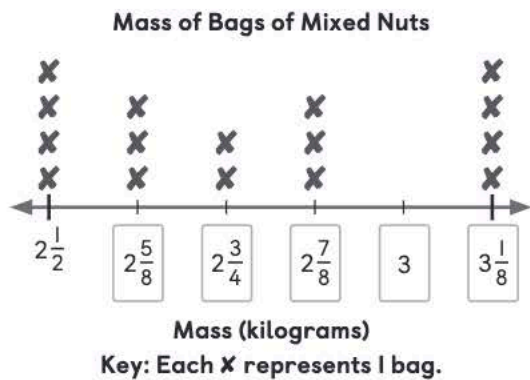
# Key Ideas

- We can interpret data from a line plot and solve problems involving the order of operations.

A grocer made a table to show the masses of some bags of mixed nuts.

Mass (kg)	$2\frac{1}{2}$	$2\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{7}{8}$	$3\frac{1}{8}$
Number of Bags	4	3	2	3	4

- (a) Make a line plot to show the data.

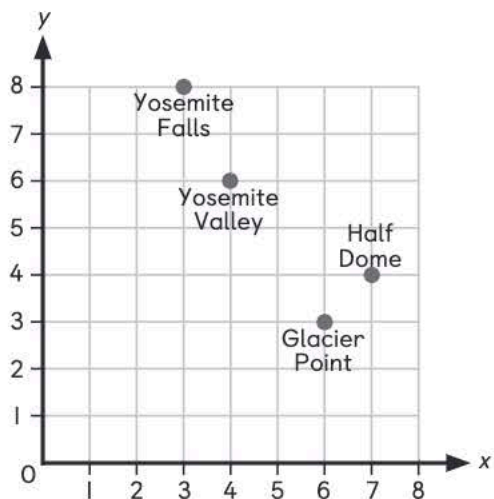


What is the total mass of all the bags of nuts?

$$\begin{aligned}
 & \left( 4 \times 2\frac{1}{2} \right) + \left( 3 \times 2\frac{5}{8} \right) + \left( 2 \times 2\frac{3}{4} \right) + \\
 & \left( 3 \times 2\frac{7}{8} \right) + \left( 4 \times 3\frac{1}{8} \right) \\
 & = 10 + 7\frac{7}{8} + 5\frac{1}{2} + 8\frac{5}{8} + 12\frac{1}{2} \\
 & = 44\frac{1}{2}
 \end{aligned}$$

The total mass of all the bags of nuts is  $44\frac{1}{2}$  kilograms.

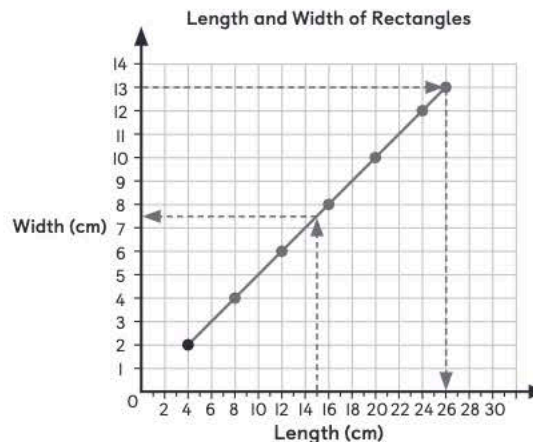
- We can describe the location of a point on a coordinate grid using an ordered pair.



- We can represent data on a coordinate grid using ordered pairs to create a line graph.

Length (cm)	4	8	12	16	20	24
Width (cm)	2	4	6	8	10	12

- (a) Plot the ordered pairs to make a line graph.



## Materials You Will Need

- 1 set of fraction circles or fraction tiles
- Grid Paper (TRO4)

## Chapter Opener (Student Book, page 211)

Consider the picture and the questions on the page. Discuss them with your student. Prompt him/her to consider the information given in the picture and what is being asked. You may wish to ask the following questions:

- **What do you notice?** *Gemma has a map with a treasure hidden. How do you determine where the treasure is hidden? An icon represents its location. The map is organized with vertical and horizontal lines that are numbered. What directions would you give her to find the treasure?*

Challenge your student to find more than one way to the treasure and to state the fastest route.

### Teaching Tip

Earlier in Grade 5, your student learned to add and subtract unlike fractions by identifying common factors or multiples to find equivalent fractions with like denominators. Your student also learned to multiply and divide fractions by a whole number. Remind your student to use unit fractions and draw bar models to represent each operation.

In Grades 3 and 4, your student learned to represent data on a line plot. Your student learned to represent mixed numbers on a number line by skip counting by a fractional part. These number lines are used to construct line plots representing fractional measurement data. Use fraction circles or fraction tiles to help your student see how each interval on the number line increases by the same fraction.

In **Recall**, encourage your student to connect skip counting in Question 3 to creating a line plot in Question 6. Invite your student to interpret the data represented by the line plot.

## Recall (Student Book, pages 212 to 214)

### Material(s)

- 1 set of fraction circles or fraction tiles

Before moving on to the problems on pages 212 to 214 of the Student Book, have your student model similar tasks using concrete materials, such as fraction circles or tiles. Once you are convinced of his/her proficiency, move on to encourage your student to create similar numbers using fraction circles or fraction tiles.



# 12A Number Patterns and Relationships (1)

### Learning Objective(s)

- Identify the rule of number patterns.
- Use a pattern rule to predict a term.

### Vocabulary

- term

### Material(s)

- 1 set of unit cubes

## NUMBER PATTERNS AND RELATIONSHIPS

(Student Book, pages 247 to 252)

### Lesson Opener

**Task** (Student Book, page 247)

Show your student the **Lesson Opener** and cover the rest of the page. Discuss the question with your student. Do not show your student how to do the task and allow him/her to explore how the number of cubes changes in each figure in the pattern. If necessary, provide your student with unit cubes to replicate the pattern.

Refer your student to **Learn** and **Learn Together** in the Student Book for reflection after your student has explored the concepts. Use questions to build understanding and direct instruction to refine understanding.

## Lesson Development

### Learn (Student Book, pages 247 and 248)

Invite your student to study the pattern in the picture. If necessary, encourage your student to replicate the problem using unit cubes.

Invite your student to explain how the number of cubes changes in each figure using a table as seen on Student Book page 247 or by writing an expression to find the 10th figure in the pattern. You may wish to ask the following questions:

**What do you notice in the pattern?** *It begins with 1 cube and increases by 2 cubes each time. How would you describe the pattern?* *It begins at 1 and adds 2. How would you use the pattern to find the 10th figure?* *create the pattern with cubes; record the pattern by adding 2 to the number of cubes each time* **How many cubes will be needed for the 10th figure?** *19*

Explain to your student that the number of cubes corresponding to each figure number is a term of the pattern. Point out that each term can be described using its ordinal position. For example, first term, second term, tenth term, etc.

### Focus Question

**How can identifying the rule of number patterns help predict terms of the pattern?**

Invite your student to ponder this question as you go through the lesson. Revisit this question when you reach the end of the lesson to check his/her understanding.

### Teaching Tip

Encourage your student to use a table to organize the figure and term numbers of the patterns in this lesson. Encourage your student to use an operation to describe the rule of the number patterns.

## Learn Answers

(Student Book, pages 247 and 248)

<b>Figure Number</b>	1	2	3	4	5	6	7	8	9	10
<b>Number of Cubes</b>	1	3	5	7	9	11	13	15	17	19





19; 2; 7; 7; 2; 9; (speech bubble) 2


## Learn Together (Student Book, pages 248 to 250)


Invite your student to use a table to describe the number pattern to solve the problems in **Learn Together**. Encourage your student to describe each of the figures and the term. Challenge your student to consider the rule to find another term in the number pattern.


Through questioning, lead your student to explore number patterns and relationships in **Learn Together**. As you go through the problems with your student, you may wish to ask the following questions:

 **What is the relationship between the figure number and the number of squares in Question 1?** *The number of squares is 4 times the figure number. How can you use this relationship to find the 100th figure?* *multiply 100 by 4*  
**How does each figure change in Question 2?** *2 more toothpicks are added to each figure. How would you describe the pattern Alex sees in the table?* *add 1 more to the figure number*  
**How will this help you find the number of toothpicks in the 20th figure?** *add 21 to 20*


 Invite your student to find how many triangles there will be in the 20th figure in Question 2.

 **What is the relationship between the figure number and the number of triangles?** *The number of triangles is the same as the figure number.*

 Invite your student to consider which rule would help him/her to find the 100th figure.

 **What two rules help you determine the pattern for the number of toothpicks?** *The figure number + the next consecutive number = the number of toothpicks or  $3 + 2 \times$  one less than the figure number = the number of toothpicks. How would you use the rule to help you find the number of toothpicks in the 100th figure?*  *$100 + 101 = 201$  or  $3 + 2 \times 99 = 3 + 198 = 201$*

After your student has explored the concepts in the **Lesson Opener**, **Learn**, and **Learn Together**, you may wish to ask the following questions to encourage further reflection:

 **How is the number pattern of each figure described? How do you see it represented in the table? What is another way to describe the pattern?**

You may wish to have your student summarize his/her learning in a math journal. Invite your student to create a number pattern of his/her own and record it in a table. Encourage your student to explain the number pattern to you.

- **QUESTION 1(a)** requires your student to observe the pattern and derive the first six terms of the pattern.
- **QUESTION 1(b)** requires your student to identify the pattern rule by describing the relationship between the figure number and the number of squares.
- **QUESTIONS 1(c)** and **(d)** require your student to use the pattern rule to predict a term.

## Learn Together Answers

(Student Book, pages 248 to 250)

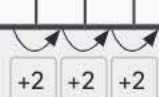
1. (a)

Figure Number	1	2	3	4	5	6
Number of Squares	4	8	12	16	20	24

- (b) 4  
 (c) 400  
 (d)  $4 \times n$

2. (a)

Figure Number	1	2	3	4	5
Number of Toothpicks	3	5	7	9	11



(b)

Figure Number	Number of Toothpicks	Pattern Rule
1	3	$1 + 2 = 3$
2	5	$2 + 3 = 5$
3	7	$3 + 4 = 7$
4	9	$4 + 5 = 9$
5	11	$5 + 6 = 11$

21; 41; 41

- (c) 19; 41; 41



- Your student can record the number pattern as an expression. Encourage your student to use a letter to represent the figure number and explain what the expression means.
- **QUESTION 2(a)** requires your student to observe the pattern and derive the first five terms of the pattern.
- **QUESTION 2(b)** requires your student to identify the pattern rule and use the pattern rule to predict a term.
- **QUESTION 2(c)** requires your student to identify an alternative pattern rule and use the pattern rule to predict a term.

## Activity! (Student Book, page 250)

Invite your student to study the pattern represented by the number of triangles and create a table to explain how he/she would find the number of blue triangles in the 20th figure.

- **What number pattern do you see?** *The figure number is being added to the number of blue triangles in the earlier figure. How would you record that as an equation? How would you use it to find the 20th figure?*

## Lesson Debrief

- Conclude the lesson and facilitate your student's reflection by asking him/her to answer the **Focus Question** and share his/her thinking.
- Extend the discussion by posing the following questions.
  - **How does identifying the pattern help you determine the rule?** *I can see the way each term changes. This rule can then be used to find future terms. Why do some patterns have more than one rule? There may be more than one way to describe the pattern with an expression.*

### Reflect and Connect

- Allow time for your student to reflect on what he/she has learned and ask questions about what he/she may be unsure of.
- Encourage him/her to share anything that was confusing or difficult, and how thinking about it differently and perseverance helped the process of learning.
- Ask your student to answer a reflection question or draw a picture to show his/her reflection. You may offer this prompt:
  - **How can identifying the rule of number patterns help you predict terms of the pattern?**

### What to look for:

- an example of identifying the number pattern using a table or a rule to find a term in the pattern
- an understanding that the rule can be represented in different ways or recorded as an expression

## Activity! Answers

(Student Book, page 250)

Answers vary. Example:

Figure Number	Number of Blue Triangles
1	1
2	$1 + 2 = 3$
3	$1 + 2 + 3 = 5$
4	$1 + 2 + 3 + 4 = 10$
20	$1 + 2 + \dots + 19 + 20 = 210$

### Digging Deeper

Invite your student to look for a pattern for the number of white triangles in the **Activity!** and describe the rule.

### For Additional Support

Provide materials for your student to recreate each number pattern with concrete materials such as toothpicks or unit cubes. Encourage your student to see how many are being added to make the next figure and record in a table.